Community Stress, Psychosocial Hazards, and EPA Decision-Making in Communities Impacted by Chronic Technological Disasters

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Psychosocial stress has emerged as an important consideration in managing environmental health risks. Stress has adverse impacts on health and may interact with environmental hazards to increase health risk.

This article's primary objective was to explore psychosocial stress related to environmental contamination. We hypothesized that knowledge about stress should be used in conjunction with chemical risk assessment to inform environmental risk management decisions. Knowledge of psychosocial stress at contaminated sites began by exploring the relationships among social capital, collective efficacy, and contamination at the community level. We discussed stress at the family and individual levels, focusing on stress proliferation, available resources, and coping styles and mechanisms.

We then made recommendations on how to improve the use of information on psychosocial stress in environmental decision-making, particularly in communities facing chronic technological disasters. (*Am J Public Health*. 2011;101:S140–S148. doi:10.2105/AJPH.2010.300039)

PSYCHOSOCIAL STRESS HAS emerged as an important consideration in managing environmental health risks. This is due to evidence that psychosocial stress has adverse impacts on health and may interact with environmental hazards to increase health risk. For example, both psychosocial stress factors[1,2] and lead[3,4] have been independently associated with hypertension, and recent studies have suggested that stress may modify the effects of lead on hypertension.[5] The emerging studies on the potential adverse interactions between psychosocial stress and environmental hazards have posed paradigm shifting questions for the future of environmental health research and practice, and particularly, of how to incorporate psychosocial stress considerations into environmental research, risk assessment, and risk management. Specifically, for communities constantly exposed to psychosocial stress related to chronic environmental contamination, assessment of psychosocial stress in addition to chemical risk assessment promises to proffer policies and decisions that are more informed. Necessary steps toward the practice of incorporating psychosocial stress into environmental risk management and research include developing an understanding of: (1) how stress interacts with environmental agents to influence health, and (2) stress triggers and coping mechanisms at the community, family, and individual levels, particularly in relation to conditions of chronic environmental contamination, conditions experienced by environmental justice communities. The article by McEwen and Tucker[6] provides a review of the evidence in support of the adverse effects of psychosocial stress on health and its modifying effect on the relationship between exposure to environmental agents and adverse health outcomes. In this article, our primary objective explores the concept of psychosocial stress, particularly as it relates to chronic environmental contamination. We explain how the presence and/or perception of environmental contamination may lead to psychosocial stress in the community, family, and individual. In addition, we hypothesize that knowledge about psychosocial stress can and should be used in conjunction with chemical risk assessment to inform environmental risk management decisions for communities affected by negative environmental conditions. Although we focus on chronic environmental contamination, we note that it is not the only important source of psychosocial stress in minority and low-income communities, and frequently occurs concurrently with other sources of psychosocial stress, potentially resulting in stress proliferation.

Studies have consistently demonstrated that the experience of stress can vary considerably by race/ethnicity and income.[7–9] The most obvious source of stress related to environmental contamination and disasters is concern about actual or potential harm emanating from the environmental agent. Less obvious, but at times even more significant, is stress caused by social and cultural changes that take place in the wake of environmental disasters or contamination. The interplay between these 2 causes of stress can often lead to disparities in impacts (including health effects) across communities given similar environmental challenges. We discuss these 2 key causes of stress from the perspective of how they may drive stress for the community, family, and individual.

Chronic environmental contamination is used interchangeably with the term "chronic technological disasters" (CTDs) in this article and refers to conditions of perceived or known man-made contamination of an environment that persists over time. Tornadoes race through a community in a matter of minutes, hurricane impact is measured in hours. A CTD, such as a Superfund site, lasts months, years, even decades. Wolfe and Schweitzer[10] characterized CTDs as complex events because such environmental contamination is often cumulative; may be latent and not identified as a problem for several years; has impacts on humans that may be delayed, dynamic, or multiple and certain; and its remediation may be technically, economically, or

politically infeasible. CTDs differ from natural disasters (e.g., hurricanes and tornadoes) in that they may not be recognized as critical issues by community residents. Acute natural disasters promote action, whereas CTDs promote consideration and uncertainty. There are frequently no obvious responses to CTDs, and signs of recovery are less obvious. Unlike acute disasters that have an obvious "before" and "after," CTDs can become a part of the context of community life.[10] Unlike natural disasters, which cycle through a set of stages and include a beginning, middle, and end, CTDs trap a portion of the population in the "warning," "threat," and "impact" stages as illustrated in Figure 1.

