

Social context and the health consequences of disasters

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Abstract

Disasters have been and will continue to be relatively common events in the human experience, and they make important contributions to variations in population health. There is a need, therefore, for conceptual models that identify the social and ecological factors influencing post-disaster consequences on population health. This article presents one such conceptual model which links the health consequences of natural, technological, and human-made disasters to a set of nested socioecological factors. Specifically, we attempt to link post-disaster consequences to aspects of the global and local environment and to highlight the roles played by social and ecological factors, including the social infrastructure, cultural beliefs, demography, and underlying historical and geographical circumstances. Examples from existing population-based health and disaster research are used to illustrate and amplify connections drawn from the model. From an applied standpoint, the model suggests that the role of multiple contextual determinants in shaping population health is likely to be complex. Practitioners interested in mitigating the consequences of disasters should pursue strategies that improve the underlying determinants of health, as well as practicable population-based interventions that could be implemented rapidly.

Key words: disasters, social context, population health, framework, environment

Introduction

Although definitions of disasters and the approaches used to study them may be quite disparate,^{1,2} scientific literature on the subject generally recognizes that disasters have been, and remain, a relatively common piece of the human experience.³ In

surveys of the United States' general population, between 13.0 and 18.9 percent of people report an exposure to natural or human-generated disasters within their lifetime.^{4,5} Comparable international data are limited, but large proportions of populations in many countries have been exposed to terrorism, famine, forced relocation, and violence, suggesting that the overall prevalence of exposure to disasters worldwide is probably considerably higher than in the United States.⁶ Against this backdrop, several recent high-profile natural/technological disasters (e.g., the Southeast Asian tsunami of 2004 and the Chernobyl nuclear accident of 1986) and human-made disasters (e.g., the September 11 terrorist attacks and the March 11, 2004, Madrid train bombings) have heightened awareness of disasters as potent determinants of population health. However, academic and public health interest in disasters remains episodic at best, surging when highly visible disasters occur and abating to a lower-level priority as these events fade in the public consciousness. In addition, much of the public health attention devoted to disasters tends to center on a medical model of disaster preparedness. Efforts to highlight the underlying social and ecological factors that influence the population-health consequences of disasters have been rare. This paper is a step toward that goal.

Disasters are traumatic events that affect many people, and they may result in a wide range of mental and physical health consequences.⁷ They range from acute-onset, time-delimited events (e.g., floods, transportation accidents) to events that take place over a longer period of time (e.g., famines, conflict, complex humanitarian emergencies). Regardless of the type, it is likely that the frequency, scope, and magnitude of disasters—natural, technological, or human-made—will

increase in the future,⁸ with concomitant and deleterious impacts on population health. This outlook makes it increasingly important for professionals to consider how to best mitigate the potential adverse population-health consequences of disasters. There is a pressing need to identify the social and ecological factors that influence the consequences of disasters, both as a tool for students interested in the determinants of population health and as a guide for practitioners making programmatic decisions. In this article, we propose a conceptual model that synthesizes the current literature on factors that contribute to population health after disasters. We use this model and examples to highlight how these factors interact with events and with each other, and we explain why consideration of these factors must be part of a comprehensive practitioner and public health approach to mitigating the consequences of these events.

A framework for organizing underlying socioecological vulnerabilities to the consequences of disasters

Our approach and guiding model (Figure 1) is rooted in socioecological perspectives on the determinants of health.⁹ Briefly, these theories suggest that factors at multiple levels of influence contribute to individual and population health. These may include historical and contextual factors, such as political structures, or individual-level factors, such as race or ethnicity. A corollary to this thinking is that this broad array of determinants should be considered within the rubric of public health research and practice.^{10,11} Building on this work, we suggest that multiple social and economic factors independently and jointly determine a population's vulnerability to an event and play key roles in shaping the population-health consequences of disasters.

