BASICS of DISASTER MEDICINE

Definition

Classification

1 simple ↔ compound
2 man-made ↔ God-made
3 duration of cause
4 radius of impact area
5 number of victims (N)
6 severity factor (S)
7 rescue, primary treatment and transport time

Scoring

disaster severity scale

Discussion

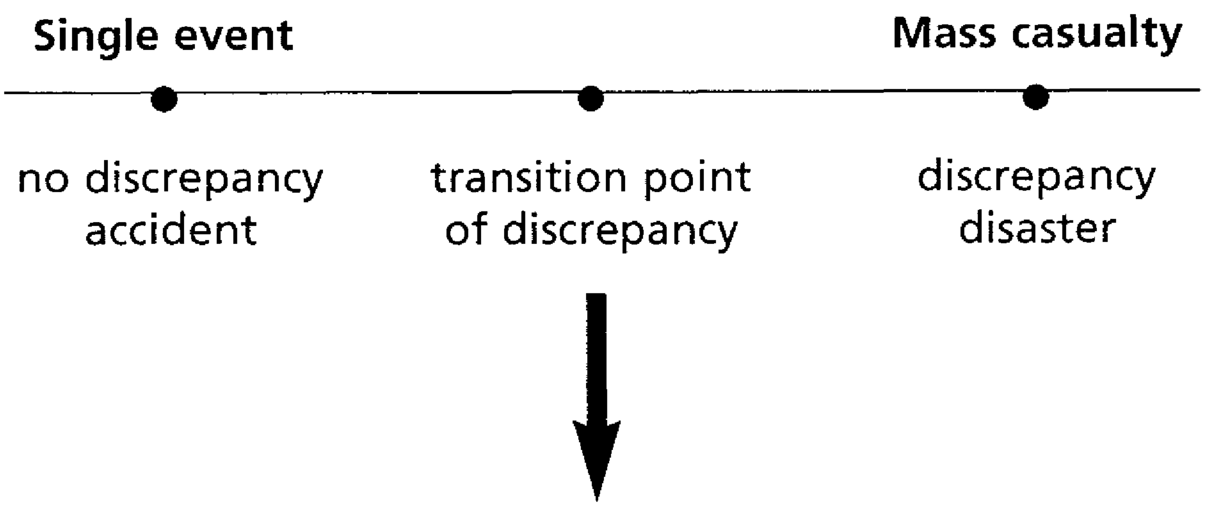
Disaster medicine studies the medical and organization problems of disasters. It is a young branch of medicine and confusion still occurs because people use terms in different ways. The foundation of any science is definition, classification and measurement, and if disaster medicine is to grow and progress, it also must have a consistent and recognized definition, classification, and measurement of disasters. By using the criteria "casualties" and "discrepancy between number and treatment capacity" a simple definition of a disaster has been formulated. The classification scheme is based on variables, which are directly related to disaster, either to its origin or to its effect. By quantifying or weighing these variables and summing the individual scores, a disaster severity scale can be constructed, which runs from 1 to 13. This approach could provide a firm foundation for the science of disaster medicine, on which basis further development can be confidently expected.

In the event of general international agreement on the definition, the classification, and the associated Disaster Severity Scale, it should be possible to assess more accurately the gravity of a given situation. However, the publication of exact figures exposes cooperating countries to the possibility of criticism. For this reason, there may be initial resistance on the part of certain countries to joining such a registry scheme. This reservation should be overcome if exact disaster registration is to be established. Additionally, more precise registration would allow scientific comparison of disasters and perhaps also provide an answer to the question of whether the incidence of disaster occurence is increasing with the growing world population and technology.

A limitation of the practical use of this scoring system is that it can only be applied retrospectively. For this reason the medical severity index had been introduced and will be discussed in the next chapter. This index not only indicates the breaking point between accident and disaster, but also quantifies the medical severity instantaneously.

THE MEDICAL SEVERITY INDEX OF DISASTERS*

* ADAPTED FROM AN ARTICLE IN THE JOURNAL OF EMERGENCY MEDICINE (1989)



Directly proportional to:	number of casualties and average severity of injuries	(N) (S)
Inversely proportional to:	treatment capacity in the chain of medical care	(C)

In 1980 an international working party postulated a definition for a disaster. Later de Boer and Rutherford utilized this concept and created a classification and scoring system. A limitation of the practical use of this system was that it could only be applied retrospectively to the comparison of different events. It was therefore decided to modify this system in a way that would make it of use during the management stage, while a disaster was still actually in process. According to Brismar the definition was modified, and on the basis of the number of casualties and the severity of injuries sustained, a medical severity index was created.

In this way an instant score could be obtained in order to calculate the response required by the medical emergency services. In the following the methodology is explained.