Such long-term exposure to warning and threat places severe demands on the coping resources of a population.[12] Examples of CTDs include the polychlorinated biphenyls contamination at Love Canal, New York and dioxin contamination at Times Beach, Missouri. Many minority and low-income communities continue to experience perceived or known CTDs.

IMPACT OF CTDS ON COMMUNITY STRESS

To understand the impact of stress generated by CTDs within a community, it is important to assess the baseline conditions of that community, that is, conditions before the discovery of contamination that predict the impact or experience of stress. We can view the capabilities for response of a community to any type of crisis as falling into 2 related areas: social and cultural.

We can conceptualize the capabilities for effective coping response in the social arena as "social capital." Although consensus has not been reached on a definition of social capital, it is generally seen as "not a single entity, but a variety of different entities having two characteristics in common: they all consist of some aspect of social structure, and they facilitate certain actions of individuals who are within that structure."[13] Social capital in a community can be measured by various community-level indicators, including income, employment, housing, crime, family type, and networking data.

For the cultural arena, we use the term, "collective efficacy." Rather than social capital, which refers to structural arrangements in a neighborhood or community, collective efficacy refers to the belief that social capital can be used effectively for the collective good. In other words, "Personal ties notwithstanding, it is the linkage of mutual trust and shared expectations for intervening on behalf of the common good that defines the neighborhood context of . . .'collective efficacy'."[14] Collective efficacy is a subjective, cultural concept; its measurement is best extrapolated from individual-level data, such as community surveys and observational studies.

Both social capital and collective efficacy deal with issues of control and, alternatively, powerlessness. Both have been found to be correlated (negatively) with community stress and (positively) with health of residents living in those communities.[14–18]

From this perspective, communities that experience the least stress most likely have a high level of social capital and collective efficacy. These are communities that are stereotyped as a New England village: those that have effective participatory governmental and civic structures, active voluntary associations, residents integrated by friendship and associational networks, and adequate economic resources for the community and its residents. The level of trust between residents, and among residents, their community organizations, and larger institutions is typically high.

By contrast, communities with low levels of social capital and collective efficacy are likely to have ineffective local government and civic structures in which individual residents do not have the opportunity to give positive input. They lack effective voluntary associations, or when they exist, they are isolated from the larger community. Residents lack positive friendship and associational networks within the community; in addition, they lack economic resources to meet the needs of the community and its residents. Instead of trust within the community and between the community and larger institutions, there is distrust and disdain, and the belief

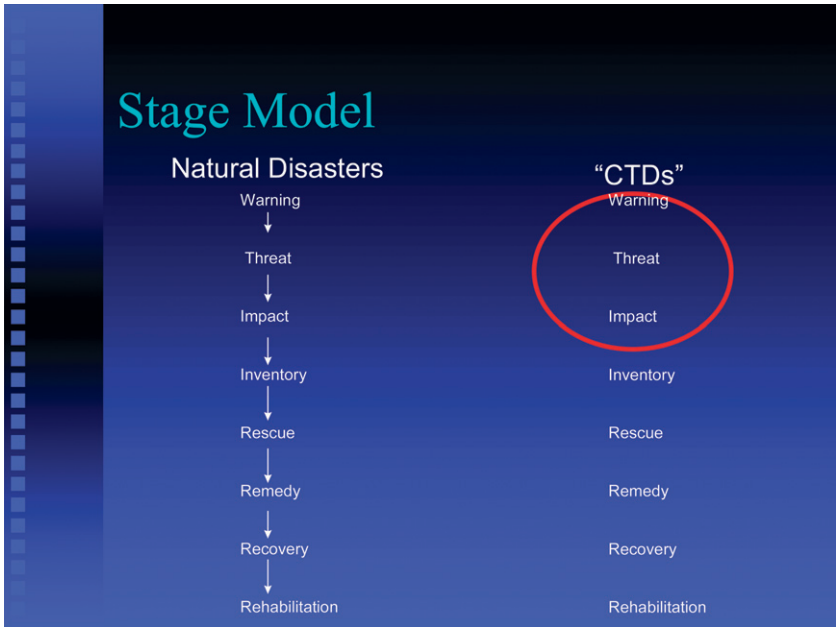

FIGURE 1—Comparison of types of disasters in terms of stages of recovery. Adapted with permission from United Nations University Press.[11]

that people cannot count on each other or on larger institutions to help them meet their needs.[18–24]

