

**Natural Disasters and Public Health Issues:
A review of the literature with a focus
on the Recovery Period**

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1.0 Introduction

We are in the midst of a dilemma in the management of natural disasters. With at least a forty-year period of development, hazard management policies in Canada should now be considered to be 'mature'. However, the 1990s - the U.N. International Decade for Natural Hazard Reduction - will likely see Canada as a more hazard-prone place to live than at any previous time. The loss of life and damages from all natural disasters, including the Montreal hailstorm (Ontario-Quebec 1998), and floods in the Saguenay River (Quebec 1998) and the Red River Basin (Manitoba 1997), reflect Canadian's apparent growing vulnerability to hazards. These events underscore a pattern seen throughout the world - losses due to weather-related disasters have escalated dramatically over the past 15 years. With economic losses in Canada escalating, there has been a concerted effort by natural hazard managers and researchers to incrementally improve existing management strategies. However, the emerging dilemma concerns how adequate these marginal adjustments are able to eliminate or reduce rather than to merely postpone significant damages in the future. The increase in damages poses not only economic but psychosocial costs as well. In the current dilemma, it is unclear to what extent the research and policy communities will address the human and specifically the public health component of the issue.

Natural hazards research and public policy efforts have focused typically on mitigative, warning, response and short-term recovery programs. This orientation reflects a long-held belief that

long-run emotional effects are minimal...[and] most disaster victims seem to recover fairly well from their harrowing experience without much in the way of specific help, and long-term, severe psychological disturbances after the usual peacetime disasters are apparently not frequent (Moore and Friedsam, 1959, 135).

This traditional view is now being questioned (Lima and Gittelman, 1990). With the frequency of disasters and the number of people affected by disasters on the increase over the last 15 years, there is greater concern regarding their potential role in contributing to longer-term public health problems. Indeed, anyone who has had direct contact with or has had a close relative or friend experience significant losses through a natural disaster is well aware of the emotional stress that these unfortunate situations produce. However, relatively little is known about the long-term human impacts that result from these events. Long-term recovery programs assist people and their communities to rebuild their economic and psychosocial infrastructure after a disaster. If this need is to be addressed effectively, a merging between natural hazard management and public health planning must be realized.

It is from this perspective that this paper was undertaken.

This retrospection reflects, in part, the evolving views about the concept of vulnerability that has come to be a recent, distinctive and important component of risk and disaster studies. Within the academic community, there has been a shift from a traditional emphasis on examining the nature of the natural or technological agents to one that values an understanding of how people and communities become 'unsafe' (Hewitt, 1997). Important

research questions now include “Who is affected by the hazard?”; and “How effectively can they and their community withstand, mitigate and recover from disasters?”

This understanding can be achieved by considering mitigative, warning, response and recovery strategies implemented by individuals, and the private and public sectors. Almost twenty years ago, Logue *et al.* (1981a; 1981b) observed the general absence of U.S.-based studies on the public health issues during the recovery period. They also suggested that “the health consequences of a disaster might differ from immediately post impact, when casualties are being cared for, to the recovery period when stress-related chronic diseases might predominate” (Logue *et al.*, 1981a, 218). Unfortunately our knowledge about the extent and significance of this problem, as well as the need for appropriate public and private policy responses have not advanced appreciably (Mileti, 1999).

Canada has prided itself on providing its citizens with high quality and publicly operated environmental management (including hazard management) and health care systems. With the present trend of increasing damages, it is appropriate to consider how research efforts can best contribute to the development of needed and appropriate short- and long-term public health policies. Unfortunately, budget cuts over the last 10 years have severely reduced the capacity of both hazard management and public health services (Hewitt, 1997). It is ironic that when the need for health care and hazard management might be at an all time high due to the rapidity of social, economic, institutional and technological change, and the increase in the frequency of disasters, that senior governments have reduced support from these areas. It is therefore timely to ponder the relationship between public health and natural disasters when these same senior levels of government are now considering how budget surpluses might be applied to reduce personal and corporate taxes, reduce current debts, and to reinvest in program spending. This paper provides an initial and timely response to this need. Specific objectives are:

- to describe the method used to search for literature;
- to identify important issues and trends in the research; and
- to identify opportunities for future research.

This report is organized into four sections. The methods are outlined in Section 2. Selected conceptual issues are described in Section 3. Section 4 provides a summary discussion.

2.0 Method

The report was initiated on 20 October 1999 and completed on 10 December 1999. During that time, a systematic search for literature was conducted on the *SEARCH HazLit* Library Database (available through the Natural Hazards Center at the University of Colorado). The following key words were incorporated into the search:

children	crowd behavior
disabled persons	disaster medicine
disease	emergency medical services
epidemiology	family impacts
first aid	forensic medicine
group behavior	hospitals
life value	lifelines
longitudinal study	medicine
mental health services	nursing
public health	social impact
social violence	

On this basis, several hundred references were identified. These items were categorized into: (1) developed and developing world contexts, and (2) technological versus natural hazard events. The report focuses attention on those public health and hazard research studies that were applied in developed world and in natural hazard contexts. Relevant materials were obtained through the libraries at the University of Western Ontario, McMaster University, the University of Waterloo, and Wilfrid Laurier University. When appropriate, interlibrary loans were ordered and obtained. In addition, a number of “Quick Response” and “Natural Hazards Working Papers” that were available through the Natural Hazards Center at the University of Colorado were ordered and acquired.

