CHAPTER 3

MORTALITY AND MORBIDITY IN NATURAL DISASTER : A GLOBAL ANALYSIS OF TIME TRENDS AND REGIONAL DIFFERENTIALS

by

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1.0 INTRODUCTION :

Natural disasters may be classified into four main categories: floods, earthquakes, cyclones and drought, in terms of the frequency and significance of their impact. Other catastrophic events, such as landslides, avalanches, snow, fires occur at rarer occasions and threaten smaller proportions of the populated world. The destructive agents in four main classes mentionxed above are wind, water (a lack or excess thereof) and tectonic forces. While all these generally cause structural damage, their mortality and morbidity effects are rather variable.

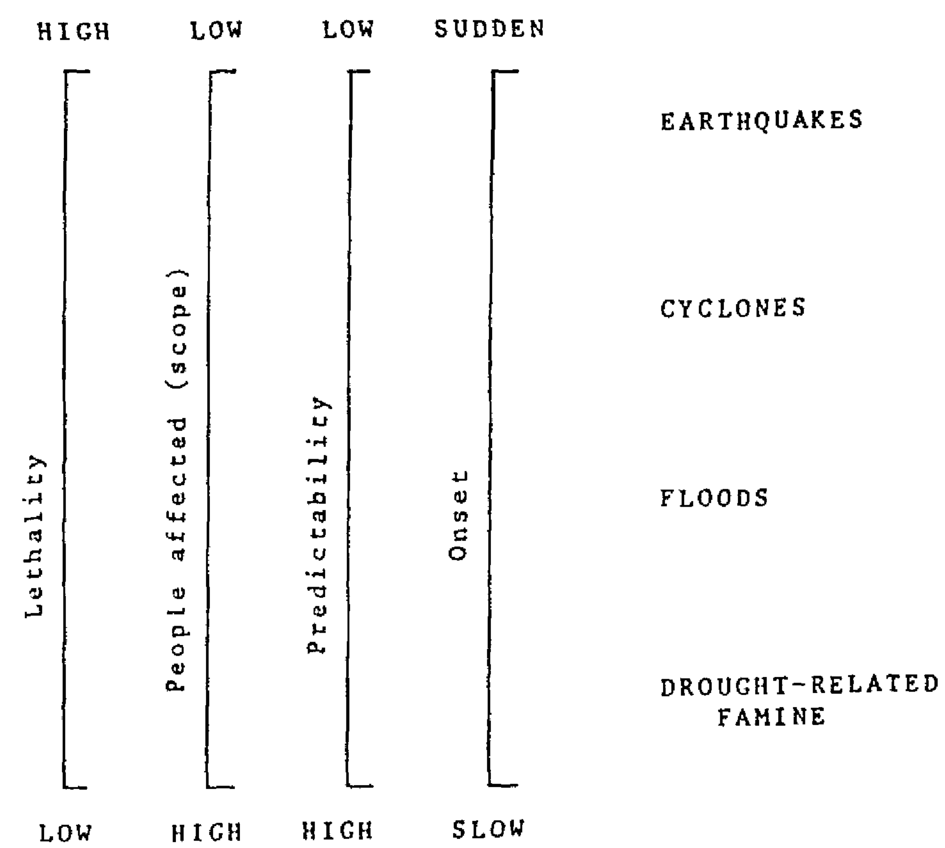
The disaster cycle can be differentiated into five main phases, extending from one disaster to the next. The phases are : the warning phase indicating the possible occurrence of a catastrophe and the threat period during which the disaster is impending; the impact phase when the disaster strikes; the emergency phase when rescue, treatment and salvage activities commence; the rehabilitation phase when essential services are provided on a temporary basis; the reconstruction phase when a permanent return to normalcy is achieved. The disaster induced mortality and morbidity differ between these phases and are mainly a function of the prevailing health and socio-economic conditions of the affected community. As a result of this, global statistics on disasters seem to indicate a significantly higher frequency of natural disasters in the Third World than the industrialised countries. Disallowing an economic consciousness of nature, a disaster may be defined by the vulnerability of the population to a natural event and not by the mere fact of its occurrence (de Ville et Lechat, 1976).

1.1. Special Characteristics of Natural Disasters :

It is useful to start by locating the four main disaster types on relative scales of lethality, predictability, onset time and impact scope. This ranking provides some guidance towards understanding the variation in mortality impact noted among disaster events across time and space. Figure 1 displays the four scales with the location of each disaster type. Although drought-related famines are a very special class of disaster, it nevertheless falls within this general paradigm.