This suggestion is not entirely novel. Many academic disciplines consider individual and contextual factors that increase a population's risk in the face of a hazard. For example, some academic disciplines have considered the factors that determine—or covary with—vulnerability.^{12,13} Still others have postulated that vulnerability can include genetic and biological vulnerability at the individual level¹⁴ and social vulnerability at the group level.¹⁵ In the realm of disaster

preparedness, it has also long been recognized that certain populations are more vulnerable to the effects of disasters than others,¹⁶ and detailed case studies have shown that multiple layers of history, ecology, and culture overlap to produce and augment existing group-level vulnerability.¹⁷ However, despite the large body of published literature, we are not aware of research syntheses that have considered how key social and ecological contextual factors influence population health in the disaster context. Using the model (Figure 1) as a guide, we draw on the published literature to discuss the key contextual factors that may shape the consequences of disasters. The model assumes that consequences reflect multiple levels and factors which operate singly or interact in an additive or synergistic fashion. Larger-scale processes of geography and history are viewed as underlying forces that operate primarily through the community and individual-level variables in the model. In the following sections, we describe the ways in which these elements might influence post-disaster consequences, and we draw examples from the literature where possible.

Contextual determinants of population health after disasters

Geography and history

Although disasters are a global phenomenon, the impact of disasters on individual and population health remains grounded in local contexts and historical power relations. Geographical factors leave specific areas at particularly high risk of disasters. This is illustrated in areas that are below sea level or are close to bodies of water that change level frequently (e.g., the Gulf Coast region in the United States, river deltas in Bangladesh), as these regions are particularly prone to flooding. Similarly, human settlements in arid areas (e.g., southern Australia) are vulnerable to fires.¹⁸ The threat of disasters in many such areas is endemic, and floods, bushfires, and earthquakes are recurrent events, displaying varying degrees of intensity in different seasons. In areas displaying such physical/geographical vulnerability, the risk of recurrent disasters is virtually unavoidable.

Geography also plays an important role in structuring the post-disaster response. News of a disaster

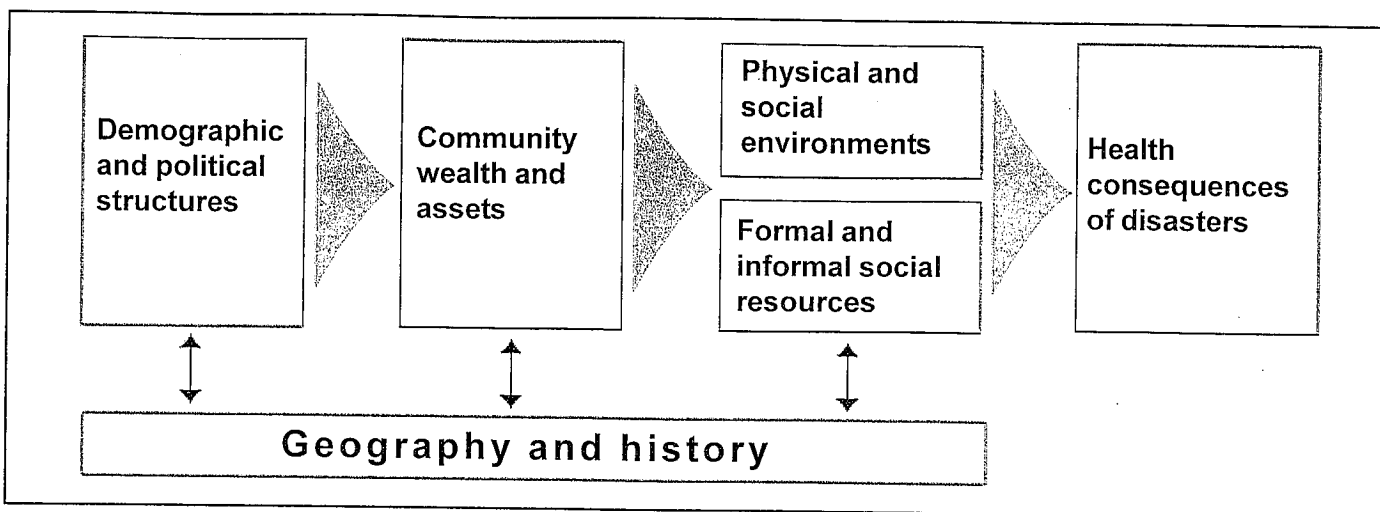


Figure 1. A conceptual framework for considering the determinants of population health after disasters. Because of the complexity of the potential relations among the determinants of health after disasters, our framework simplifies a number of potential relations between the domains shown here and discussed in the article. The arrows in the figure are purely schematic and are not meant to be exhaustive or definitive; there are several interrelationships between the domains presented here, and we would anticipate that most relationships would be multidirectional. This pictorial representation of the framework is also limited by its static nature. A fuller depiction of the determinants of the health of populations after disasters would incorporate changes over time (e.g., a destabilizing government) that are important determinants of population health in and of themselves.