When examining what constitutes an effective community response to environmental contamination, it is a community that has some collective power to decide on and help implement a course of action that will contain or ameliorate the problem. The community creates or maintains social solidarity, meets the needs of its members, manages social conflict, and finds and utilizes economic and social resources. The community, therefore, can be a major actor that, along with government agencies, and perhaps industry, can effectively combat the physical and/or social problems caused by toxic contamination.

CASE STUDY

A considerable amount of research had supported the contention that environmental contamination is most likely found in communities with high proportions of residents of color and residents with low income.[19,25–28] Generally, communities with confirmed chronic environmental contamination tend to be socioeconomically disadvantaged and lacking the social, economic, and cultural resources to respond effectively. In addition, the social capital and collective efficacy possessed by a community is severely taxed by the contamination and its attendant social processes.

Community stress triggered by environmental contamination and the buffering effects of social capital and collective efficacy has been well-studied. CTDs are different in important ways from other types of disasters and have decidedly different social and psychological impacts. Two characteristics are paramount: time and level of human/technological involvement. Unlike hurricanes, tornadoes, or industrial plant explosions, ever-present environmental contamination over a long time adds to community-level stress in ways analogous to how chronic stressors add to psychological distress at the individual level. Another characteristic of CTDs is that they are not seen as acts of nature or acts of God, but as human/technological interventions in the environment that may be viewed as significantly or positively beneficial in some ways to the affected community. This greatly heightens the likelihood of social conflict within the contaminated community between those who greatly fear the consequences of contamination and those who see the economic benefits (e.g., a polluting industry) of being worth the risk.

Five main elements for the unique stressors associated with CTDs have been identified from the literature.[29,30] These 5 elements can occur at all social levels (community, family, and individual) and include: (1) uncertainty (related worries about the health effects of the exposure [both for the individual and possibly one's children])[31]; (2) housing and job security (possible evacuation or the threat of an evacuation, fear of contamination from housing or the community, and possible loss of property value)[32]; (3) social rejection (social stigma and discrimination due to coming from a "toxic" community)[33]; (4) media siege (how information is transmitted about the community, how debate about the community is shaped, and how the "public fear" angle could be manipulated)[34]; and (5) cultural pressure (conflicting public pressures and implicit social messages about how to behave, what information to believe, and what can be expected now and in the future).[35]

CTDs often put severe strains on a community's social capital and collective efficacy. Specific effects on community social capital occur in a variety of ways. Local government is likely to become overwhelmed and unable to respond effectively because its structures are not designed to respond to this type of problem. External agencies and organizations, often with little knowledge about or sensitivity to the cultural context within which they are working, enter the community to provide assistance. Given this lack of knowledge of the local community, these well-meaning agencies underutilize local knowledge and resources that could be helpful in solving the problem and, in some cases, exacerbate problems within the community by creating social conflict. In addition, grassroots groups often form to try to deal with the contamination problem. These groups mobilize social capital toward achieving their ends and can help a community to gain some control over contamination-related issues. At the same time, grassroots groups may also foster social conflict within a community, further diminishing the community's social capital. These structural strains and changes often last a long time.

CTDs also affect collective efficacy. In cases of contamination, it is common to see the development of a "culture of distress" that diminishes or destroys a community's collective efficacy. A major cause of the culture of distress is the destructive social conflict that takes place in many contaminated communities. Conflict occurs over issues such as the severity of the health dangers from contamination, the extent of the contamination itself, remediation strategies, and how to keep residents safe. Conflict often pits neighbor against neighbor, destroying trust and alienating members of the community from one another, as well as from outside institutions, which are perceived as ineffective in dealing with contamination issues.

Not all contaminated communities experience this destructive social process. We do not have sufficient research to know why some communities are more resilient than others when confronted with environmental contamination. However, there is much qualitative evidence that substantiates the argument that communities with low social capital and low collective efficacy have significant problems responding to CTDs.[36]

A classic example of the destruction of social life caused by a CTD is the Centralia mine fire.[21] In 1962, a mine fire was discovered burning just outside an eastern Pennsylvania mining community of about 1000 residents. Over the next 20 years, governments at various levels spent over $5 million in unsuccessful attempts to put out the fire. By the early 1980s, at least 7 citizens' groups had formed in this small community, each fighting the others over what should be done about the fire. Local government resources were overwhelmed; state and federal governmental response was slow, piece-meal, and disorganized.