3.0 Conceptualizing Natural Hazard and Public Health Management

Three issues were considered to be relevant and significant in this area. First, the linkage between theory and practice is important because the manner in which a problem is framed often influences the final outcome and recommendations. Second, how natural hazards and disasters are defined is important. This has implications for determining the extent to which people and communities are vulnerable to hazards. The final issue considers how stress and coping behaviours are measured. Each is considered below.

3.1 Linking General Theory to Practice

According to Bogard (1988), relatively little effort has been expended on integrating the mitigation of environmental hazards into contemporary sociological theory. Instead, most research efforts have applied a relatively narrow field of organizational theory to question how effectively public agencies respond to natural hazards. This orientation is implicitly rather than explicitly tied to a general sociological theory of action. It also has implications for defining ‘successful’ hazard outcomes because many theories are based on a view that an intervention (*e.g.* policy) should bring the hazardous situation back to “normal”. Psychologists and other social scientists have also been challenged to consistently conceptualize hazard responses (Glenn, 1979; Meliti, 1999). An issue that has received more recent attention concerns the unintended effects of mitigation policies. These would include an increased vulnerability to a hazard, increased hazardousness of a location, or a shift in costs to certain social groups or classes (Hewitt, 1997; Mileti, 1999).

In general, social science theory has not provided a clear guide for research. Bravo *et al.* (1990) identified two extreme positions regarding psycho-pathological phenomenon in transcultural settings. On one hand, proponents of cultural relativism maintain that cultural groups promote or support specific behaviours. In this way, different cultures are expected to respond in a variety of manners. On the other hand, proponents of the “more traditional psychiatric position [maintain] that the psychopathological phenomenon exists in a stable form that is similar throughout diverse cultures...” (Bravo *et al.*, 1990, 40). Therefore, cross-cultural disaster research is limited to observing, measuring and comparing these behaviours. As will be reflected in the subsequent discussion, neither of these conceptual positions are clearly supported by empirical research. The role of community and the relationship between a person and the environment are among a host of variables that confound the development of a single accepted theory that explains and predicts responses.

However, one popular conceptualization used by social scientists is based on research in psychosocial stress. Stress has been defined as “the affective, behavioural and physiological response to aversive stimuli” (Glass and Singer, 1972, 6). Bravo *et al.* (1990) suggested that stress might be viewed as a state of change in an individual caused by environmental agents. From this perspective, certain environmental situations can create stress. The work of Lazarus (1966) has had a profound impact in identifying the types of appraisal or coping processes that operate during stressful situations. He suggested the following stages in appraising stress:

Primary appraisal – psychological processes that differentiate between potentially threatening situations from non-threatening ones;

Secondary appraisal – assesses individual resources for coping with a threatening situation; and

Reappraisal – changes in the original perception of the situation that reflect changing environmental conditions or changes within the person that reflect coping behaviours.

Based on or influenced by Lazarus' (1966) work, various stress models have evolved and usually consider four major components: (1) stressor, (2) psychological responses, (3) social situation, and (4) personal antecedents (Bravo *et al.*, 1990). Glenn (1979, 34) concluded that this type of integrative model, one that would ideally combine “non-behavioural intrapsychic psychological theory with behavioural theory”, offered the best opportunity to develop predictive capability. In this manner, it should be possible to more precisely link a disaster event, with coping responses and appropriate intervention. Over the last twenty years, it is unclear to what extent we have successfully progressed towards these ends.

The presence of many academic disciplines that study natural hazards and public health issues suggests that it is a very complex topic. As will be noted later, a “successful outcome” or an “effective coping behaviour” can reflect how the problem is conceptualized and success defined. What is clear is the dichotomy that exists between the natural hazards and public health research communities. Very few studies have embraced the basic four-component model stress model in its entirety over a long time period. If the need for and success of long-term public health disaster programs are to be assessed systematically and rigorously, this level of effort and multidisciplinary perspective is required. Nevertheless, it is possible to identify at least two additional conceptual or methodological issues that confront this diverse research community. These are: (1) defining the magnitude of a disaster; and (2) measuring stress and coping strategies.

3.2 Defining Natural Hazards and Disasters

A hazard may be defined “as a source of danger whose evaluation encompasses three elements: the risk of human harm, such as injury, trauma or death; the risk of property damage; and the acceptability of the level of risk” (Kovach, 1995, 2). This definition suggests that each natural hazard event is unique because of the idiosyncrasies of the event itself as well as the differences in the population. Therefore, it is important to have an understanding of the particular disaster situation and community in which the disaster occurred (Logue *et al.*, 1981a).

This requirement poses a significant problem for the research community because there is no clearly accepted definition of a ‘natural hazard’ or ‘disaster’. Indeed, these terms have been used loosely and interchangeably. Disasters commonly refer to particularly acute and extensive stressful situations that may be viewed in terms of the loss of life and the destruction of the natural or built environment. However, disasters can also be more broadly

defined “as a basic disruption of the social context within which individuals and groups function, or a **radical departure from the pattern of normal expectation**” (Giel, 1990, 8; emphasis added). These different definitions pose challenges to the research community.