event in an isolated community may take far longer to reach aid agencies or the media (as with 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, which killed an estimated 80,000 people.^{18,19}

Event and country history, as well as the region's record of international relationships, will influence the post-disaster impact primarily through mechanisms related to local and international aid and recovery response. At the national level, the available evidence suggests that levels of emergency aid vary with the security interests of the disaster-afflicted country. As Olsen and colleagues²⁰ point out, many of the most disaster-prone countries worldwide are in areas that are of little security interest to the United States and other developed countries, and therefore receive minimal emergency funding. Colonial relations also influence responses and, as a result, post-disaster consequences. Geography and history, noted in the framework as important determinants, influence each

of the other elements of the model and are relatively immutable, making them unlikely to be focal points for public health interventions.

Demographic and political structures

The demographic trends and population structures of disaster-affected areas describe which groups are most likely to be affected by a disaster. Populations or communities with age structures dominated by the very young will experience greater physical morbidity and mortality than populations with lower fertility rates and age structures skewed toward older residents. Because of the increased vulnerability of infants and young children, there is also some evidence that mortality during crises is greater among households with relatively large numbers of children; this may be particularly true in complex emergencies that result in food scarcity.²¹ Populations dominated by the elderly are also vulnerable and will be uniquely influenced by disasters, conflicts, and crises. This may have substantial implications for understanding and dealing with post-disaster consequences in the near future. Developing countries will account for most of the worldwide increase in the number of people older than 60 in coming decades; it

is projected that by 2050, over half of all persons older than 60 will live in countries with average incomes of less than two dollars per day.²² Less obviously, populations' age structures also influence production and tax bases prior to disasters, which may increase the availability of resources for post-disaster relief.

Political structures and systems of governance establish the parameters (e.g., taxation, federal-state relations) that shape many of the other contextual factors that, in turn, shape health after disasters. Political systems and structures are immensely complicated, and it is difficult to draw generalizations about how specific political systems may influence the consequences of particular local disasters. However, specific observations about *features* of such systems are possible. Democratic governance is typically associated with greater governmental openness and responsiveness to domestic criticism, and there is some evidence that such regimes are less prone to state failures. For example, analyses of state failures such as those that have occurred in Liberia and Somalia, which often precede or predispose nations to disasters, show that these events are far more likely to occur in partial, as opposed to fully, democratic regimes.²³ Similarly, post-disaster response may be influenced by political structures and governance. Pelling,²⁴ for instance, has shown how Guyana's "top-down" political approach led to the gradual erosion of community involvement in community projects focused on alleviating vulnerabilities to flooding. Despite rhetoric encouraging community involvement, actual community participation was subverted by dominant individuals and political elites who sought to monopolize resources for their own private projects. This led individuals to shun community-level solutions and preferentially implement more costly and individual-level coping strategies.

Perhaps a more consistent feature of political structures, which relates directly to the mitigation of disaster consequences, is the *effectiveness* of political structures and governance. Effectiveness of government can span a broad spectrum. At the extreme end are a few societies without an effective government of any sort. For example, Somalia has not had a central government since 1993; instead, informal

organizations—typically organized along clan lines—have emerged to provide a loose form of governance that will generally organize response to mass disasters such as famines, in terms of both providing relief for persons in affected communities and dealing with international aid organizations and outside offers of help. Less dramatically, within well-established national political structures there have been several recent examples of both effective and ineffective governmental responses to disasters. Focusing on the United States, during the past three decades subsequent federal administrations have relegated more government functions to state and local governments. Taxes have been cut at the federal, state, and local levels; some environmental and consumer regulations have been loosened; and many previously public services (e.g., sanitation, water, healthcare) have been privatized.²⁵ This devolution of responsibility to lower levels of government has contributed to underfunded social and public health systems that, in many instances, have failed to rise to emerging health threats. For example, limited regulation of municipal water supplies has been considered at least partly responsible for water-borne disease outbreaks in some North American cities.²⁶ Most recently, the ineffective and uncoordinated US governmental response to Hurricane Katrina, in August/September 2005, has been widely attributed to devolvement of central governmental authority and poor coordination between federal, state, and municipal levels of government.²⁷

