

**AN ASSESSMENT OF DISASTER VULNERABILITY:
Fifteen Tenets About a Crucial and Complicated Concept**

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Abstract:

The following paper reviews the research literature on disaster vulnerability and provides 15 tenets about this important concept. Findings are taken mainly from sociologists, but also include various disciplines such as geography, engineering, anthropology, political science, economics, public administration, social work, public health, urban planning, environmental science, etc. The purpose of identifying these tenets is to uncover what is known about vulnerability, and stress the centrality of this concept for academics and practitioners pursuing disaster reduction.

Introduction

Scholars interested in disaster studies are currently calling for a holistic and even revolutionary shift in paradigms (see Mileti 1999, 35; Geis 1999). The need to rethink traditional theoretical perspectives and entrenched policy approaches stems from a recognition that we are not doing all that is possible to reduce the frequency and severity of disaster. Ironically, however, attention still focuses on hazards while insufficient recognition is given to vulnerability. The failure to appreciate the importance of this concept is limiting our understanding of disaster phenomena as well as our ability to prevent or manage the adverse effects of mass emergencies.

With the above in mind, the following paper reviews relevant research literature. Findings have been taken mainly from sociologists, but also include various disciplines such as geography, engineering, anthropology, political science, public administration, economics, social work, public health, urban planning, environmental science, etc. The paper proposes and discusses 15 tenets about the concept of vulnerability. The purpose of identifying these tenets is to uncover what is known about vulnerability, and stress the centrality of this concept for academics and practitioners interested in disaster reduction.

Tenet 1: We have control over vulnerability - not natural hazards

Throughout history, humans have traditionally viewed disasters as acts of God (Drabek 1991, 3). The problem with this conceptualization is that it ignored the natural processes of the physical environment. With this added knowledge, people later equated disasters to natural hazards such as earthquakes and hurricanes. While this overcame the weaknesses of the previous perspective, it was also flawed in that it ignored the human component of disaster (O'Keefe, Westgate and Wisner

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1976). For example, a tornado that touches down in a vacant field is only a natural hazard. When a tornado interacts with a social system that has not taken measures for mitigation or preparedness, a disaster may result. But this is not all. Some disasters, such as a hazardous materials spill or terrorist attack have human instead of natural causes. Another problem with the natural hazard paradigm is that it resulted in a technocratic approach to disaster reduction. Efforts were aimed at controlling nature, which often resulted in repetitive losses and frustration. Taking this into account, social scientists, particularly sociologists, have recently come to recognize that disasters are not just natural phenomena. Instead, there is a social cause for mass emergencies; disasters are also non-routine social problems (Kreps and Drabek 1996). The first proposition of vulnerability, therefore, is that we mainly have control over this “social” aspect of disasters. In contrast, humans have less control over natural hazards. Thus, as Cannon illustrates (1993) so well, “a hazard need not a disaster make.” For this reason, academics and practitioners need to focus attention on understanding and reducing disaster vulnerabilities rather than just focusing on hazards.

Tenet 2: We may be vulnerable to many different types of hazards

While attention needs to be shifted towards vulnerability, this does not imply that hazards are unimportant. A second and major point to be made is that people can be vulnerable to a plethora of hazards (Merriman and Browitt 1993; Perrow 1999; Falkenrath, Newman and Thayer 1998). For instance, we may be vulnerable to natural hazard agents such as earthquakes, hurricanes, tornadoes, volcanoes, floods, tsunamis and wild fires. We may also be vulnerable to severe winter storms, excessive temperature fluctuations, landslides, and other extreme natural phenomena. In addition to being vulnerable to natural hazards, we may be vulnerable to biological and environmental hazards. This may include the spread of aids, small pox and other infectious diseases. Vulnerability to global warming and other forms of environmental degradation is also possible. Technological hazards also exhibit a relation to vulnerability. This may include vulnerability to airplane crashes, train derailments, hazardous materials spills, dam failures, power losses to electric grids, nuclear plant accidents, industrial explosions and computer malfunctions. Finally, we may be vulnerable to civil type disasters such as mass shootings, riots and terrorist incidents. Thus, it is possible to be vulnerable to many different types of hazard agents.

