

# Research and Evaluations of the Health Aspects of Disasters, Part III: Framework for the Temporal Phases of Disasters

Marvin L. Birnbaum, MD, PhD;<sup>1</sup> Elaine K. Daily, BSN, FCCM;<sup>2</sup> Ann P. O'Rourke, MD, MPH<sup>3</sup>

1. Emeritus Professor of Medicine and Physiology, School of Medicine and Public Health, University of Wisconsin, Madison, Wisconsin USA; Emeritus Editor-in-Chief, *Prehospital and Disaster Medicine*
2. Nursing Section Editor, *Prehospital and Disaster Medicine*; Executive Secretary, World Association for Disaster and Emergency Medicine, Madison, Wisconsin USA
3. Assistant Professor, Division of General Surgery, Department of Surgery, School of Medicine and Public Health, University of Wisconsin, Madison, Wisconsin USA

## Correspondence:

Marvin L. Birnbaum, MD, PhD  
Suite 407  
610 N. Whitney Way  
Madison, WI 53705 USA  
E-mail: mbirnbaum@wadem.org

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**Abstract:** Each of the elements described in the Conceptual Framework for disasters has a temporal designation; each has a beginning and end time. The Temporal Framework defines these elements as phases that are based on characteristics rather than on absolute times. The six temporal phases include the: (1) Pre-event; (2) Event; (3) Structural Damage; (4) Functional Damage (changes in levels of functions of the Societal Systems); (5) Relief; and (6) Recovery phases. Development is not a phase of a disaster. The use of the Temporal Framework in studying and reporting disasters allows comparisons to be made between similar phases of different disasters, regardless of the hazard involved and/or the community impacted. For research and evaluation purposes, assessments, plans, and interventions must be described in relation to the appropriate temporal phase.

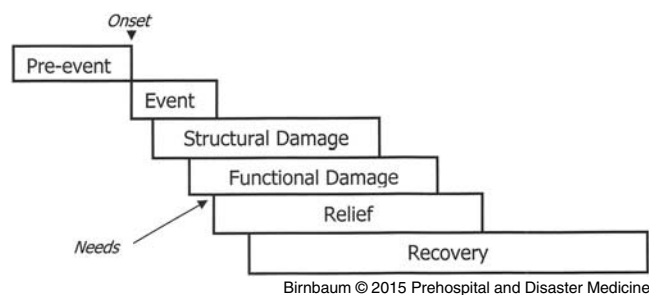
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## Introduction

Each of the elements described in the Conceptual Framework has a temporal value; each has a beginning and an end, and hence, a duration. Absolute values in terms of hours, days, months, years do not lend themselves to comparisons and synthesis with the temporal pattern associated with other events and disasters. Yet, such comparisons are essential in order to define the epidemiology of disasters, and to understand the impact(s) of interventions provided.

Previous descriptions of the epidemiology of disasters (including the Disaster Management Cycle) have consisted of describing the chronology by sequential, longitudinal phases denoted by absolute times following the onset of the event (eg, Day 1 and Day 5). But, time courses can vary between events caused by similar or different hazards; the circumstances of Day 5 following one earthquake may not resemble those of Day 5 following another earthquake; or the circumstances on Day 8 of a flood may be quite different from Day 8 following an earthquake. Sequentially partitioning a disaster into temporal phases using absolute times has not been particularly useful for studying disasters; in some instances, it may have served to confuse rather than clarify.<sup>1,2</sup>

Instead of describing each of the elements in the Conceptual Framework in terms of absolute times, it is cogent to consider each with its own temporal description. Although temporal relationships described in the past have consisted of sequential phases or stages (ie, each phase/stage began following the end of the preceding phase/stage), the elements comprising the Conceptual Framework may overlap: Functional Damage may begin before all of the Structural Damages have concluded; interventions directed at Recovery should begin as soon as possible following the onset of Relief activities (ie, before Relief interventions have ended).<sup>3</sup> These temporal periods have been referred to as stages and/or phases. However, while a stage is a point or period in a process or development; the distance between two stopping places; a periodic process of phenomenon,<sup>4</sup> a phase is a temporary manner, or pattern;<sup>5</sup> a distinct period or change or development.<sup>6</sup> Stages have a sequential beginning and end while phases may overlap. For this reason, the temporal patterns associated with the elements of the Conceptual Framework are called "phases," and for descriptive purposes, the phases can be plotted longitudinally against time.