Community wealth and assets

A community's low socioeconomic status may affect residents' health through two primary mechanisms: 1) limiting the availability of salutary resources that may be beneficial to residents' well-being, and 2) psychosocial stress accompanying the chronic shortage of essential resources.²⁸ These 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 fewer resources under good circumstances are less likely to have access to salutary resources such as health/social services or food reserves. Similarly, post-disaster circumstances

are more likely to heighten preexisting stressors, potentially leading to poor coping behaviors (e.g., substance abuse). Evidence about the consequences of disasters across communities with different levels of deprivation comes, for example, from research after the 1992 earthquakes in Humboldt County, California: Rio Dell, a more marginalized town, experienced a worse disaster response and a slower and more limited recovery than Ferndale, an equally affected but more affluent community.²⁹

Importantly, post-disaster wealth inequalities may actually be greater than those pre-disaster. Psychosocial stress that results from living in communities with high income disparity may be associated with greater interindividual tension and an increased likelihood of interpersonal violence. Also, perceived and actual inequality caused by discrepancies in income distribution erodes social trust and diminishes the social capital that shapes societal well-being and health,³⁰ and it may lead to underinvestment in public goods. Income inequality also may be associated with disinvestment in communities' material resources.⁹ Congruent with our discussion about the role of community socioeconomic status, these mechanisms may also be particularly relevant in the post-disaster context. Some of our work has shown that community income inequality is associated with a greater risk of psychopathology after a disaster regardless of the contribution of individual income.³¹

Physical and social environments

The human-built environment can influence both physical and mental health. Empiric evidence about the relationship between the built environment and health conditions includes, among others, asthma and other respiratory conditions, injuries, psychological distress, depression, and child development.³²⁻³⁶ Some have linked different aspects of the built environment to specific health outcomes. For example, specific features of the built environment, including quality of housing, density of development, mix of land uses, scale of streets, aesthetic qualities of place, and connectivity of street networks, may affect physical activity³⁷ and, in turn, all-cause mortality.³⁸ Infrastructure is also a critical part of the physical environment and

determines how a city provides water, disposes of garbage, and provides energy.³⁹ Water scarcity and water pollution are serious problems in less wealthy countries. It is estimated that nearly 1.5 billion people lack safe drinking water and that at least 5 million deaths per year can be attributed to water-borne diseases.⁴⁰

The physical environment is perhaps one of the most obviously central contextual features of post-disaster recovery. Structures like buildings, bridges, and skyscrapers may be vulnerable to natural or human-made disasters, as recent earthquakes in Japan and Iran and the September 11 terrorist attacks on New York City demonstrated. Features of the physical environment can be immediately linked to fatality rates after disasters.⁴¹ This was seen in recent earthquakes of comparable magnitude in Kobe, Japan, in 1995, and Bam, Iran, in 2003, which led to 5,200 and 26,000 deaths, respectively. Despite differences such as political or economic factors between Iran and Japan, both historically and in the present, much of this disparity in mortality can be attributed to a significant difference in the quality of buildings. Japanese buildings had been reinforced to cope with earthquake tremors; much of the Iranian city of Bam, which lacked such an architectural precaution, collapsed with the earthquake, killing thousands of residents.⁴² Less immediately, infrastructure can be damaged after an earthquake or hurricane, straining already taxed systems and contributing to the spread of disease post-disaster. In the longer term, lengthy reconstruction of the local physical environment may contribute to prolonged community suffering, limited job opportunities, and a slower recovery of physical and mental population health after a disaster.

The social environment has been broadly defined as including "occupational structure, labor markets, social and economic processes, wealth, social, human, and health services, power relations, government, race relations, social inequality, cultural practices, the arts, religious institutions and practices, and beliefs about place and community."⁴³ This definition, by its very complexity, suggests that there are multiple ways in which the social environment may affect health. Social order, stability, and integration are conducive to conformity, while disorder is conducive to

crime and poor integration into social structures.⁴⁴ Limited social cohesion may predispose individuals to poorer coping and adverse health.^{45,46} Social capital effects are thought to offer general economic and social support on an ongoing basis as well as make specific resources available in times of stress. These effects may include manifestations at the community level and at the social-network level. Social capital is associated with lower all-cause mortality,^{30,47} reduced violent crime,⁴⁸ and improvements in self-reported health.⁴⁹ Spatial segregation of different racial/ethnic and socioecological groups may enforce homogeneity in resources and social-network ties, suppressing diversity that may benefit persons of lower socioeconomic status. People who live in segregated communities may have disproportionate exposure, susceptibility, and responses to economic and social deprivation, toxic substances, and hazardous conditions.⁵⁰