FIGURE I

Ranking of Principal Natural Disasters on Relative Scales of Predictability, Lethality, Scope, Onset Delay



Famines are disasters of high predictability. With the exception of the Great Bengal Famine of 1941-43, almost all the following important famines certainly the ones of Sahelian Africa and Ethiopia were more or less foreseen as impending events. Famines, in fact, provide an excellent illustration of the fact that the knowledge of impending disaster does not imply that a community can or will take responsive action. On the other end of the scale, earthquakes tend to be least predictable, striking with little warning. Japan is one of the few high risk countries that have an effective warning and evacuation system, as well as excellent community education programs (Nakano, 1974). The earthquake of Niigata (16th June, 1964) registered 7.7 on the Richter scale. Although 20,000 houses were destroyed, only 13 people were killed and 315 injured. Due to the quality of its preparedness programs registering a high number of seismic shocks, Japan suffers very limited mortality. (Akimoto,R.,1982)

TABLE 1

Crude Disaster Mortality and Population Affected Between Disaster Types and Over Time

DISASTER TYPE	DEATHS		AFFECTED (in millions)	
	1960-69	1970-79	1960-69	1970-79
Droughts	10.100	231.100	18.5	24.4
Floods	28.700	46.800	5.2	15.4
Cyclones	107.500	343.600	2.5	2.8
Earthquakes	52.500	389.700	0.2	1.2
Total	193.800	1.011.200	26.4	43.8

Source : U.S. Office of Foreign Disaster Assistance. Annual Report

In terms of lethality, earthquakes present the greatest risk of death to those affected (Table 1). The chances of dying if one is within the scope of the quake is 106 times that of a cyclone. Onset delay is also the shortest in earthquakes, which is interrelated, to a certain extent, with its low predictability. Famine, on the other hand, has a slow buld up period before it reaches acute emergency proportions. Floods can be somewhat ambiguous in their onset characteristics. They can be slow-developing and fairly predictable such as the annual floods in Eastern India Gangetic plains or in the Itajai River basin in Brazil, causing regardless, a certain amount of deaths and damage (Civil Defense of Santa Catarina, 1983). Acute and catastrophic floods are those, usually generated by cyclones or tsunamis, such as the ones in Phillipines (1984) and Bangladesh (1985). Floods, relative to other disasters cause somewhat lower mortality but the scope of damage is generally wider and more pervasive.

2.0. MORTALITY FROM NATURAL DISASTER : TRENDS AND DIFFERENTIALS

On a global level, the mortality generated by natural disasters show some interesting tendencies, creating the beginnings of an analytical framework within which specific impacts may be systematically analysed for robust indicators, efficient needs assessment or preparedness and rehabilitation planning. The mortality from disasters is a function of the relationships of risk, development and coping or adjustment capacity (preparedness). Table 2 displays some countries with their degree of risk, developmental status and adjustment capacity namely, technology and resources for preparedness and mitigation activities.

TABLE 2

Comparative Score of Risk, Development and Adjustment Capacity
Vis-à-vis Natural Disasters

COUNTRY	DEGREE OF RISK	DEVELOPMENT STAGE	ADJUSTMENT CAPACITY
Japan	4.0	4.5	4.5
U.S.A.	3.5	5.0	4.0
Chile	4.5	3.0	3.0
Bangladesh	4.5	2.5	2.0
Indonesia	4.5	3.0	3.5
The Netherlands	4.0	4.5	4.5
Unied Kingdom	2.5	4.0	4.0
Malaysia	4.0	3.5	3.5

Adapted from : Environmental Risk : Management Strategies in the Developing World, by W.R.D. Sewell and H.D. Foster, in Environmental Management, Springer-Verlag, New-York, 1976.

The official disaster data reveals two important variations in disaster mortality : a temporal increase and a geographical correlation.

2.1. Time Trends in Disaster Mortality :

Between the two ten-year periods, 1960-69 and 1970-79, a significant increase in average mortality per event is noted in all categories except perhaps in floods where direct mortality is generally low. (Table 3).

TABLE 3

Changes in Disaster Mortality Between the Periods
1960-1969 and 1970-1979

DISASTER TYPE	DEATHS PER EVENT		MORTALITY (per 1000 exposed)		IMPORTANCE OF INCREASE
	1960-69	1970-79	1960-69	1970-79	
Drought-related famine	202	2.311	0.5	9.5	+ + + +
Floods	158	213	4.5	3.0	-
Cyclones	88	2.291	43.0	122.7	+ +
Earthquakes	750	4.871	262.5	324.7	+

Adapted from
Source : U.S. Office of Foreign Disaster Assistance. Annual Reports.
cited in Swedish Red Cross, [illegible]