Tenet 3: Vulnerability occurs at the interface of the physical and social/organizational environments

Although it is possible to categorize our vulnerability in terms of many different hazards, doing so runs the risk of oversimplifying the complexities of vulnerability and disasters. In other words, we are likely to be vulnerable to a combination of several different types of hazards at the same time (e.g. natech disasters such as the combination of earthquakes and hazardous materials spills). Moreover, vulnerability may emanate from the physical environment based on the hazards and geography of that area. It may exist in the built environment due to the construction of edifices, dams, roads and bridges, water systems, phone lines and other infrastructure. And it may also be based on human activity and the nature of our social, political, economic and other institutions. However, vulnerability is more a function of each of these environments together, rather than being a result of any single environment alone. Vulnerability is therefore most likely to be present at the intersection of the natural, built, social/organizational environments (Mileti 1999; Burton, Kates and White 1993; Cutter 1993; Liverman 1990).

Tenet 4: Vulnerability is determined by both the positive and negative features of the physical and social/organizational environments

Vulnerability is not only complex due to its overlapping relationship with different environments, but it is complicated further due to the positive and negative features of those distinct but

overlapping realms. On the one hand, there are many negative features of the physical, built and social/organizational environments that augment vulnerability. This may include being located in on a dangerous hillside, living in a poorly constructed home, or having certain attitudes that downplay the potential for disaster. These we may label as liabilities. On the other hand, there are also positive features in the aforementioned environments that actually reduce vulnerability. For instance, a certain location may be less vulnerable to technological disaster if it is situated far from an airport, an industrial center or a hazardous materials transportation route. Buildings may be less vulnerable to structural failure based on certain engineering practices. Or, heavy furniture and water heaters can be tied down to reduce vulnerability to certain hazards such as earthquakes. These we may label as capabilities (see Anderson and Woodrow 1998). In reality, the vulnerability of any given area is determined by both the liabilities and the capabilities of the environments at play in that location. Hence, a specific low-lying area may not be vulnerable to earthquakes but may be vulnerable to episodes of flooding. A building that is less vulnerable to high winds may be vulnerable to a terrorist attack involving biological weapons. Communities that are less vulnerable to a disaster in terms of preparedness measures (as they are better able to respond) may not have done enough to prevent them in the first place. These liabilities and capabilities may not always work at cross-purposes however. The combination of certain environmental features may produce a situation where liabilities are low and capabilities are high. For example, it is possible to locate a building in a safer area and construct it in a way as to withstand many different hazards. Or, a society may do much to reduce the probability of disaster through mitigation efforts while still maintaining an adequate state of readiness to respond. In most cases, though, both liabilities and capabilities influence the degree of vulnerability in a convoluted fashion.

Tenet 5: Vulnerability is the product of many variables

The positive and negative features of the distinct but overlapping environments include many variables that influence the level of vulnerability (see Alexander 1993). The geography of an area may increase or reduce vulnerability in terms of proximity to hazards. Building design and construction plays a role in whether the occupants are vulnerable or protected. Political values determine what hazards will be addressed and those we accept (e.g. giving priority to environmental hazards vs. terrorism or vice versa). Economic preferences and practices may reduce vulnerability, ignore it altogether or actually increase it. Psychological processes may encourage a community to pursue safe development or undertake activities with no regard for the outcome. Technology may lead to a disaster if it is used improperly, or it may help us in our efforts to prevent and respond to these deadly, destructive and disruptive events. Attention given to planning, training and exercises determines the effectiveness or ineffectiveness of important disaster functions such as emergency response, damage assessment, donations management, and debris removal. Family structure may facilitate emergency response or inhibit recovery. Education may promote preventive actions or inhibit emergency operations if it is based on inaccurate assumptions. Other variables, including zoning laws, building code inspections, insurance coverage, scientific research, networking of emergency managers, language barriers, computers, cooperation of first responders, the media and demographic trends, also impact vulnerability. In short, there are many variables that interact to produce the degree of vulnerability.