In July 1983, a federally financed geologic study of the fire revealed that the situation was worse than most people feared.[37] At that time, the fire was burning under about one third of the Borough of Centralia. The study concluded that the fire would eventually burn under all of the community. At the time of

the study, the fire was burning under fewer than 200 acres of land. The study stated that the fire could eventually burn under 3700 acres of land. Based on these dire conclusions, the federal government passed a special authorization of $42 million to relocate Centralia residents and businesses that wished to move. Most Centralians left the Borough by the end of the decade; some have refused to move to this day. At the time of this writing, 9 people still live in Centralia.

What happened in this community illustrated the social and psychological impacts brought about by CTDs. The controversy generated a very high level of social conflict that shattered the sense of community felt by Centralians. Long before most residents vacated the community and long before most homes were torn down, the social community of Centralia had ceased to exist. This was keenly felt by residents, some of whom, although admitting feeling stress caused by dangers associated with the fire, said that fighting with friends, neighbors, and family members over what to do about the fire was much more stressful.

Part of Centralia's response was no doubt due to the social, cultural, and historical circumstances of this small mining community. However, part was also due to the chronic technological nature of the disaster itself. Studies of responses to contamination in very different types of communities have found similar patterns of destructive social conflict and psychological stress to those found in Centralia. These communities have included those in rural, suburban, and urban settings, in different parts of the United States, and in different countries throughout the world.[19,38–47]

In summary, CTDs generate social stresses that eventually translate to psychological stress. Frequently, when contamination occurs in disadvantaged communities already experiencing significant stress from other sources (e.g., low income, high unemployment, violence, crime), the social stresses caused by the presence or perception of environmental contamination add to the complex mixture of pressures that, in a way analogous to allostatic load (McEwen and Tucker[6]), overwhelm social and cultural resources and defenses found in a community.

CONTAMINATION AND INDIVIDUAL AND FAMILY STRESS

Community stress adds to psychological stress at the individual level, which has negative physical health consequences for residents of contaminated communities. Many theories to date have examined stress and stress-related outcomes as they occur in a community or other social setting. A common thread in these theories is the notion of both physical and personal resources.[48–51] The individual stress response theorized by Lazarus[49,50] envisioned stress as a transactional process occurring between events (stressors) that cause changes in the environment, an individual's evaluation of these stressors, and the individual being able to obtain resources to cope with or manage the stressor or the emotions associated with the stressor. Lazarus termed the evaluation process "appraisal," and believed that there were 2 appraisal components: primary and secondary. Primary appraisal is the process by which an individual determines the threat level of the event; secondary appraisal is where the person examines the resources available to address the event. The processes of primary and secondary appraisal can occur at different social levels (community, family, and individual),[52,53] and resources have to be examined, particularly personal resources, to understand stress and its impacts on persons.

Hobfoll[54,55] suggested general categories of resources in his conservation of resources model. These general categories are: object, condition, personal, and energy resources. Each of these categories is described in the following.

Briefly, object resources are physical objects and possessions (i.e., house, car, jewelry, clothing, etc.). These object resources provide a safe "base of operations" for coping; specifically, these possessions are often necessary to act in a problem-solving manner. Condition resources refers to conditions that are valued by people or conditions that help facilitate the protection of valued resources. Examples of these conditions can include seniority at work, stable employment, a good marriage, or being a member of a stable family. Personal resources are characteristics or skills that people possess. Key personal resources can include job skills, social prowess, optimism, and a sense of personal efficacy. Energy resources facilitate the attainment of other resources; thus, these resources are valued to the extent of allowing access to other resources. Examples of energy resources can include savings (money), credit, owed favors, and knowledge.

When an individual's or a community's resources are depleted, they will tend to use less active, problem-based coping and use more passive, emotion-based coping. Changes in coping and resource loss have been linked to increasing community distress.[56] Research has suggested that responders may enhance coping efforts by identifying resources for coping or by filling in for certain absentee resources.[57–59] Resource loss has been investigated using a valid and reliable instrument[60] and a general survey.[59] Both of these inventories ask questions and have subcategories based on Hobfoll's 4 categories of resources.