METHODOLOGY

From a medical point of view a disaster can be defined as a destructive event that causes so many casualties that a discrepancy occurs between their number and treatment capacity.

Considering this definition, the parameters needed to quantify a disaster are the casualty load (number of casualties), the severity of incident (severity of injuries sustained), and the capacity of the medical services.

ESTIMATING NUMBERS OF DISASTER VICTIMS

Basic figures for contingency planning

IMMOVABLES			RANGE[1]
Residential area[2]	Per hectare	Low-Rise Buildings	20-50
		High-Rise Buildings	50-200
Business area	Per hectare		0-800
Industrial area	Per hectare		0-200
Leisure area	Per type	Stadium	-[7]
		Discotheque	-
		Camping-site	-
Shops	Per type	Department store	-[7]
		Arcade	-

MOBILE OBJECTS			RANGE[1]
Road transport	Per 100 M (length)[3a]	Multiple collision	5-50
	Per type[3b]	Coach	10-100
Rail transport[4]	Per type	Single deck	5-400
		Double deck	10-800
Air transport[5]	Per type	Small	10-30
		Large	150-500
Inland Shipping[6]	Per type	Ferry	10-1000
		Cruise ship	200-300

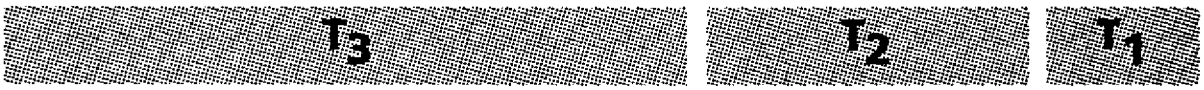
1 depends on date, time and other local circumstances.
2 combination of number of residents per house (1.8-2.8) and number of houses per hectare (30-70).
3a per car: lenght 5m and 1.5-3 passengers (see 1).
3b (articulated) local bus or (articulated) double-deckerbus.
4 carriages of 3 or 4 wagons (see also 1).
5 seat occupancy 70%.
6 seat occupancy 80%.
7 awaiting further research.

CASUALTY LOAD (N)

When the ambulance control receives the first notification, it may be difficult to make anything but the most tentative guess at the number of casualties to expect. In minor to moderate disasters such as transport accidents, the size of the coach or train as well as the type of accident (e.g., head-on collision of train, of coach or derailment) may give an upper limit of casualties. The original estimate by a member of the public who reports always tends to be overestimated (Rutherford's Rule). The dispatcher will respond by sending some ambulances to the site and will then receive a revised estimate from someone inside the system. While this figure often has to be modified later as casualties start being identified, sorted, and transported, it is good enough for the first calculation, and can be designated as N. The controller should then attempt to keep track of the numbers of casualties being cleared from the site. In major disasters like earthquakes, early reports describe a single fragment of a much larger situation and tend to be underestimated (Rutherford's Rule). Therefore it is necessary to send a mobile (preferably airborne) medical unit to survey the whole stricken area and assess the magnitude and nature of damage, the number of casualties, and their location. Subsequent estimates made at intervals of 1 hour, 2 hours, 3 hours, etc., are to be designated as N1, N2, N3, etc. These estimates should than fit in the ranges as provided by empirically determined tables. These estimates are based on Rutherford's Rule. For further reading see one of the next chapters.

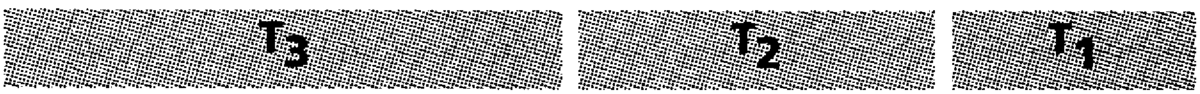
$$S = \frac{T_1 + T_2}{T_3}$$

S = 0 - 1 many slightly injured



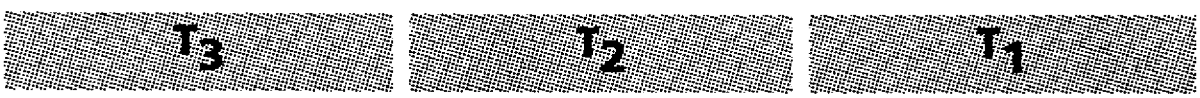
$T_3 > T_1 + T_2$ civil disturbance, hurricane

S = 1.0 "normal"



$T_3 \sim T_1 + T_2$ traffic accidents

S = 1 - 2 many severely wounded



$T_3 < T_1 + T_2$ fires, explosions

← total number of victims →

Theoretically S varies between O and ∞
Practically S varies between 0.5 and 2.0

SEVERITY OF INCIDENT (S)

The severity of incident may be represented by the symbol S. Although alternative methods of classification of injured are possible, casualties can be divided, from a medico-organizational point of view, into 4 categories: 4-dead and the dead-on-arrival (DOA); 1-life threatening cases demanding immediate attention; 2-non-life-threatening cases requiring hospital treatment; 3-casualties not necessarily requiring hospitalization but rather less demanding single point care.