Predisaster social environments critically influence post-disaster health; conversely, disasters may influence the social environment in myriad ways. Predisaster community cohesion is a foundation upon which post-disaster recovery can be built.^{16,51} In addition, preexisting social stressors, influenced by racial/ethnic and socioecological strains, may influence post-crisis interactions during the recovery phase. For example, strained relations between Somalis and Somali Bantu have carried over into resettlement communities and have forced resettlement agencies to tread carefully along these ethnic lines.⁵² Preexisting social stressors may also influence social interactions between disaster-affected communities and those attempting to provide post-disaster aid. This was evident in the aftermath of Hurricane Katrina, as tensions in the racially segregated city played out repeatedly in clashes with military and paramilitary aid workers on national television in the United States. Also, in the context of limited post-disaster resources, predisaster social relationships that enforce or reward the equitable distribution of resources may be essential to ensure that resources will be available to those individuals who are most vulnerable to the consequences of disasters.

Formal and informal social resources

Although related to features of the social and cultural environment, civic society frequently plays a distinct

role in shaping a context that is salutary for population health. Civic society defines a space not controlled by government or the market in which residents interact to achieve common goals. Several participants in civil society influence the health of populations. For example, community-based organizations (CBOs) such as neighborhood associations and tenant groups provide services, mobilize populations, and advocate for resources. CBOs and nongovernmental organizations (NGOs) have a long history of working to improve living conditions, both in their own home countries and internationally. For example, CBOs in the United States during the 1960s and 1970s, sometimes with government support, promoted economic development, established health centers, advocated for improved public education, and built new housing.⁵³ In the 1980s and 1990s, CBOs were at the forefront of the struggle against the AIDS epidemic in the United States.⁵⁴ Many of these organizations developed into effective international NGOs and advocated for global AIDS control in the 1990s. Places of worship and faith-based organizations offer social support, safe spaces, and political leadership.^{55,56} In many instances, civic society may well be the only formal societal structure standing in the aftermath of a disaster able to command the population's respect and trust. Particularly in human-made disasters, when the population's suspicion of formal governmental authority may be high, civic society can serve as an honest broker, delivering aid relief and helping to rebuild the social and physical environments. For example, during the extended conflict between Israel and Lebanon in the 1980s and 1990s, local civic institutions, many predating the conflict, played a central role in providing health and social services to local populations in contested territory.

The role of culture in shaping health in general, and in the post-disaster period in particular, has been difficult to quantify but is likely quite pervasive. Measuring the impact of culture is made difficult by diverse definitions and interpretations. For the purposes of this article, we will consider culture to comprise the beliefs or rules of behavior that are passed on from one individual to another via some form of social learning.⁵⁷ Because members of groups often, by definition, share

norms and beliefs, distinct groups of people will likely experience, react, and respond in very different ways to the same disaster event. Some researchers have suggested that differing and culturally specific norms related to fatalism may alter both pre- and post-disaster responses.⁵⁸ Some evidence to support this claim has arisen in interviews with survivors of Hurricane Andrew. There is also the possibility that expressions of posttraumatic stress disorder and other mental health morbidities may vary by ethnic or cultural group.⁵⁹ Sociologists have suggested that ethnic groups in political power may steer health-related resources toward their ethnically similar constituents, which in turn may improve the health and well-being of one ethnic group at the expense of others.⁶⁰