**Figure III-1.** Temporal Framework: Phases that Comprise a Hazard Developing into a Disaster. The temporal phases progress in chronological order, but are defined by their characteristics rather than intervals of time. Many of the phases usually overlap—phases may run concurrently.

For comparison purposes, the chronology of the findings and interventions associated with a disaster are best described in terms of the respective temporal phase in which they occurred.

### Temporal Phases of a Disaster

The components of disasters as outlined in the Conceptual Framework can be assigned into specific temporal phases, which may overlap and are not assigned to a specific time. The temporal phases in which the elements of the Conceptual Framework occur include: (1) Pre-event; (2) Event; (3) Structural Damage; (4) Functional Damage (changes in function(s)); (5) Relief; and (6) Recovery phases (Figure III-1). Although not part of the Conceptual Framework, a pre-event phase has been added as all of the changes (both structural and functional) from an event relate to the affected community's structural and functional status before the onset of the precipitating event occurred. The impact of an event on the affected community relates to the changes in functions that resulted from the event.

Impaired function(s) (Functional Damage) creates immediate needs that can be filled by Relief responses (interventions) provided by the community (local responses) or outside the affected community (outside responses). Deteriorations in the level(s) of function may be corrected by repairing the Structural Damage, or by replacing the damaged structures (Recovery response), or by providing the needed goods, services, and other resources. A response constitutes an answer to something.<sup>7,8</sup> All responses consist of some type of intervention. In the Temporal Framework, response is not considered to be one specific temporal phase; rather, the period formerly referred to as the response phase<sup>9(p157)</sup> has been divided into a Relief phase and a Recovery phase. The Relief phase consists of those interventions directed at limiting additional Structural and/or Functional Damage(s) (damage control; ie, preventing additional injuries/illnesses and deaths, filling the existing gaps in functions or levels of function, and relieving pain and/or distress). Relief responses also address the conditional (situational) needs<sup>9(p115)</sup> that result from the increased burdens associated with a disaster (eg, the surge of injured/ill victims that are part of the human damage (structural) from the event). The Recovery phase consists of the assessments and interventions directed towards returning the levels of functioning of the affected community to their pre-event levels of function.<sup>9(pp69-101)</sup> Recovery interventions mostly address the repair and/or replacement of Structural Damage and enable restoration of pre-event levels of function.

For research/evaluation purposes, it is important to describe disaster-related assessments and/or interventions according to the temporal phase in which they were undertaken. This allows findings to be categorized according to phases and, thus, become readily useful for further comparisons. Each of the temporal phases of a disaster is described briefly below.

#### Phase 1: Pre-event Status

The degree of Structural Damage and the resulting changes in function (Functional Damage) sustained by any community cannot be determined without knowing the pre-event status of the Societal System being studied.<sup>10</sup> As the ultimate goal of Recovery is the restoration of the levels of functioning to their respective pre-event functional state, it is necessary to know the status that existed prior to the onset of the event.