One of the most important personal resources available to humans is the quality of their social networks; good social support is one of the most important moderators of stress.[61] Social networks and social support mechanisms need to be examined at the level at which they occur (community, family, and individual) for broad stressors that have impact across levels. Although the individual might not categorize these different levels as discrete categories, it is helpful for theorists and interventionists to be able to properly assess and categorize these stressors according to how they affect communities as well as individuals and how stress coping can influence different levels.

In general social-ecological theory, there are hierarchies of systems that affect social, biological, and psychological levels. After community-level stress, the next important system level to impact a person is the family.[60,61] The structural nature of families helps to influence which stressors occur, how members respond to these stressors, and the meaning and significance attached to these events.[64] The most prominent family stressors for low-income families across cultural domains tend to be economic strain, discrimination, victimization/violence exposure, family transitions, and family conflict.[65] These

stressors are then exacerbated by CTDs due to both coping with the stress of the event itself and the additional drain on resources. The notion of stressors arising from other stressors has been termed stress proliferation.[66] Concepts such as stress proliferation help to explain how early life circumstances can affect later health and well-being as well as how a person copes with future stress events.[67]

There are a small number of research studies on families impacted by CTDs. Reports in the literature tended to emphasize that although natural disasters were more related to direct psychological effects, such as acute stress disorder and post-traumatic stress disorder (PTSD), the nature of CTDs resulted in somatic complaints and fears of future health effects. Mothers, in general, because of their concerns about the health of their children, were the group most affected by CTDs.[68,69]

The research literature has suggested that marital status may also be a risk factor for stress related to CTDs, especially for women.[70] Solomon found that women who perceived themselves as having excellent spouse support were more vulnerable to stress than women with weaker ties. These results were interpreted to mean that social ties and obligations could be a source of stress for married women. The results also demonstrated that single parents may be chronically exposed to a high level of stress that is difficult to alter, even in the context of a CTD.

Research has found that parental stress has also been known to increase after a technological disaster.[71,72] Studies have found that technological disasters have resulted in increased problematic behaviors for children and adolescents, including both externalizing (delinquency, temper tantrums, and disruptive behaviors) and internalizing (dependency, separation anxiety, and clinginess) behaviors.[73]

RISK PERCEPTION AND COPING WITH STRESS

The demands of a stressful event require that a person first evaluate the event and the possible implications at the initial stage before being able to marshal resources (secondary appraisal) to address the event. Lazarus[49,50] viewed primary appraisal as both cognitive and emotional, noting that the event could trigger affective states such as anger, anxiety, and/or sadness. Primary and secondary appraisals are ongoing processes throughout coping. Appraisal processes can be complex, and these processes are shaped by individual and group differences, the hazard or the disaster event, and the relationship to the disaster event.[53] Primary and secondary appraisals affect risk perception, which has been increasingly viewed as part of larger social, cultural, and political processes. Understanding risk perception is important to help understand how a community or individual is impacted by chronic environmental contamination. It is also important to note that risk perception changes over time due to reappraisal of the stressor, changes in coping strategies and possibly resources, and changes to the context of the stressor and community-wide views.[52]

The research literature found gender and cultural differences in the risk perception of a disaster. Racial and ethnic minorities in the United States exhibited greater perceived risk than non-Hispanic Whites when rating real or perceived environmental threats.[74] Minority groups might perceive greater industry-related health risks because they have more experience with toxic exposures, they feel more vulnerable to these exposures, and they view such exposures as a form of injustice. Other factors related to the greater level of threat perception by minorities include greater proximity to a threat, attachment to place, and economic ties to the industry involved in the technological exposure. Many community residents are aware of the history of a response. Thus, poorly handled disaster events in the past might interfere with efforts to address community concerns in the present.[25]

Coping has significant implications for the study of stress, both in terms of dealing with short-term acute stress and the emotional and physical effects of chronic stress. How a researcher conceptualizes stress has important implications for work on stress, adaptation, risk, competency, and resilience. However, there remains a debate in the scientific literature about how to best define and categorize coping strategies.[75] Coping can be defined as an organizational construct encompassing behaviors, cognitions, and perceptions.[67,76] Skinner et al.[77] argued that coping was also a hierarchical construct in which the lowest level constituted "instances" (examples) of coping, and the higher level was those processes that intervened between psychological, social, and physiological outcomes to aid in adaptation. Skinner argued that the higher level category should be labeled "ways of coping" (dimensions of coping) and should represent categories by which lower levels of coping were nested. These categories should be conceptually clear and mutually exclusive.