The greatest increase is noted in earthquakes, which takes a quantum leap from one period to the other. The mortality in 1960-69 was 750 deaths per earthquake whereas in the following ten-year period the death toll per event went up to 4,871 deads per earthquake.* The huge increase in earthquake mortality is partially explained by the Tangshan strike of 1976 in China which contributed more than half of the entire ten year period death toll. The official estimate of 224,000 dead accounts for exactly 47% of the total number dead due to earthquakes during this time. But even accounting for the Tangshan quake, the death mortality per strike remains as high as 1,780 in earthquakes versus 750 in the previous decade. Population density (Lechat, 1984), structural quality (Glass, 1977), time of strike (De Bruycker, 1983) and intensity of seismic activity (Alexander, 1985) seem to be the main risk factors but they fail to explain adequately the mortality to be expected in

* It is interesting to note here that the total number of earthquakes requiring international assistance did not increase significantly from one period to the other.

earthquakes. Local conditions, evidently, play a bigger role than expected in determining disaster mortality.

2.1.1 Disaster mortality rates: The mortality rates of the different disaster types increase significantly over the two decades for all except floods and they increase slightly in earthquakes. This stability in the mortality rates of earthquakes is mainly due to its being a high risk disaster with comparatively localized effects. The greatest increase is observed in drought-related famines where the population get progressively weaker from previous famines and succumb in each successive crisis in greater numbers. Floods show a slight improvement, as it were. However, mortality impact of floods may be hypothesized as being typically spread over the period following the flood rather than as a direct and immediate effect of the event.This increase in the mortality rate, possibly reflects the inability of current disaster management policies to reduce the vulnerability of a community .Despite significant disaster assistance and aid of nearly one billion dollars in the 1970-1978 period, the increase in mortality, controlling for the number of events, indicates a steady degradation in the resistance of the populations to disasters.(Stephens, 1982)

2.2. Regional Differentials in Disaster Mortality :

Geographically, the mortality generated by disasters is consistently and positively correlated to the level of the economy. Table 4 presents some figures of mortality classified into three income categories at the national level.

TABLE 4

Disaster Mortality by Level of Economy

MORTALITY	ECONOMY		
	LOW INCOME	MIDDLE INCOME	HIGH INCOME
Per event	3.300	500	125
Per 1000 populat.	69	28	19
Per 1.000 KM^2	48	8	1

Adapted from Swedish Red Cross, 1985

The mortality, controlling for the number of disaster events are substantially higher in poor countries than in the richer ones. The classification is, of course, gross and the data demands closer analyses for better definition of risk factors and vulnerability patterns amongst the severely affected populations. Such analyses can have direct impact on program planning and policy-orientation. The Table 4, however, does serve to indicate the important influence of the prevailing socio-economic conditions on the eventual disaster impact. (Cuny, 1983, Shah, 1985). For predictive and needs assessment purposes then, the prevalent socio-economic and health conditions prevalent in the affected community could be a better determinant of the epidemiological impact than the physical characteristics of the event.

As seen in Table 2, disaster generated mortality increases dramatically as economies descend the income scale. Barring a deliberate selectivity of nature in her allocation of high intensity disasters to low-income countries, a less "natural" explanation is the communities differential power to resist and recuperate from shock.

Table 5 presents some data on the 1971-1972 earthquakes of Managua (Nicaragua) and San Fernando Valley (United States of America).

TABLE 5

Comparative Characteristics From Earthquakes in Managua (1972) and California (1971)

DISASTER CHARACTERISTICS	MANAGUA	CALIFORNIA
Richter Scale Reading	5.6	6.6
Extent of destruction (Mercalli Intensity Range VI-VII)	100 KM^2	1.500 KM^2
Population in affected area	420.000	7.000.000
Dead	5.000	60
Injured	20.000	2.540

The comparison reveals some interesting points. "Naturally" speaking of the two earthquakes, the seismic activity level of the California earthquake was significantly higher registering 6.6 on the Richter scale versus 5.6 in Managua.* On the Mercalli scale (measuring the extent of physical damage over surface area) the California quake caused major damage (IX - XI level damage) over 100 square kilometers whereas Managua registered a lower level of damage to a smaller area of land. The population directly affected by the earthquake in California was 13 times that of Managua.

* One unit increase is an important proportion due to the logarithmic scale of Richter readings.

Despite all physical conditions indicating to the contrary, the mortality in Managua was somewhere around 5,000 deaths vis-a-vis 60 deaths in California.

3.0. MORBIDITY AFTER NATURAL DISASTERS :

The data on morbidity (namely injuries and disease) after a disaster is remarkable by its absence or incomparability. The definition of injury, when registered, is largely unstated and reporting of diseases largely ncomplete. This has resulted in a series of observations, some anecdotal, some systematic but nearly all fragmentary. There is clearly, an urgent need for standardised reporting of injuries and cause of death, preferably using the Ninth Revision of the International Classification of Disease. Without such standardisation, disaster planning and management remains an ad hoc activity.