Ideally, an inventory of the pre-event status of a disaster-affected community is determined prior to the onset of an event, and the information is readily available to the teams performing assessments of Structural and Functional Damages that resulted from the event.<sup>11-13</sup> Examples of essential pre-event information include descriptions of existing infrastructure, known hazards, the characteristics of the hazard responsible for the event, and a profile of the affected population, including its health status, culture, economy, and security. However, such data/information often are/is difficult and expensive to acquire, and knowledge of the pre-event status may not be available during a crisis. Furthermore, the pre-event status of a community/society affected by a prolonged disaster may be more difficult to ascertain than that affected by a sudden, high-intensity onset, short-duration event. For example, the damages from the extensive floods that blanketed parts of Pakistan in 2010 could not be determined due to a lack of baseline information.<sup>14</sup> Determining which point of reference to use to describe the pre-event status may be difficult. If an earthquake occurs tomorrow, the pre-event level of the affected community would be the situation as it is today (before the earthquake), or as close to the onset of the event (earthquake) as possible. Thus, the temporal bounds used for the determination of the pre-event inventory/status must be known. Ideally, the pre-event inventory should be part of static information readily accessible in a database;<sup>15</sup> in reality, this may be complex. For example, the earthquake and tsunami that ravaged Aceh Province of Indonesia in 2004 was complicated by the civil unrest that was occurring at the time the earthquake and tsunami struck—the pre-event status of many Systems was difficult to determine. Many of the societal functions had ceased prior to the earthquake and tsunami as a result of the ongoing conflict. Such pre-existing disturbances of function(s) must be documented in order to attempt to define the damages related to the earthquake and/or tsunami.

#### Phase 2: Event

An event is an occurrence that has the potential to affect living beings and/or their environment.<sup>9(pp40-43)</sup> An event consists of changes in the rate/magnitude of the kinetic energy released by the hazard (ie, some or all of the potential energy contained within the hazard is released or the balanced release is disturbed from the baseline), and may impact natural (including humans and other living beings) or built structures.<sup>16</sup> In situations in which the community is using some of the energy contained in the hazard, the event may be due to the release of energy that overwhelms the community (in excess of the useable energy), or may be related to the amounts of energy released by the hazard being inadequate to

meet the needs of the community for energy. As a temporal phase of a disaster, Event refers to that period during which changes occurred in the amount/magnitude of kinetic energy released by the hazard changes from the norm for that community. While some events are brief (eg, earthquake), others may be prolonged (eg, rainstorm or flooding).

Discussions of the event phase of a disaster include descriptions of the characteristics of both the hazard and the event. These characteristics should be described using the descriptors provided in a preceding paper in this series.<sup>16</sup> Comparisons using these descriptors are essential in order to determine the epidemiology and to identify the respective absorbing, buffering, and response capacities of communities affected by similar events.<sup>9(pp45-51)</sup>

### *Phase 3: Structural Damage*

Structural Damage as a phase of a disaster refers to that period during which physical damage occurs from an event. Damage is harm or injury that impairs the value or usefulness of something, or the health or normal functions of persons. Structural Damage is the result of the energy released from the hazard by an event.<sup>17</sup> Structural Damage refers to physical damage to structures, be they living beings, the natural environment, and/or the human-built environment. Injuries/illnesses to humans caused by an event are considered Structural Damage. Structural Damages from an event may be direct or indirect. Direct damage is caused by the energy released by the event, such as injuries to living beings and structural failures of buildings. Indirect damage is Structural Damage that is not due directly to the changes in the energy of the event, but rather, a consequence of the event.

As with the Event phase, the Structural Damage phase of a disaster may be relatively brief, such as with a tsunami, or prolonged, such as with a drought. The Structural Damage phase may overlap with the Event phase (ie, Structural Damage may begin before the event has ended). In addition, Functional Damage may begin before the Structural Damage phase has ended.

Discussion of this phase of a disaster includes descriptions of overall and specific physical damages and injuries, both direct and indirect, as well as the effects of interventions undertaken prior to the event to increase the absorbing capacity for changes in the amount of energy related to an event.

### *Phase 4: Functional Damage (Changes in Functions)*

The Structural Damage(s) from an event may result in changes in the levels of functioning (Functional Damage) of one or more of the Systems that comprise a community. A flood may damage the physical structure of a water treatment plant that, in turn, leads to a decrease in its capability to provide potable water: a change in the level of function. Changes in levels of function, such as the inability to obtain water or an increase in water-borne infections, may infer Structural Damage that caused the change.