Tenet 6: The variables of vulnerability exhibit distinct patterns

In spite of the fact numerous factors produce vulnerability, there are identifiable patterns of interaction (McEntire 2001). These include cultural attitudes and practices, development processes, and institutional arrangements. First, culture may influence vulnerability. Beliefs about the causes or controllability of disaster have an impact upon what steps an individual or community takes to address vulnerability. Vulnerability is also influenced by daily activities at home or at work. The development of economies and urban areas likewise influence the degree of

vulnerability. Economic growth may facilitate spending on emergency management while a highly unequal distribution of resources may augment the vulnerability of certain individuals and groups. Urban planning that takes disasters into account may limit the concentration of people and property or make people and property more vulnerable. A final pattern deals with institutions. For instance, we may build response institutions through planning, training and exercises only, thereby ignoring the importance and need for prevention. Or, we can organize ourselves in such a way as to promote prevention activities and facilitate responses when necessary. Therefore, the patterns of culture, development and institutions may help us to understand the causes of vulnerability.

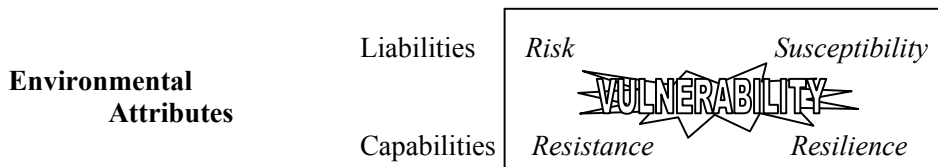
Tenet 7: The variables and patterns of vulnerability influence the degree of risk, susceptibility, resistance and resilience

The variables and patterns that influence the level of vulnerability may be placed under the categories of risk, susceptibility, resistance and resilience (see Blaikie et. al. 1994; Dow and Downing 1994; Timmerman 1981). Risk indicates potential for adverse impact, and is often associated with location, construction and technology. Susceptibility implies proneness to being affected by a disaster due to social, cultural, political, economic, psychological and organizational variables. Resistance suggests the ability of structures to withstand the forces of powerful agents in order to minimize damage and destruction. Resilience includes the individual and community ability to respond and recover based on preparedness and other measures. Welchgartner’s review (2001) of the literature illustrates that risk, susceptibility, resistance and resilience are frequently mentioned in definitions of vulnerability.

Table 1

Environments

Physical (including natural, built, technological)	Social/Organizational (including cultural, political psychological, economic)
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Adapted from McEntire, D.A. (2001).

Tenet 8: The categories of vulnerability are not mutually exclusive but interact in complicated ways

It should be noted that risk, susceptibility, resistance and resilience are not mutually exclusive or exempt from interaction (McEntire 2001). This is to say that the lines of demarcation among the positive and negative attributes of both the physical and social/organizational environments are fuzzy and fluid, never exempt from interaction. In other words, each category of vulnerability may influence, or is influenced by each other category. For instance, risk may be increased if resistance is lowered, while resilience may be decreased if susceptibility is heightened. At the same time, risk and susceptibility (as well as resistance and resilience) often interact in mutually reinforcing ways (e.g. the social, cultural, political, technological and economic environments may encourage people to locate in dangerous areas while a lower degree of resistance may make response and recovery

more problematic). Furthermore, risk could jeopardize resilience, and resistance and susceptibility may have an inverse relationship. Thus, there are complex and interdependent relationships among risk, susceptibility, resistance and resilience.