One major difficulty in precisely defining a disaster pertains to the varying relationship among the event, damage suffered and lives lost (Foster, 1976). A second difficulty relates to the scale of problem. For instance, Hobfoll (1988) suggested that an event or situation is stressful to an individual if their ‘object resources’ (*e.g.* property), ‘conditions’ (*e.g.* marriage, relationships, job roles), ‘personal characteristics’ (*e.g.* self-esteem) or ‘energies’ (*e.g.* time, money) were threatened or lost. From this perspective, an individual’s appraisal of the perceived or actual loss, the significance of the loss, and the individual’s coping style define the magnitude of a stressful situation and successful recovery. In contrast to this personal frame-of-reference, Barton (1970 as cited by Logue *et al.*, 1981a) defined a disaster as being part of a larger category of stressful situations which occur when many members of a social system fail to receive the expected conditions of life from the system. Lechat (1990, 70) defined disasters as “a disruption of the human ecology that the affected community cannot absorb with its own resources.” Geil’s (1990) suggestions that a person’s failure to meet their expectations adds another dimension to this problem. Combining these views, disasters have been defined on the basis of how well individuals and communities can withstand, respond and recover from environmental stresses, as well as their ability to interfere in people’s ability to meet their expectations.

No matter what definition is applied, the measurement of the magnitude of the hazard should be an important research element. There have been three general approaches to measuring magnitude: (1) characteristics of the agent, (2) disaster magnitude scales, and (3) individual perception. Research efforts should also be measuring the ability of people and communities to withstand, respond and recover from disasters. These ideas establish the direction for the following discussion.

3.2.1 Characteristics of the Agent

The traditional view of managing hazards requires a detailed and precise understanding of the natural process or agent responsible for causing the damage. In the context of earthquakes, interest could be placed on the following areas:

- The depth of the epicentre (*i.e.* shallow-focus of 0 to 70 km deep, intermediate-focus of 70 to 300 km deep, or deep-focus of 300 to 800 km deep);
- Plate tectonics with an interest in accretionary plate, subduction plate, collision and transform boundaries; and
- Landform effects such as faults and scarps (Coch, 1995).

The Richter scale, named after its inventor, measures the magnitude of earthquakes. Using a seismograph, he measured the maximum amplitude of different earthquakes within a 600 km distance. The Richter scale applies a logarithmic scale to the base 10 to classify earthquake intensity. A magnitude greater than 7.5 is termed ‘great’, 6.5 to 7.5 is referred to as ‘major’,

and 5.5 to 6.5 is viewed as 'large'. A magnitude of 5.5 is considered to be the threshold of damage for most communities (Kovach, 1995).

In the context of flood hazard management, studies that focus on natural processes would examine issues such as precipitation-runoff relationships, probability of occurrence, and the lag time to peak. While these topics will remain an important element for future study, they fail to incorporate the three elements that define a hazard that were previously noted by Kovach (1995). On their own, they are unable to answer questions related to "Who is vulnerable?" and "How do people and communities become unsafe?." These studies also provide a weak foundation to link public health issues to the magnitude of an event. Thus, other approaches to measuring a disaster are required in order to address these shortcomings.

3.2.2 Disaster Magnitude Scales

An alternative way to measure the magnitude of a disaster is to survey the damage inflicted by the number of lives lost and/or damage inflicted. This approach was used by Sheehan and Hewitt (1976 as cited by Foster 1976) who defined a disaster as an event meeting one or more of the following criteria: (1) it caused at least \$1,000,000 in damage; or (2) killed or injured at least 100 people. While easily applied to many areas of the world, these approaches make the effective comparison of events among and within different countries difficult. These types of damages have implicit implications for damages borne by individuals. However, they provide little insight about how adequately individuals and communities can withstand, respond to and recover from an event.

In order to address this problem, Foster (1976) proposed a disaster magnitude scale that is based on the generation of different stress levels for different disaster impacts. Modifying concepts and techniques available at that time, Foster (1976) developed a social readjustment rating scale (Table 1). By summing the individual stress values, Foster (1976) maintained that the total stress for an event could be calculated. In order to apply this at a community level, information on the social network of a community, particularly the marital state and friendship networks must be obtained through social surveys or other instruments. While recognizing that it would be difficult to precisely establish these relationships, Foster (1976) maintained that reasonable estimates of the stress levels associated with personal losses could be obtained from a mix of primary and secondary sources.

He was also aware of the need to calculate stress values associated with infrastructural disruption (Table 2). He also suggested that these ratings could be improved by obtaining responses from disaster victims.

Table 1
Abridged Social Readjustment
Rating Scale

<i>Life Event</i>	<i>Mean Stress Value</i>
Death of Spouse	100
Death of Close Family Member	63
Death of Close friend	37
Personal Injury or Illness	53
Injury of illness of close family member	44
Injury or illness of close friend	25
Loss of employment	47
Change in financial state	38
Revision of personal habits	24
Change in living conditions	25
Change in work hours or conditions	20
Change in residence	20
Change in schools	19
Change in recreation	18
Change in social activities	18

(Foster, 1976)

The total stress for an event in the developed world could be calculated by applying the following formula:

$$TS = x(a) + y(b) + cd \quad (1)$$

Where:

TS = total stress of a community

x = constant that reflects the stress value the deceased was considered to have suffered (100 from Table 1) to that experienced by the husbands and wives (survivors) of the % fatalities that were married.

a = number of fatalities

y = constant that reflects stress units experienced by close family members who were neither the disaster victim nor married to the deceased and those units suffered by friends.