3.1. Injury Profiles of Natural Disasters :

There are some recorded figures available on injuries sustained in earthquakes which registered and published morbidity data.It remains questionable what qualified as injury and more importantly, the bias introduced by those who were not hospital treated. Non-traumatic morbidity is even less recorded or published. Classification bias and general incomparability is an important problem here vis-a-vis analyses for program or policy purposes.

Injuries have tended to generally concentrate on fractures, in case of earthquakes, the disaster type most susceptible to traumatic injury. Among earthquake generated injuries, fractures constitute the major portion of the impact among which those of the extremities are significantly more than any other sort. In the few instances, where injuries were classified according to type, about 69% were those of the limbs in the Tashkent (1966) and Ashkabad (1948) earthquakes (Beinin,1981). Other evidence from ijuries sustained in Managua (1971) and Iran were 77% and 58% fractures of the extremities, respectively (Whittaker1974; Saidi,1963). Most injuries, be it lacerations in cyclones or fractures in earthquakes, tend to occur during the catastrophe itself or in the very immediate post-impact phase.

Clearly, in both earthquakes and cyclones, structural quality of housing is a major determining factor of the extent and type of injury, which, in effect is a proxy variable for the socioeconomic level of the community or the household.

3.2. Disease Profiles of Natural Disasters : Despite popular belief, major epidemics are fairly rare events after natural disasters (de Ville de Goyet and Lechat,1976; Seaman 1981), especially in industrialised countries. Some risk, for what its worth, exists in the developing countries where sanitation is poor and endemicity of many communicable diseases are high at normal times. A severe malaria epidemic occured after Hurricane Flora in Haiti in 1964, mainly caused by the multiplication of breeding places for mosquitoes in the damaged area. Thus overcrowding and breakdown of fragile sanitation systems can provoke epidemics in the developing countries. An epidemic of leptospirosis was reported in Recife Brazil after floods in 1978 (de Oliviera, 1977). However, they are fairly unimportant in scope. More serious of course are those brought by famine, sich as cholera epdimec Somalia in 1985 and meningitis in Ethiopia earlier. Usually, however, disasters do not generate 'new' diseases unless brought in by migrating populations as in famines.

A regional variation in diseases similiar to that seen between developed and developing countries is noted within a developing country. The infection of a cholera epidemic in Bangladesh was found to be correlated to education and income. The poorer sections of the affected region used canal water for drinking and washing purposes and were of lower physical resistance. The incidence rate of the disease per 1000 families with no schooling was 16.3 vis-a-vis 8.2 among families with at least one high school graduate,(Levine et al, 1976). In famines, the synergy between malnutrition and infectious diseases give it a altogether different dimension as compared to others. Communicable and nutritional deficiency diseases in famine disaster are , in fact, the principal manifestation of the event.

4.0. LONG TERM IMPACT OF NATURAL DISASTERS :

The long term impact of disasters, possibly the most pervasive and destructive phase, expresses itself variously. Disaster induced death and disability of an earning member of a family, implies a lifetime loss of revenue and subsequent destitution. A study by Karakos et al (1983) found, after the earthquake of 1980 in Thessaloniki, among all the families with at least one death, 50% of the households affected, lost their only working member and thus experienced a direct decrease in income. In developing countries, where the informal sector is an important source of revenue for large proportion of the population and social security is less developed, such loss can be fatal to the surviving members of the family.

In flooding disasters, saltwater contamination of subsistance and marginal farmers indicate not one but several harvests lost. For nutritionally and economically fragile populations, this means a rise in mortality as a secondary effect of the disaster. Similiarly, death of breeding stock of herdsmen, loss of capital or tools of trade due to water damage, cyclones or earthquakes, effectively destroy the means of livelihood of these families.

Finally, death of mothers have a devastating effect on small children, raising the morbidity rates among them at secondary and tertiary levels.(Patil, B.R. 1984)

5.0 SUMMARY AND CONCLUSION :

In conclusion, the perspective from which natural disasters have been traditionally viewed, as that of urgent action involving medical specialists in helicopters, assorted volunteers, drugs and medicines, needs to be reworked. The horizons of disaster relief and rehabilitation need to tbe broadened, in terms of building up the resistance levels of the communities themseves to future disasters. Evidently, preexisting health and socio-economic conditions play a highly decisive rôle in determining the extent and type of impact caused by the disaster. There remain two important, even crucial gaps in general disaster management; one, the lack of standardisation and reporting of the cause of death, injury and other related morbidity after disasters; and two, the lack of evaluating and incorporating the enormous long-term damage in the disaster needs assessment reports. These two areas remain the most serious negligences in effective disaster relief and mitigation programme policy.

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