Unfortunately, there are over 400 different instances of coping in the literature and many different ways to conceptualize the basic ways a person can adapt to a stressor or stressors. The 3 most common adaptive strategies are: (1) problem- versus emotion-focused strategies; (2) approach versus avoidance strategies; and (3) cognitive versus behavioral strategies.[78] There continue to be conceptual problems, however, with all 3 approaches as well as categories that are not mutually exclusive.[77] Studies showed more of a positive relationship between coping and distress (more coping and more distress) than an inverse one (more coping and less distress) for technological disasters. Research has suggested that coping should be viewed as a response to distress or an indicator of it.[79] The nature of coping makes it difficult to study, because individuals can use different forms of coping simultaneously, which makes it difficult to isolate unique effects.[77]

Given the conceptual and practical limitations to studying the relationships between technological disaster stress, individual coping, and outcome, it would be more feasible and effective to take a community-level approach to evaluating stress triggered by a community-scale adverse event such as a CTD. This community-level approach would address the rebuilding and replenishment of community resources to reduce psychological distress.[32] Although this approach has been used more with natural disasters, a community-based rebuilding framework could also be used for CTDs.

The concept of coping is distinct from other related concepts such as resilience.[75] A primary distinction is that coping refers to the process of adaptation, whereas resilience refers to successful

stress outcome. Psychosocial resources known to increase resilience include positive emotions (optimism and humor), cognitive flexibility (positive explanatory style, positive reappraisal, and acceptance), meaning (religion, spirituality, and altruism), social support, and active coping style.[61] There is little literature on resilience as it relates to CTDs, but it can be expected that the chronic nature of this stressor and the constant drain on resources will make a successful community outcome seem remote.

CONCLUSIONS

The contribution of stress to ill health is well-documented. McEwen and Tucker[6] articulated its direct effects on health and indirect influences on the health impacts of chemical stressors in the environment. For many low income and racial minority communities, psychosocial stress is experienced from typical factors such as economic strain, violence, etc., and chronic environmental contamination/CTDs. In this article, we provided an overview of how CTDs drive stress at the community level, and in addition, highlighted the concept of stress proliferation in these communities. We concluded that assessments in these communities to drive risk management decisions and studies/research to assess the health impacts of chronic environmental contamination should concomitantly evaluate psychosocial stress at the community, family, and individual levels, in addition to chemical risk.

Community stress assessment continues to be an ever evolving, multidisciplinary phenomenon. Community stress has been operationally defined as an interaction between neighborhood context factors, community stressors, and community resources.[80] Community stressors can be particularly difficult to assess given their multiplicative and diverse nature. We know that, in general, community stressors can be physical and psychosocial. Physical stressors can include factors such as noise, temperature, humidity, visible light, radiation, and particulate matter.[81] By contrast, psychosocial stressors can include conditions such as crowding, social disorganization, racial discrimination, CTDs, community violence, family turmoil, and economic deprivation.[82,83] These physical and psychosocial stressors can be exacerbated in low income and ethnic minority communities[84] due to structural limitations and reduced resources as well as other reasons.

Data Gaps and Need for Further Research

The ultimate success of any assessment model is its helpfulness in assessing the impact of the contamination in terms of community risk appraisal.[85] This assessment should be comprehensive enough to provide information on how to effectively mobilize resources (formal and informal) to address the community's concerns and assist in the community's development, and improve the overall health and wellness of community residents. To this end, research is needed to develop and/or test current community stress indexes. There has been promising work on the psychosocial hazards scale related to lifetime cumulative lead exposure, cognitive functioning, and stress-producing elements of neighborhood environments.[86] Further work in the utility of this scale in terms of capturing community stress as conceptualized by other researchers is greatly needed. Although one caveat of a single community index might be to mask the influence of individual stressors,[87] a valid and reliable community assessment measure has great potential to study stress impacts on health outcomes. This measure combined with an allostatic load index could ultimately demonstrate how community improvements can lead to lower biological burden and improved health and wellness.