b = number of seriously injured

c = infrastructural stress associated with the event (Table 2)

d = total population affected

Table 2
Infrastructural Stress Values

<i>Event Intensity</i>	<i>Designation</i>	<i>Characteristics</i>	<i>Stress Value</i>
I	Very Minor	<ul style="list-style-type: none"> • Instrumental 	0
II	Minor	<ul style="list-style-type: none"> • Noticed by only sensitive people 	2
III	Significant	<ul style="list-style-type: none"> • Noticed by most people including those indoors 	5
IV	Moderate	<ul style="list-style-type: none"> • Everyone fully aware of the event. Some inconvenience experienced, including transportation delays. 	10
V	Rather Pronounced	<ul style="list-style-type: none"> • Widespread sorrow. Everyone greatly inconvenienced; normal routines disrupted. Minor damage to fittings and unstable objects. Some crop damage. 	17
VI	Pronounced	<ul style="list-style-type: none"> • Many people disrupted and some frightened. Minor damage to old or poorly constructed buildings. Transportation halted completely. Extensive crop damage. 	25
VII	Very Pronounced	<ul style="list-style-type: none"> • Everyone disturbed; many frightened. Event remembered clearly for many years. Considerable damage to poorly built structures. Crops destroyed. High livestock losses. Most people suffer financial loss. 	65
VIII	Destructive	<ul style="list-style-type: none"> • Many injured. Some panic. Numerous normal buildings severely damaged. Heavy loss of livestock. 	80
IX	Very Destructive	<ul style="list-style-type: none"> • Widespread initial disorganization. Areas evacuated or left by refugees. Fatalities common. Routeways blocked. Agriculture adversely affected for many years. 	100
X	Disastrous	<ul style="list-style-type: none"> • Many fatalities. Masonry and frame structures collapse. Hazard-proofed buildings suffer considerable damage. Massive rebuilding necessary. 	145
XI	Very Disastrous	<ul style="list-style-type: none"> • Major international media coverage. Worldwide appeals for aid. Majority of population killed or injured. Wide range of buildings destroyed. Agriculture may never be reestablished. 	180
XII	Catastrophic	<ul style="list-style-type: none"> • Future textbook example. All facilities completely destroyed; often little sign of wreckage. Surface elevation may be altered. Site often abandoned. Rare survivors become life-long curiosities. 	200

(Foster, 1976)

By summing the stresses for individual communities, the total stress of an event could be calculated. Although this formula is difficult to operationize, it provides a basis of comparing the levels of stress among different natural and technological disasters within a country, and when modified to better reflect the human context in developing countries, comparisons between developed and developing world could be made (Foster, 1976).

In a similar vein, Rossi and Wright (1981) proposed an “impact ratio” that reflected the potential for psychological impairment. It reflected the ratio between the loss inflicted on and the available resources held by a community. A very basic measure could reflect the proportion of the affected disaster population relative to the non-affected community population. Where impact ratios are very high, recovery and reconstruction activities may

create numerous living problems and negative psychological effects on victims. It was suggested that victims who could not return to their residences for a long time were the most likely to experience increased levels of psychological stress (Rossi and Wright, 1981).

While the types of measures provided by Foster (1976) and Rossi and Wright (1981) can reflect the stress level produced by an event, there are limitations. They assume that damages, both emotional and financial, are distributed evenly throughout the affected population. In addition, the secondary impacts and indirect losses associated with a disaster are not incorporated into the calculations. However, a single numeric value that characterizes an event is produced. This 'common currency' can enhance the comparison of different disasters – both natural and technological, and assist in research studies. These measures provide a visible although descriptive linkage between an event and the potential need for public health services. However, the literature review suggests that these approaches are not widely used by the research community.

3.2.3 Victim Perception of Magnitude

A third approach to measuring the magnitude of a disaster is to ask victims about their perception of the significance of the loss. This is the most popular approach to the study of public health and disaster issues. As will be noted in the next section, there are a number of standardized research instruments that have been applied in a wide variety of disaster situations.

3.3 Measuring Victim's Stress and Coping Responses

Psychologists, epidemiologists, public health officials and sociologists predominantly apply this research approach. A wide set of emotional responses has been measured in disaster studies. A typology of behavioural responses is outlined below.

- General fears, anxieties and tensions.
- Situational and deeper depression. Severe or prolonged disasters appear to be linked to more severe depressive reactions. Grief reactions have been observed among disaster survivors and are often associated with deaths of family and friends, but may occur in response to the loss of home and property. For some survivors, guilt is a prevalent emotion when a large number of lives have been lost. For others, a death imprint will be one way in which to remember the disaster.
- Psychosomatic and physical health problems (*e.g.* sleep disturbances).
- Social impacts. These manifest themselves in variety of interactive or interpersonal disturbances. For instance, irritability and the inability to get along well with other family members during recovery have been noted (Bolin, 1985).

Two noteworthy behavioural outcomes have been associated with disaster events. The first is post-traumatic stress disorder (PTSD) which is characterized by two features (Horowitz, 1990). First, a traumatic event, such as a natural disaster, precedes post-traumatic signs and

symptoms. Second, the person experiences a “formal quality of *intrusiveness* in conscious experience or action in relation to conscious violation” (Horowitz, 1990, 24). Examples include involuntary and unwanted memories, negative changes in behaviour, and temporary or permanent lapses in self-esteem. PTSD has been reported to affect up to 37% of adolescents following a natural disaster (Garrison *et al.*, 1993). The second major behavioural outcome is a disaster syndrome which is a response to a very unexpected and severe impacts. The disaster that occurred in Buffalo Creek provides a classic example of the disaster imprint and some literature refers to the “Buffalo Creek syndrome” (Gleser *et al.*, 1981). It has been suggested that possibly 10% of all disaster victims may develop acute problems that require interventions (Bolin, 1985). However, these types of estimates are quite variable and reflect the multitude of stress factors that were noted by Bravo *et al.* (1990) - (1) the stressor, (2) the psychological responses, (3) the social situation, and (4) the personal antecedents.