As a phase of a disaster, Functional Damage refers to that period during which compromised or loss of functions of one or more of the Systems that comprise the community occurs. The duration of this phase varies, and is specific to the System affected; not all Systems are affected similarly following the onset of an event. The duration of the Functional Damage phase also is dependent on the System's buffering capacity. Thus, the Functional Damage phase is described according to the Societal System(s) of the community affected (or studied). Discussion of the Functional Damage phase also includes descriptions of Functional Damages within other Systems that may have impaired

the functioning of the System being studied, and the effects of any attempts that had been made to increase the buffering capacity of the System being studied.

Diminished or loss of function(s) in any System generates needs, which are determined from assessments of current levels of function compared to pre-event levels of function. Therefore, the assessments and inductive processes that are used to identify needs are included in the Functional Damage phase.

### *Phase 5: Relief*

To relieve is to bring or provide assistance to alleviate or reduce pain and suffering;<sup>18</sup> to furnish assistance or aid.<sup>19</sup> The Relief phase of a disaster is that period of time during which all efforts (responses) are aimed at minimizing the disturbances in levels of functioning associated with the Structural Damage sustained. Relief responses are directed at maintaining essential levels of function. The duration of the Relief response phase depends on how quickly critical and essential levels of function can be restored.

Initially, Relief interventions may be directed at bringing the levels of function within the Systems of the affected community above critical (life-threatening) levels, or at preventing the functional levels of one or more Systems of the affected community from falling below critical levels of function.<sup>20</sup> Interventions aimed at Relief are used to fill the gaps in levels of function. These gaps in levels of function may be created by damage to infrastructure and personnel and/or to the quantities and quality of the available goods, services, and other resources. This includes the ability to respond to the conditional (situational) needs created by a post-onset surge in needs and the needs created due to Structural Damages in other Systems.

Therefore, the Relief phase of a disaster consists of the period of time when interventions (responses) are directed at minimizing further Structural and Functional Damages (eg, mortality, pain, and suffering), of an affected community. It includes life-saving and search and rescue efforts, and focuses interventions aimed at meeting the six so-called vital needs: (1) security; (2) water; (3) food; (4) shelter; (5) sanitation; and (6) medical care.<sup>9(p157)</sup> The Relief phase begins as soon as possible following the identification of needs. Following the onset of the event, Relief activities may begin before the initial assessments of the damage and functional status have been completed. Such interventions are the result of capacity-building measures that anticipate some of the needs of the affected community based on science and/or previous disaster experiences.

During the Relief phase, the goods, services, and other resources are used that are part of the response capacity of the affected community, as well as the goods and services that must be brought in from outside of the affected area. When available resources do not need to be supplemented from outside of the affected area, by definition, there is no disaster, even though the affected community still is experiencing an emergency that requires ongoing use of the local extraordinary response capacity.

All Relief interventions must have an established goal and objectives based on assessments of function; some responses may be initiated on the anticipation of the needs based on previous experiences. The Relief response phase continues until no further deterioration of the functions of the affected community can be achieved without outside assistance, even though recovery to pre-event levels of functions has not been attained.

Discussion of the Relief phase includes identifying specific local responses, the noted inadequacies of the local response

		Community A	Community B
Disaster A			
	Pre-event		
	Event		
	Structural Damage		
	Functional Damage (changes in function(s))		
	Relief		
	Recovery		
	Pre-event		
Disaster B			
	Pre-event		
	Event		
	Structural Damage		
	Functional Damage (changes in function(s))		
	Relief		
	Recovery		
	Pre-event		

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**Table III-1.** Use of the Temporal Framework Facilitates the Comparison of Any Temporal Phase from Similar or Different Disasters in Similar or Different Communities

capabilities, and descriptions of specific outside responses. Inherent in describing specific responses is inclusion of the objective of each intervention provided.