Tenet 9: Vulnerability changes continuously

Vulnerability is not static. In other words, any particular degree of vulnerability does not remain constant over time (Lewis 1999). Instead, vulnerability is dynamic and may fluctuate minute-by-minute, day-by-day, and over months and years. For instance, the arrival of an inebriated employee will augment the vulnerability at a manufacturing plant dramatically in spite of an otherwise safe and productive work crew. The transportation of hazardous materials makes some communities more vulnerable than they were the previous day. Immigration patterns over the past few years to the South and West have had an adverse impact on vulnerability to hurricanes and earthquakes. The ongoing expansion of communities as well as the methods and materials used for construction also determine vulnerability. Cultural misunderstanding, mistakes in public policy, the unfair treatment of minorities and global poverty augment our current vulnerability to terrorist attacks. A new Airbus 380 is being built in Europe that will hold between 555 and 800 people. The plane is schedule to fly around 2004. Can we fathom the potential impact if this plane crashes due to adverse weather, pilot error or mechanical malfunction? These and other examples illustrate that vulnerability may change quickly and is altered constantly.

Tenet 10: We must assess vulnerability periodically

Because vulnerability is in a constant state of flux, it is necessary to evaluate vulnerability periodically. The growth of communities, arrival of new businesses, and building of new critical facilities and infrastructure make repetitive assessment necessary. While small changes in a community may not be readily apparent, they will have significant impact upon vulnerability over time. Thus, it is extremely important that hazard and vulnerability analyses and emergency operations plans be revisited at least once each year. Mitigation strategies, planning, training, exercises and other emergency management activities must take into account changes in the degree of vulnerability in any given assessment period.

Tenet 11: We can and should reduce many types of vulnerabilities

Without a doubt, we must not delay in recognizing and reducing vulnerabilities (weichselgartner 2001). Evidence increasingly suggests that disasters are becoming more frequent and intense (mileti 1999). While it is true that there is some debate as to whether the number of natural hazards is rising or not, there is less disagreement that technological and other man-made disasters are occurring more often (waugh 2000). However, one thing is indisputable: we are becoming more vulnerable to a variety of hazards (mileti 1999; lewis 1999; merriman and browitt 1993). For this reason, attention and resources should be increasingly directed towards the reduction of disaster vulnerabilities.

Tenet 12: We cannot and should not try to eliminate all types of vulnerabilities

While much can be done to reduce vulnerability, it is imperative to remember that it is impossible to eliminate all types of vulnerabilities. Attempting to eliminate vulnerability assumes omniscience and omnipotence, jeopardizes freedoms and requires excessive expenses. Humans are not all knowing, and they do not have control over mother nature (and each other at times). In addition, we must admit that there is no hazard-free area. What is more, the regulations imposed on society would hurt liberties, and the resources needed to produce an "invulnerable society" could limit economic productivity and lead to poverty. In addition, there are benefits from things that increase

risk and susceptibility (e.g. farming in a flood plain is advantageous due to the presence of rich and fertile soils). Finally, the infrequency and sometimes-unpredictable nature of disaster makes prevention and preparedness difficult from a political standpoint. Thus, we must concede that it is not wise or possible to eradicate all types of vulnerability.