The complexity of attributing specific psychological or public health problems is compounded by the wide variety of survey instruments that have been used to describe, explain and assess individual outcomes following a disaster. A sample of these instruments include:

- Brief Symptom Inventory (Rao *et al.*, 1985)
- Center for Epidemiological Studies Depression Scale (CES-D) (Krause, 1987)
- Child Stress Reaction Survey (Allen and Rosse, 1998)
- Child Behavior Checklist (Boore *et al.*, 1990)
- Clinician Administered PTSD Scale (CAPS-1) (Drescher and Abueg, 1995)
- COPE (Shaw *et al.*, 1991; Allen and Rosse, 1998)
- Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R) (Garrison *et al.*, 1993; Shannon *et al.*, 1994)
- Disaster Supplement to the National Institute of Mental Health Diagnostic Interview Schedule (DIS/DS) (Gordon *et al.*, 1987; Smith and North, 1988; Boore *et al.*, 1990)
- Dissociative Experiences Scale (Drescher and Abueg, 1995)
- Frederick Reaction Index for Children (RI) (Shannon *et al.*, 1994)
- Impact of Events Scale (IES) (Zilberg *et al.*, 1982; Boore *et al.*, 1990; Drescher and Abueg, 1995) Keane MMPI-2 Scale (Drescher and Abueg, 1995)
- Langer Index of Psychological Stress (Logue *et al.*, 1981a; 1981b)
- Lifetime Trauma Query (LTQ) (Drescher and Abueg, 1995)
- Penn Inventory (Drescher and Abueg, 1995)
- Psychiatric Evaluation Form (Gleser *et al.*, 1981)
- Resource Loss Questionnaire (Shaw *et al.*, 1991)
- Revised Children’s Manifest Anxiety Scale (RCMAS) (Shannon *et al.*, 1994)
- Sensory Exposure Checklist (Drescher and Abueg, 1995)
- Stanford Acute Stress Reaction Questionnaire (Allen and Rosse, 1998)
- Symptom Checklist-90 (Logue *et al.*, 1981a; Boore *et al.*, 1990; Shaw *et al.*, 1991)
- Zung self-rating depression scale (Logue *et al.*, 1981a; 1981b)

The use of this diverse set of instruments makes it difficult to judge which emotional reactions to a disaster may be considered normal and transitory, and which are pathological and require intervention by trained personnel.

Previous studies are characterized by three general orientations:

- (1) descriptive population studies that evaluate the number and characteristics of people affected by a specific disaster in a specific population;
- (2) descriptive case studies that understand the myriad of behaviour patterns that victims display; and
- (3) explanatory population studies that identify the diverse responses of different groups of people to specific experiences during a disaster (Bravo *et al.*, 1990).

This diversity of purpose reflects the realities of research. However, the limitations that this reality places on generalizing research findings must be considered in the context of achieving a single unified theory of hazards and public health management.

3.3.1 Selected Findings from Studies that focused on the Characteristics of the Agent/Impact

Some research has examined the interaction between the natural hazard and the human psychosocial response. In this regard, three factors seem particularly relevant. First, the 'intensity and horror' factor has been linked with mental health problems (Bolin, 1985; Bravo *et al.*, 1990). Terror is most likely to occur in intense situations like flash floods, severe earthquakes and tornadoes. The Buffalo Creek research provides much of the clinical evidence for the terror components of disaster impacts (Gleser *et al.*, 1981). The sheer forces of that flood and its unexpectedness were important features that remained in victims' minds. While the perceived physical attributes of an event are important, they do not entirely provide the definitive link with mental health outcomes. For instance, unlike the experience in Buffalo Creek, large flood events in Big Thompson (Colorado) and Rapid City (South Dakota) were not associated with the same level of mental health impact (Bolin, 1985). Part of this difference can be explained by the exposure to death (or horror) associated with Buffalo Creek. "More than terror, the witnesses of death in disasters, the accidental discovery of bodies, the often unsightly physical condition of corpses, and the nature of the cause of death are likely to generate serious mental health problems" (Bolin, 1985, 8).

Related to the terror factor is the duration of the impact. This refers to the time it takes for disasters to run their course and it often differs from the duration of personal impact. Bolin (1985) suggested that the higher the intensity of short-duration impacts, the more likely it will produce mental health problems. Events such as the gradual onset of a flood are expected to produce lower problems, although if this lasts for a long duration, emotional problems for victims can be created. The predictability and controllability of a hazard are also influential factors. If a disaster cannot be controlled, the impact on mental health is expected to be greater.

In summary, major natural hazards have characteristics that make them strong stressors. They are disruptive, produce scenes of terror and horror, are often unexpected, are undesirable and uncontrollable, and may have a prolonged duration (Bravo *et al.*, 1990).

3.3.2 Selected Findings from Research focused on the Time Period following an Event

The type of symptoms that victims suffer and its duration vary. “Although evidence suggests that disaster stress varies according to the type of disaster experienced, findings also show that responses to all disasters evolve in a relatively predictable trajectory of early shock and anxiety, followed by anger, depression, generalized mental stress, and post-traumatic stress” (Hardin *et al.*, 1994, 428). Takuma (1978) and Parker (1977) have supported this behavioural pattern that is characterized by a decreasing number of impairments over time.