Many unexplored areas of research remain regarding the effects of the interaction of psychosocial stress and toxicant exposure on human health. Community and social scientists wonder about the representativeness of contaminated communities in the current body of research that documents mostly destructive social processes. It is as yet unexplained why different communities with the same socioeconomic status react differently to being exposed to environmental toxicants.

Recommendations

Research on CTDs was sufficient to show some best (and worst) practices agencies implement to incorporate psychosocial stress in assessments of environmental contamination. Recognizing the presence and potential influence of psychosocial stress can provide agencies with more accurate assessments, and therefore enable the implementation of more health protective plans to deal with the potential and/or actual dangers posed by the contamination. We recommend the following actions to improve the use of information on psychosocial stress in environmental decision-making, particularly in communities facing CTD:

1. Include an evaluation of potential community psychosocial stress in planning and scoping actions in a community affected by significant contamination. For agency personnel charged with ameliorating environmental contamination, it is critically important to be aware that the problems confronting contaminated communities are not only related to technical clean-up and physical health, but also the social aspects of the community. In many contaminated communities, a destructive social process develops that exacerbates the psychological and physical health impacts on community residents. Specifically, if the psychosocial impacts of chronic environmental contamination are unrecognized, risk management decisions may fail to adequately address community needs and may make the social process even more destructive. Working in partnership with a community provides opportunities to recognize the multiple stressors at play in the community, and also possibly decrease the development of social stresses and increase the social capital and collective efficacy available to a community to respond to contamination.
2. Establish a positive relationship with local leadership and community groups. Although this might seem obvious, positive involvement of local leadership and community groups with the process of environmental clean-up and/or containment is crucial. Open, honest communication that accurately and realistically conveys the risks of the situation and the processes involved in response is essential to building trust, and trust is the most essential element needed to build a positive response from community residents. The best outcome of community involvement is to

empower community residents to have some control over what is happening in their community; the worst outcome is to render the community and its residents collectively and individually powerless. Government involvement with both outcomes clearly illustrates how agencies are a major part of these outcomes, whether they are positive or negative; likewise, grass roots organizations can also have positive or negative impacts on community stress, depending on whether they empower members and other community residents, or help render them powerless.[21,35] It is important for agency personnel to understand the social dynamics brought about by contamination and to draw upon the professional and local expertise needed to help operate in such communities.

3. Collaborate among government agencies. Continued collaboration between government agencies, such as Environmental Protection Agency (EPA) (environmental protection and public health) and Centers for Disease Control (CDC)/Agency for Toxic Substances and Disease Registry (ATSDR) (public health), is recommended for knowledge sharing and general pooled resources. The CDC/ATSDR as public health agencies are particularly well-versed in addressing the social and psychological aspects of a disaster, including the development of indexes to measure social vulnerability and toolkits for assessing community resilience, resources, and communication. However, these tools have mainly been utilized in the context of natural disasters, and their potential in assessing technological disasters has not been fully realized. Collaborations with EPA could lead to refinements and modifications of these assessment tools to address the unique features of CTDs and greatly improve multidimensional outcomes of clean-up efforts. A follow-up recommendation is to use multidisciplinary teams to examine sites from several perspectives for an improved understanding of the true impact of a contamination event.
4. Acknowledge commonalities of CTDs and the uniqueness of each community. Finally, being sensitive to the similarities and differences of contaminated communities can help all agencies to deal more effectively with the social aspects of contamination disasters. Each disaster is shaped by the distinct culture of the community in which it takes place. At the same time, due to the nature of CTDs, there is a pattern of social response that often takes place that is distinctly different from the response of communities to natural disasters. Agencies need to be aware of this and develop their actions on the specific characteristics associated with social responses to CTDs.
5. Assessment. Finally, we recommend that the EPA and ATSDR, as the 2 main federal government agencies responsible for assessing and ameliorating environmental contamination and its effects, work together to develop common assessment instruments that can be used in contaminated communities. We recommend that these agencies review the many community, family, and individual assessment instruments that currently exist and develop a set of instruments that would be best suited for the assessment of psychosocial stress and stages of social response in contaminated communities. Such a set of instruments could be used to complement chemical and physical health assessments to provide a more complete set of indicators of resources and problems associated with environmental contamination, and therefore help the agencies and communities to develop effective and comprehensive responses. ■

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