Tenet 13: Everyone plays a role in reducing vulnerability

Although we cannot eliminate vulnerability, everyone can take steps to reduce it. In the academic realm, scholars from a wide variety of disciplines provide important information about vulnerability (see Merriman and Browitt 1993). For instance, geographers attempt to reduce vulnerabilities by recommending the use or non-use of certain locations or structural mitigation devices (Maddrell 1993). Meteorologists attempt to reduce vulnerabilities by giving advance notice of possible weather disturbances (Slater et. al. 1993). Engineers attempt to reduce vulnerabilities by building structures that are able to withstand and resist strain (Hodgson and Whaites 1993; Norton and Chantry 1993). Anthropologists attempt to reduce vulnerabilities by exposing constraining attitudes and risky behavior (Oliver-Smith and Hoffman 1999). Economists may help to reduce future vulnerabilities by discussing the important role of insurance in the recovery phase of disaster (Dlugolecki 1993). Sociologists attempt to reduce vulnerabilities by illustrating what individuals and groups are most susceptible to disaster (Enarson and Morrow 1998; Peacock et. al. 1997). Psychologists attempt to reduce vulnerabilities by exposing how people process risk, or by helping victims and responders understand their emotions and overcome post-traumatic stress disorder (Phifer 1990). Epidemiologists and others in the medical field attempt to reduce vulnerabilities by exploring those factors that increase disease, injury and death, or by building the capacities of those who respond to the victims' emergency and long term health care needs (Shoaf and others 1998; Noji 1997; Auf der Hiede 1989). Political Scientists attempt to reduce vulnerabilities by showing what government policies are ineffective or even dangerous (McEntire 1999). And scholars of Emergency Management attempt to reduce vulnerability through discussions about how various preparedness measures (such as community education, planning, training and exercising) improve the performance of emergency functions (such as warning, evacuation, search and rescue, mass care, mass casualty, sheltering, public information, damage assessment, and debris management) for the protection of people (Drabek and Hoetmer 1991; Britton 1986).

Practitioners and citizens also play an important role in the reduction of vulnerability (McEntire, forthcoming). In regards to the public sector, it is the politicians that give priority to disaster policies and enact relevant pieces of legislation. Department leaders play a significant role in the implementation of disaster regulations while emergency management organizations build the prevention and preparedness capacities of the community, state or nation. The private sector likewise helps to reduce vulnerability. The goal of corporations to increase profits may jeopardize the safety of employees, nearby residents and the community as a whole. Nonetheless, the private sector is involved in a variety of functions (e.g. consulting, business continuity, insurance, debris removal, hazardous materials clean up, etc.) that have a bearing on vulnerability. The non-profit sector works diligently with vulnerable groups either to improve their capacities to care for themselves or by helping them to recover once a disaster occurs (thereby reducing future vulnerability). The public, private and non-profit sectors cannot resolve the vulnerability problem alone however. The values and activities of individual citizens also determine the level of vulnerability. Citizen Emergency Response Teams, volunteers, and emergent groups also determine levels of vulnerability. Therefore, everyone must take responsibility for the reduction of liabilities and the building of capacities.

Tenet 14: We can address vulnerability through each phase of emergency management

Vulnerability can be reduced through mitigation, preparedness, response and recovery activities and operations. This concept is related to mitigation in that hazard/vulnerability mapping, the appropriate location of settlements, the use of structural mitigation devices, sturdy construction techniques and environmental protection reduce vulnerability. Furthermore, infrastructure engineering, retrofitted buildings, a slower pace of (or controlled) urbanization, a reversal of social marginalization, the changing of cultural attitudes, political will to do something about disasters, a reduction of poverty, early warning systems, the careful use of technology, the anchoring of heavy furniture and equipment, the strengthening of the infrastructure, and the careful use and maintenance of hazard containing devices such as dams may also reduce vulnerability.

Vulnerability is related to preparedness in that it notes how local emergency planning committees, community education, insurance coverage, and the availability of disaster related resources reduce liabilities and build capacities. It is also related to preparedness in that vulnerabilities may be created or minimized through planning, training and exercising for specific emergencies and disasters (such as hazardous materials spills, school shootings, hurricanes, etc.) or for important post-disaster functions (such as dispatch operations, emergency medical care/tactical EMS, search and rescue, public information, continuity of government, EOC operations, media relations, debris management, etc.). Preparedness and planning measures are strong determinants of whether a community will reduce its future vulnerability during disaster recovery operations. Insufficient or inappropriate steps taken for preparation may therefore increase the vulnerability of communities to disaster (Weichselgartner 2001; Britton 1986).