Contrary to the popular portrayal of disasters in the news media and film industry, uncontrolled public panic is not the predominant behaviour during a disaster. While some looting and violence have occurred during a disaster, they are the rare exception and not the rule (Bolin, 1985; Bravo *et al.*, 1990). In the context of developing world disasters, Noji and Toole (1997) identified three myths and the realities surrounding the public health impact of disasters. Some of these comments are pertinent to the developed world.

Myth 1: Foreign medical volunteers with any kind of medical background are needed. *Reality:* The local population almost always covers immediate life-saving needs. Only medical personnel with skills that are unavailable in the affected country may be needed.

Myth 2: Any kind of international assistance is needed, and it is needed now! *Reality:* A hasty response that is not based on an impartial evaluation only contributes to chaos. It is better to wait until the genuine needs have been assessed.

Myth 3: Epidemics and plagues are inevitable after every disaster. *Reality:* Epidemics do not spontaneously occur after a disaster, and dead bodies will not lead to catastrophic outbreaks of exotic diseases. The key to preventing disease is to improve sanitary conditions and educate the public.

Most often, people in a disaster show considerable self-control and willingness to help others. Another important disaster behaviour during and immediately following a disaster is the restoration of a community’s communication lines.

With respect to short-term public health issues, Glenn (1979) offered the following symptoms that appear a day or two after a disaster: overactivity, restlessness, fatigue, insomnia, headaches, pallor of the face, coldness, sweating, tremors of the hands and body, gastro-intestinal problems, reduced appetite, vomiting and diarrhea. “These physical symptoms are explained through a general autonomic arousal that occurs under stress” and usually clear up within a few days (Glenn, 1979, 28). Chapman (1962) reported on illnesses in the “remedy period”, and noted that a sizable proportion of survivors experienced insomnia, digestive upsets, nervousness and other emotional tensions. These types of problems

tend to subside within several days after the disaster (Logue *et al.*, 1981a). Smith and North (1988) reported that 92% of respondents felt at least partially recovered, and 40% reported complete recovery within four weeks of the Madison Florida tornado.

General physical illness have not been identified as a long-term health consequence (Bolin, 1981). Kario and Ohashi (1997), who concluded that a relatively high death rate of older people from coronary heart disease persisted for a few months after a 7.2 Richter earthquake, supported this view. Trevisan *et al.* (1986) found similar results applying a longitudinal study design a few weeks after a major earthquake. Specific health problems have been reported such as phobias and sleep disturbances (Newman, 1976; Gordon *et al.*, 1987) severe headaches and bladder trouble (Logue *et al.*, 1981b), psychiatric symptoms such as anxiety, depression, childhood behaviour problems, and nervousness and separation anxiety (Falik and Britton, 1974; Okura, 1975; Bolin, 1985). Other authors are often less specific about health problems experienced by noting that there has only been a change in health status following a disaster.

In addition to these physical symptoms, there are a variety of psychological ones as well. These include a continuation of the anxiety which is often coupled with depression. A common reaction among victims is to tell their story many times in an apparent attempt to desensitize their emotional stress. This can also be done through nightmares. Anger has been observed and is often expressed at rescuers or a neighbour (Glenn, 1979).

Psychosocial outcomes that are associated over the longer term (*i.e.* weeks or years after an event) include all the previously noted short-term effects (Glenn, 1979). The list of long-term disorders would also include grief over the loss of lives and possession, psychomatic disorders, and a variety of other clinical symptoms. Gordon *et al.* (1987) noted that 40% of respondents reported to have trouble sleeping four months after the Baldwin fire. Gleser *et al.* (1981) concluded that as many as 30% of disaster victims from Buffalo Creek sustained mental distress, many for years after the event. Shaw *et al.* (1991) reported the most frequently reported responses from faculty at the Medical University of South Carolina 8 weeks after Hurricane Hugo were the following: (1) feeling easily annoyed and irritated (41%); (2) feeling low in energy or slowed down (35%); (3) feeling critical of others (33%), (4) worrying too much about things (32%); and (5) feeling blocked in getting things done (30%). Some adults have reported long-term depression and anger for as long as 36 months (Hardin *et al.*, 1994).

Examination of the literature indicates that researchers have yet to reach a consensus regarding the degree of physical and psychological impairment following a disaster. Estimates range from Bates *et al.* (1963), who found no significant impairment four years after a disaster, to Lifton and Olson (1976), who found overwhelming evidence that everyone exposed to the Buffalo Creek disaster had experienced some or all of the manifestations of the survivor syndrome. These manifestations include death imprint and anxiety, death guilt, psychic numbing, and impaired human relationships. However, the Buffalo Creek event was particularly extreme case study.

Perry and Lindell (1978) presented the following conceptual model that isolated important variables and suggested the channels through which disaster might produce positive or negative psychological consequences. For those lasting one week: (1) community variables such as level of preparedness, forewarning; disaster subculture and formation of a therapeutic community; (2) disaster variables such as scope and duration of impact, and the resulting property damage and destruction of kin and friendship networks, which may result in grief reactions; and (3) personal variables such as demographic variables (*e.g.* gender, age race, ethnicity, family size, income) and pre-impact psychological stability. Impacts occurring from one week to six months following a disaster were believed to be influenced by all the above factors as well as by relevant institutional arrangements for recovery (Perry and Lindell, 1978 as cited by Logue *et al.*, 1981a). This integrative model contains many of the variables that were noted by Bravo *et al.* (1990). In terms of future research, what appears to be needed are studies that actually apply this type of model over long time periods and in several locations.