The purview of culture also entails group-specific norms and beliefs regarding patterns of fairness, justice, and sharing, which themselves vary tremendously across cultures and neighborhoods⁶¹⁻⁶⁴ and may influence levels of person-to-person assistance, helping behavior, and contributions to public goods in the post-disaster context. Studies in nondisaster settings have linked these norms of trust and fairness to public health outcomes including violence⁶⁴ and food insecurity.⁶⁵ Social cohesion and norms of cooperation may be reinforced by identity symbols or through social security networks, which also serve to minimize the risk of resource shortfalls. These networks, which are frequently biased toward kin, have also been identified across a broad range of societies as informal sources of assistance called upon during disasters.^{66,67} Importantly, this "moral economy" of sharing is also linked to community socioeconomic status, which influences the efficacy of informal support networks. Less affluent communities may be less able to mobilize economic and material resources to assist others than more affluent communities,^{68,69} but this may or may not be true for other domains of social support. These networks can be severely disrupted during post-disaster relocation or resettlement schemes, which can have devastating effects on information transfer, cooperative networks, and access to health-care and parenting support. Strong cultural norms regarding societal organization and altruism also contribute to communal efforts to restore public places

and other physical structures to their predisaster states. There is a tremendous need for qualitative methods and ethnographic study of informal responses to disaster situations.

Social relationships associated with formal social and religious institutions are also elements of the cultural context and may shape health. Religiously sanctioned or endorsed behaviors and practices have the potential to influence health in the predisaster context. For example, religious prohibition of alcohol use is associated with much lower rates of alcohol dependence among Muslims as compared to non-Muslims.⁷⁰ Conversely, destruction of culturally significant places may be associated with communal grief,⁷¹ which has in turn been associated with elevated rates of depression in the aftermath of disasters.⁷²

Formal health and social services infrastructures undoubtedly play a role in influencing post-disaster outcomes. Predisaster availability of health and social resources is inextricably linked to post-disaster recovery. Rich countries and communities are characterized by an array of health and social services, particularly when compared to poorer countries or communities.^{73,74} In the United States, even the poorest communities often have dozens of social agencies, each with a distinct mission and service package. Many of the public health successes in wealthy countries over the past few decades, including reductions in HIV transmission and improved tuberculosis control, have depended in part on the efforts of these groups.⁷⁵ However, social and health services in poorer countries are often limited. In poor communities or less wealthy countries, social and health services are frequently susceptible to changing national and donor fiscal realities, with the resultant decrease in service frequently coinciding with times of greater need in the population.^{74,76} For example, in the United States over the past few decades, the decline in the national economy and tax revenues has forced many cities and states to reduce services at the very times when unemployment and homelessness were increasing.^{77,78}

Disasters of different scopes and magnitudes may be associated with the decimation of all, some, or no predisaster health and social services. In disasters where preexisting health and social services continue

to function after the event, the contribution of these resources to the preservation or restoration of the population's health is self-evident. However, these preexisting resources are relevant even in devastating disasters where most formal resources are destroyed. Local health and social service practitioners have local knowledge, are accepted by local community members, and are much more likely to be able to provide continuity of care than are services provided by outside aid agencies.^{79,80} Therefore, preexisting services with attendant trained personnel who may continue providing services after a disaster are a key component of the disaster context and may critically contribute to the improved health and well-being of populations after disasters.

Covariation of contextual factors influencing post-disaster health

Although we have discussed contextual factors in isolation throughout this article, we do not mean to suggest that these factors act in isolation from one another or that they are likely to change independently of one another. In fact, it is much more likely that a specific disaster will influence multiple elements of the local context, and that these factors will co-jointly influence post-disaster health. By way of illustration, focusing on the physical environment, the relation between infrastructure and health is shaped by systems of government and the effectiveness of governments in maintaining a serviceable quality of infrastructure. The decline of an aging infrastructure coupled with declining local municipal resources may challenge a community's ability to continue to provide safe water and sanitation for its residents when the system is strained by an unexpected crisis.⁸¹ As a specific example, in rapidly urbanizing areas (frequently within less wealthy countries), cities are often challenged to maintain adequate fresh water supplies for growing numbers of urban residents and to transport accumulating sewage and other waste. The likelihood of a breakdown of sanitary infrastructure after disasters is much higher in systems that are already taxed, have no built-in redundancies, and have no tradition of rapid response to breakdowns. As another example, racial segregation may affect health through its influence on

access to health resources and healthcare services. Segregated communities frequently face shortages of healthcare providers and disproportionately low rates of health insurance; both factors are among the most important predictors of differential access to medical care.⁸² More-segregated communities could have lower levels of social capital, which, as discussed, have been associated with poor health.⁸³ Therefore, communities are frequently characterized by multiple features of the social environment that may be detrimental to population health. It is likely that these communities are particularly vulnerable, then, to the consequences of disasters.