Vulnerability is likewise related to a more efficient, effective and appropriate form of disaster response in that it increases the capacities of responders by delegating authority to the local level, avoiding overly stringent bureaucratic operating procedures, encouraging self-reliance among the affected population, improving decision making in crisis situations, and discouraging the creation of dependency through well-intentioned but sometimes ineffective and counter-productive relief operations. Vulnerability also shows relation to this functional area because, as Britton (1986) and Weichselgartner (2001) suggest, the failure to effectively perform emergency operations functions (e.g. flood forecasting, evacuation, incident management, logistics, sheltering, resource management, etc.) increases the inability of people to cope with disasters that cannot be prevented. In addition, failure to take necessary safety precautions during search and rescue, damage assessment and debris removal increases the vulnerability of emergency workers to secondary hazards.

Vulnerability is related to recovery because disaster relief is intricately related to local capacity building. For instance, disaster assistance may - depending upon how it is distributed and received - encourage dependency or reduce one's vulnerability to future disaster. Vulnerability also links reconstruction, relocation and redevelopment back to mitigation for the reduction of future vulnerabilities. Furthermore, the handling of debris could lead to environmental degradation or other problems, which may create future disasters. Moreover, this concept also includes the emotional vulnerability of people by helping them to cope with and bounce back from disaster losses.

Vulnerability therefore helps us to address disasters in a holistic and integrated manner. Such an approach is imperative if we are to take a more proactive approach towards mitigation. Nonetheless, a fundamental part of disaster vulnerability is the inability to prepare, respond or recover effectively. Vulnerability consequently has an important relation to each phase of emergency management.

Tenet 15: We must pay special attention to those individuals, groups and nations that are most vulnerable

As emphasis and activities shift towards vulnerability, it will be imperative to focus on those that are most vulnerable. Research has repeatedly illustrated that some people are more vulnerable to disaster than others. This may include women, children, the elderly, the disabled, and the poor (Fothergill et. al. 1999; Enarson and Morrow 1998; Fothergill 1996; Rahimi 1993; Eldar 1992). Minority groups are also more likely to be vulnerable to disaster (Peacock et. al. 1997). In addition, developing nations, which may lack knowledge, technology and material resources, rank among those most vulnerable (Lewis 1999). Although responsibility for vulnerability reduction should never be taken away from those that are vulnerable, steps can and should be taken to assist individuals, groups and nations reduce their vulnerability. Political values, partnering, education, technology transfers, development priorities can all be adapted to help those who are most vulnerable.

Conclusion

This review of the research literature suggests that vulnerability should be the focal point of our academic and practical efforts to reduce disaster. Focusing on vulnerabilities, instead of hazards, would shift emergency management from a reactive field to a proactive profession. It would allow us to recognize what we cannot control and help us to concentrate on those areas which we can control. In addition, the concept of vulnerability appears to provide a holistic approach in that it is related to all of the hazards, variables, actors, phases and disciplines of disasters. With the above 15 tenets in mind, perhaps it may be wise to rename our approach for the reduction of the quantity and quality of disasters. One possible label is “vulnerability management” (McEntire, forthcoming). This implies that we endeavor to assess liabilities and capabilities, reduce risk and susceptibility, and raise resistance and resilience. At a minimum, implementing vulnerability management would require:

- a better understanding of vulnerability as it relates to development and disasters (through contributions by all disciplines),
- continued assessments of community liabilities and capabilities
- citizen and decision maker education about vulnerability and disasters,
- stronger disaster prevention and emergency management institutions,
- altered attitudes about disasters and development,
- holistic politics (focusing on all triggering agents, phases, actors and variables),
- the use of carrots and sticks (e.g. incentives, legislation, and enforcement),
- increased but cautious reliance on technology,
- environmental protection,
- poverty reduction,
- additional coordination among citizens and the public, private and non-profit sectors,
- and, individual and community empowerment and responsibility.

Regardless if vulnerability management is accepted as a new paradigm and policy guide, it is certainly apparent that more attention needs to be directed towards the disaster problem. It is therefore hoped that this paper has helped to generate new ideas and initiatives for this purpose. To the extent it has not, more research should be conducted on ways to reduce disaster vulnerability.

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