In addition, most reports of post-disaster health have not used a control or non-disaster comparison group. Some studies have tended to use a comparison group in which data are collected for other purposes. This shortcoming was addressed by Logue *et al.* (1981a; 1981b) who specifically designed a study that compared the life changes and illness experienced of two groups of men who were residents in the communities of Wilkes-Barre and Kingston Pennsylvania. The two populations were essentially the same with the exception that Hurricane Agnes (1972) impacted some respondents. The study was conducted three-years following the flood and focused on three time periods: six months before the flood, from the flood to 2.5 years later, and the most recent 6 months. They concluded that the “stress associated with a disaster may last for years and could be responsible for excess long-term morbidity” (Logue *et al.*, 1981b, 78). This type of speculative conclusion was dismissed by Krause (1987, 61) who maintained that previous empirical findings on the impact of stress on health “have failed to support the hypothesis that stressful life events play a major role in the development of illnesses and emotional disorders. Rarely has the correlation between stress and these health measures exceeded .35.”

In short, the duration and significance of the symptoms after an event are difficult to evaluate because of the inconsistent nature of the research and the idiosyncrasies of each event. The range of time probably extends from longer than a few days to several years. However, the significance of these symptoms is not well established. From a more positive perspective, several studies cited above have reported that impairments no longer existed or were minimal between 14 months and 4 years.

4.0 Discussion

This section addresses two issues: (1) who is at risk, and (2) future research opportunities.

4.1 Who is at risk?

According to Mileti (1999), most recovery research has sought to answer the following questions:

- What types of families are most disrupted by disasters?
- What types of families recover most quickly?
- What things account for different rates of family recovery?

The essence of these questions embraces the theme “Who is at risk?”.

Disasters do not affect everyone the same. Vulnerability is unevenly distributed among different social groups “with disaster victims more likely to be groups of individuals who have the least amount of power and resources in the social system to recover or escape from natural or technological hazards” (Wilson and Oyola-Yemaiel, 1998, 3). Precisely identifying populations at risk is a difficult task. “Demographics, social support and self-efficacy protect against or mediate the deleterious disaster stress” (Hardin *et al.*, 1994, 428). Our current knowledge is not definitive on how to identify vulnerable groups and individuals.

Mileti (1999) suggests that one problem in achieving this goal is the different models of family recovery have been used by researchers. This has led them to investigate different variables. While most researchers have examined how recovery is affected by a family’s socioeconomic status, others have used demographic characteristics, position in the life cycle, race or ethnicity, real property loss, employment loss, loss of wage earner(s), family capacity (reserves, family support/assistance), or use of institutional support programs (Mileti, 1999). In addition, recovery has been defined differently. For instance, recovery can refer to how successful victims were in regaining pre-disaster income levels; the relationship between the magnitude of the losses and available economic resources; whether families returned to the original damaged home or a comparable one, or whether the victim family believed it had recovered (Mileti, 1999). Gordon *et al.* (1987) assessed recovery from the standpoint of the community rather than the individual. Thus, different measures or conceptualizations have been applied to the concept of ‘successful recovery’. The populations that are often identified as being vulnerable are noted below.

Children are often identified as a vulnerable group because they are believed to have lower coping capabilities. For instance, Allen and Rosse (1998, 1) conclude that “research on children’s response to exposure to traumatic events clearly documents that children who experience traumatic events are at risk for developing short- and long-term negative emotional reactions.” Kingston and Rosser (1974) and Bolin (1985) supported this view. However, this view was not shared by Hampe *et al.* (1973). This difference of opinion reflects, in part, the varying ability of parents to deal with the hazard. For instance, Allen and Rosse (1998) found a statistically significant correlation ($p < 0.005$) between high levels

of parental stress symptoms and a child's level of stress symptoms. Thus, it is unclear whether child-focused studies are measuring a child's or a parent's ability (or their shared ability) to respond to a disaster. Locke (1988) found that of 183 students referred for psychological assistance following tornadoes in Texas, more younger students (97) were referred than older ones (30); and more females (104) than males (79). As noted earlier, Garrison *et al.* (1993) found a range of estimates for PTSD in adolescents ranging from 0% to 37%. In reviewing previous studies they suggested that "the intensity of exposure to a disaster, previous exposure to other traumatic events, and parental reaction to the disaster may affect the outcome in the adolescent."

The elderly are another frequently mentioned vulnerable group because they may lack the physical and economic resources necessary for effective response, are more likely to suffer health-related consequences, and may be slower to recover (Tobin and Ollenburger, 1992). Shaw *et al.* (1991) found an increase in body weight following Hurricane Hugo was one negative health-related issue that was significantly associated with increased age. However, Bolin (1985) suggested that the research findings concerning the elderly being a vulnerable group were mixed.

According to Wilson and Oyola-Yemaiel (1998, 3) "women are the population most at risk to disaster events. Women typically have fewer resources and less autonomy as well as greater caregiving responsibilities which serve to accentuate their hazard vulnerability and victimize them disproportionately at all stages of disaster." Shaw *et al.* (1991) concurred with this conclusion. They studied faculty and student populations at the Medical University of South Carolina following Hurricane Hugo. Specific health concerns related to unhealthy changes in food consumption, weight and exercise patterns. Females and those people with high losses displayed greater changes. Garrison *et al.* (1993, 522) identified that PTSD occurred more frequently in young females compared with young males ($p < 0.05$) after Hurricane Hugo.