Although we have discussed the factors that we consider to be among the most important contextual determinants of population health following disasters, these factors are by no means comprehensive. Other contextual factors that might also contribute to post-disaster population health are the degree of urbanization and the extent of in- and out-migration.

Structural change and population-based interventions

Once those interested in public health promotion recognize that predisaster context is inextricably linked to post-disaster outcomes, questions naturally arise about courses of action available to public health and medical professionals that may influence the identified factors. It might be reasonably argued that affecting features of the social environment that influence post-disaster health is a challenge beyond the scope of most public health and medical practitioners. However, we suggest that although effecting structural and systematic change to influence underlying contexts may seem daunting, a focus on the fundamental determinants of population health is essential if we are interested in mitigating the consequences of disasters. Leonard Syme⁸⁴ has argued, quite effectively, that interventions that take account of and act on only the individual level will doom public health to small positive effects. In addition, interventions that are misdirected (at either modifiable variables or other levels) may well have unintended consequences and can result in unanticipated changes in behavior. The public health literature contains examples of

well-intended interventions leading to such unfortunate consequences.⁸⁵ Understanding the relevant features of local contexts that may contribute to population health after disasters is an imperative for public health employees and medical practitioners concerned with mitigating the consequences of disasters. It is critical that such professionals understand the contexts of disasters, and that health practitioners consider efforts to ameliorate these contexts—to change structures and ecologies—before a disaster occurs.⁸⁶

Conclusion

We have presented a conceptual framework that we hope is helpful to those interested in understanding how social context shapes the consequences of disasters. The framework presented here is inarguably a function of our own experience and perspectives. We hope, however, that it achieves two purposes. First, we hope that it stimulates discussion and debate about the intersection of the social environment and the consequences of disasters, and that others may confirm, or refute, our suggestions and offer alternate frameworks that may improve our thinking in the field. Second, we hope that this generates empiric research that considers the relationship between specific features of the social environment and health in the aftermath of disasters. Ultimately, we hope that clearly formulated frameworks will lead to testable hypotheses that can illuminate avenues for intervention and better mitigate the consequences of mass traumas and disasters.

In conclusion, we suggest that there are three primary implications of the observations noted here for those concerned with public health promotion. First, public health practitioners interested in mitigating the consequences of disasters need to consider both policies that might improve the underlying determinants and practicable, population-based interventions that might be implemented rapidly in the post-disaster period. Although policy change that influences some key underlying factors such as income distribution in communities may well be considered outside the realm of public health practice, we suggest that it is the role of public health to influence the determinants of health at all levels. There are multiple examples throughout history of instances

where public health has indeed acted on contextual factors, and these examples expand considerably beyond the realm of individual exposure or behavior. For example, it was public health efforts to improve cities' sanitary conditions that led to improvements in European cities' infrastructure and the attendant reductions in morbidity and mortality throughout the nineteenth century.⁸⁷ Effecting structural change requires 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 contextual features that may influence the health of populations after disasters. This represents a plausible, and desirable, goal for those interested in health promotion.

Second, healthcare practitioners, who are likely to be at the forefront in dealing with the consequences of any disaster, may also find it fruitful to consider the context shaping the consequences of specific disasters. Healthcare practitioners are frequently faced with health conditions that reflect a complex set of circumstances in terms of etiology, including, as discussed here, social causation. Although daunting, a full understanding of this etiology is essential in providing comprehensive interventions that can mitigate the consequences of disasters and mass traumas. For example, physical illness after disasters is likely to be both co-occurring with and complicated by mental illness that is directly linked to the experience of mass trauma. Compliance with medication protocols post-disaster is likely to be as much a function of available social and practical supports as it is of good and well-informed clinical care. Therefore, primary and secondary care practitioners must recognize, and account for, the contribution of social context to post-disaster mental and physical health when considering diagnoses and treatments.

Third, the role of multiple contextual determinants in shaping population health following disasters is likely to be complex. Although we have drawn on the available literature to suggest how these contextual domains may influence population health, the ultimate role of each factor will be specific to the local context. Therefore, public health efforts to improve context and thus mitigate the consequences of disasters have to center around locally responsive,

population-based interventions. Toward this end, we suggest that emerging 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.

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