*Phase 6: Recovery*

Recovery is the process of returning the levels of functions of the Systems of an affected community to their pre-event levels.<sup>21</sup> Therefore, the Recovery phase is that period during which interventions (responses) are directed, not to the prevention of deaths and pain and suffering, but to returning the community or its components towards their respective pre-event levels of functioning. Consequently, the goals and objectives of Recovery interventions (responses) differ from those directed towards Relief.

Recovery interventions generally are aimed at repairing and/or replacing damaged structures. Recovery interventions also include physical and psychological rehabilitation of the persons whose functional status has become compromised as a direct or indirect result of the event. Recovery interventions should begin as early as possible following the onset of the precipitating event.<sup>3</sup> For example, when the available water supplies are inadequate, as a Relief measure, water must be supplied from another source; however, repair of the water facilities should occur concurrently in order that the community can return to supplying its own water (Recovery). Consequently, the Recovery phase of a disaster generally overlaps with the Relief phase. What distinguishes it from the Relief phase are the goals/objectives of the responses.

Following each Recovery intervention, it is essential to evaluate whether the intervention (or set of interventions) has returned the level of functioning of a specific System of the affected community (or components of a System) back to its pre-event level. If the pre-event level of functioning has not been restored following the Recovery intervention(s), new assessments of function must be conducted, needs identified, plans developed, and additional appropriate interventions directed towards the newly defined needs should be implemented. The Recovery phase is not ended for the affected community until each of the affected Systems of the community has returned to its pre-event levels of function. However, the disaster may be ended for some of the Societal Systems affected.

Discussions of the Recovery phase include descriptions of all responses aimed at Recovery of the affected community, the assessments and identified needs upon which the responses were made, and the goals and objective of the responses for any of the Systems of the community.

**Development**

Development is not a temporal phase of a disaster. Development occurs when an intervention raises the pre-event status of a basic component of a community to levels above the pre-event condition. In terms of disaster, such interventions are not responses to needs for either Relief or Recovery. Rather, they are interventions directed towards reducing the future impact of events either by reducing the probability that a hazard materializes as an event, mitigating the consequences of an event should an event occur, or

reducing the probability that an event morphs into a disaster by increasing the absorbing, buffering, or/and response capacities. Development improves the resilience of the community-at-risk so as to be better able to cope with the next event—"building back better."<sup>22</sup> Development raises the pre-event baseline status (level of function) to a new, higher level. Although capacity building is development, not all interventions aimed at development contribute to resilience; some add luxuries to the community, and some may increase the vulnerability of a community to a hazard. For example, reconstructed and "improved" transportation infrastructure may result in areas of deforestation that increase the risk for mudslides.

Development efforts may be integrated into Relief and Recovery interventions. For example, initiating a measles vaccination program in a refugee camp decreases the vaccinated children's current and future risk of contracting measles (increases absorbing capacity), and thus, improves the health status of the children resident in the camp, particularly if the program can be sustained. Likewise, reconstructing damaged buildings after an earthquake using energy-absorbing materials and construction techniques elevates the absorbing capacity of the buildings to a higher level than during their respective pre-earthquake states.

### Comparisons Using Temporal Phases

The grid provided in Table III-1 illustrates a method of comparing disasters utilizing the Temporal Framework. Using this Framework allows comparisons of a specific phase of a disaster in two different communities or of the same phases of two different disasters in the same community. Use of the Temporal Framework was essential in the comparison study of the damage created by the earthquake and tsunami in Southeast Asia of December 2004 between the countries impacted.<sup>17</sup> Its use is central to both epidemiological and interventional disaster studies, and allows findings to be readily categorized for easy accessibility and use.

### Summary

The Temporal Framework describes the temporal phases of a disaster based on the characteristics of each phase rather than on absolute times; the duration of the phases vary for each disaster, and there is considerable temporal overlap between the phases. Organizing a disaster into generic temporal phases facilitates the study and comparison of disasters from which information can be obtained that contributes to building the science of disaster health. Any phase of a disaster in any community can be compared to the same phase of any disaster in another community or of another disaster in the same community.

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