A range of other groups and characteristics are also mentioned in the literature. Socioeconomic status, race, ethnicity, and gender are interrelated in complex and different ways. "Ethnic and racial minority groups are typically disproportionately poorer, and disproportionately more vulnerable to disaster and to the negative impacts of long-term recovery" (Mileti, 1999, 231). Ethnic differences have been found to affect the way in which people process warnings and respond to disasters (Perry *et al.*, 1982). Language barriers can limit access of minority groups to disaster warnings and disaster information such as that related to the government aid process. Mileti, (1999, 231) suggested that poorer families have more difficulty recovering from disasters and likely have the most difficulty in acquiring assistance from sources external to the family. Poorer households more often live in sub-standard or ill-built and inadequately maintained housing, increasing their vulnerability to hazards (Philips, 1993; Wilson and Oyola-Yemaiel, 1998). While the economic losses suffered by the poor will be less in absolute terms, minor losses can be devastating relative to their economic resources. Thus, a person's place within the social structure determines the likelihood of their becoming a disaster victim and their ability to recover from a disaster. Researchers have also found that traditionally less powerful groups

are less likely to be part of existing disaster planning, response and recovery efforts (Mileti, 1999).

In terms of geographic location, Mileti (1999) identified rural victims as more likely to use relatives as a source of emergency shelter compared to urban families. Perhaps not surprisingly, rural victims are less likely to receive assistance from external family sources relative to urban victims (Mileti, 1999). In rural areas, high-income victims had fewer losses than low-income families; but in urban areas, income seemed to make no difference. Thus, the pattern of urban and rural growth seems to influence the identification of vulnerable groups

Based on psychological characteristics, research findings provided some evidence suggesting that those persons who sought help in non-disaster laboratory settings exhibited different personality characteristics than those who chose not to pursue external offers of aid. It appears that people who are defensive tend to avoid or defend against threatening stimuli, typically do not pursue offers of assistance. In contrast, persons who are described as sensitizers tend to maintain a heightened awareness to threat, and are more likely to accept offers of or seek help. In this regard, Rao *et al.* (1985) and Allen and Rosse (1998) found statistically significant relationships between adult coping styles and stress levels. Unfortunately those individuals who likely need the most assistance are those who are less likely to seek from various sources, in part, because they are unaware of their distress (Rao *et al.*, 1985). A final comment on the relationship between personality status and coping behaviour is offered by Coleman (1976, 204): “The more stable and better integrated the personality and more favorable the individual’s life situation, the quicker will be [their] recovery from a civilian shock reaction.” Thus, these antecedent factors influence the identification of vulnerable groups. In short, social situation and personal antecedents can moderate or facilitate negative behaviours. The nature of the disaster itself affects how people respond.

Vulnerable groups have also been identified on the basis of the ‘victim level’. Two types of victims are readily identified in disaster situations - primary and secondary (Bolin, 1985). Primary victims directly experience physical, material and personal losses. They are most likely to exhibit emotional distress and are most likely to utilise mental health counseling in the aftermath. Secondary victims witness the destructiveness of the disaster but do not experience the actual impact (*e.g.* experienced it vicariously through the material losses of their family and friends). The focus of research has obviously centred on the former rather than the latter group. Most studies of the near-miss phenomenon have followed disasters for a short period of time and have tended to focus on the current psychological status and the coping strategies.

Although difficult to assess precisely, psychosocial processes are very important in disaster situations. A close social support network facilitates rehabilitation efforts. When this network breaks down during a disaster because families may be temporarily separated, the risk to vulnerable people such as children who are separated from family is increased. Psychosocial processes also operate before a disaster occurs through individual and

community support for mitigative programs. Thus, it is foolhardy to separate disaster behaviours following an event from the total range of disaster responses and everyday living.

4.1 Future Research Opportunities

In terms of future research, some important questions remain to be answered. Following the recent focus on vulnerability, research should ask more specific questions about: “Which disasters?”, “Which consequences?”, “At what moment?” and “To whom?” (Green, 1985). That research should also include an assessment of mitigative, warning, response and recovery programs. In this way, better mitigative measures that reduce the level of vulnerability in the first place could decrease the need for long-term public health recovery programs. In assessing public agency disaster initiatives, there should be a clear focus on institutional arrangements. All government and private responses should be viewed as a collective decision-making process among a variety of groups and institutions. The goal of these public and private responses must be oriented to reduce the vulnerability of the entire population.

The need for long-term longitudinal studies of disasters is clearly demonstrated. The mixed results from previous studies reflect the problems and differences in measuring the stressful event, or by arguing that the impact of stress is mediated or buffered by factors such as social support, or feelings of self mastery (Krause, 1987, 61). Future studies should devote more attention to the relationship among a disaster event, the onset of initial symptom development, and the salient features of appraisal and coping strategies. Long-term studies on the recovery period should be contemplating time periods of at least 2 years following an event. Those few studies that have reported the long-term consequences of natural disaster have been based on general observations or have suffered from methodological problems, such as lack of a comparison group. Comparison of findings from these studies has been difficult for many reasons. Any effort to conduct comparative studies over the long term would address these shortcomings. In conducting these comparative studies, the use of measures, such as the ‘impact ratio’, could provide a basis to compare the impact of an event among individual communities.

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