Since category 1 and 2 casualties are those who need medical attention by professionals, those who have to be transported to hospitals by ambulances, and those who have to be admitted to hospitals, they form the crucial group-crucial because any delay in treatment result in more dead and dead-on-arrival, while the condition of the remaining injured deteriorates.

It is known that in most fires and explosions, categories 1 and 2 comprise more than 50% of the total number of casualties, while civil disturbances, on the other hand, usually result in many slightly wounded and a few heavily wounded.

Therefore, it would seem that deviation to either side of seriousness occurs depending on the type of disaster and possibly some other factors, like population at risk, site where the disaster took place, and the time of occurence. Thus S is expressed as $\frac{T1 + T2}{T3}$

If many seriously wounded casualties (categories 1 and 2) are to be expected, S is scored between 1.0 and 2.0. If only many slightly injured are to be foreseen S is scored between 0.0 and 1.0. Some disasters usually result in a figure between these extremes, and therefore S can be indicated as around 1.0. This forms the basis for scoring the medical severity of the incident.

In the chapter on Epidemiology the results of an analysis of more than 400 disasters is shown.

The Medical Rescue Capacity (MCR):

the number of victims that could receive Basic or Advanced Life Support per hour;

The Medical Transport Capacity (MTC):

the number of victims that could be transported to hospitals per hour;

The Hospital Treatment Capacity (HTC);

the number of victims that could be treated in a hospital per hour.

The lowest capacity in the chain of medical care determines the capacity of the whole chain.

The total capacity TC is determined by the number of hours the lowest capacity in the chain can proceed.

Capacity of Medical Services

Progressive medical care of disaster casualties is a concept of aid appropriate to the needs of the individual at any given time, beginning at the disaster site and continuing through the transportation and distribution phase to the period of the definitive therapy in hospital. Thus, the capacity of medical services is divided into three phases. Medical care at the site, or medical rescue capacity (MRC), depends on the amount of professional medical help at the site and can be expressed as the number of T1 and T2 victims which can be treated per hour by experienced doctors, nurses, and paramedics plus material and equipment available at the disaster site. The doctors, nurses, and paramedics usually work as a team, and the team is assisted by first aiders. It is assumed that a team, comprising a surgeon, an anaesthesiologist, and two nursing staff can deal with 8 casualties categories 1 and 2 per hour, provided again they are afforded the support of personnel and equipment. Under abnormal conditions, say difficult terrain or bad weather this number will be fewer than 8. Medical transport and distribution of casualties, categories 1 and 2, to and among hospitals, or the medical transport capacity (MTC) depends on the number of ambulances with drivers, the ease of evacuation, and a patient distribution scheme. Such a scheme is based on the capacities of the surrounding hospitals and their special expertise, like neurosurgery and cardiovascular surgery. This MTC can also be expressed in number, for which a formula is introduced recently. Medical treatment in the hospital, or the hospital treatment capacity (HTC) depends on the total number of surgeons, anesthesiologists, operating rooms, intensive care beds, residents, and the like. The HTC refers to the number of casualties (categories 1 and 2) that can be treated according to normal medical standards in one hour. If the disaster takes place at night or on the weekend, the HTC will be lower than the HTC during the morning of a weekday. As a rough figure, obtained empirically through many exercises held at hospitals of different sizes, a HTC for general hospitals can be estimated as 3% of the total number of beds.

$$\frac{N \times S}{TC}$$

$N \times S < TC$ accident

$N \times S > TC$ disaster

Category 3 casualties frequently consult their local or private doctor or are spontaneously transported to the nearest hospital by private cars. Thus the nearest hospital to the disaster site is often overloaded with category 3 casualties and should preferably be excluded from category 1 and 2 casualties.

All the capacities mentioned are based on a "normal" situation of roads, weather, and working hours. If the terrain is difficult, the weather is bad, or if the disaster takes place at night or on a holiday or weekend, then the capacities are lower than under "normal" conditions. If, on the other hand, the roads are perfect, the weather is bright, and the disaster takes place on a weekday, out of season, and in the morning, the capacities are higher than under "normal" conditions. The capacities are expressed per unit of time, that is, per hour.

Under disaster conditions, doctors, nurses, ambulance drivers, first aiders, and others can probably work efficiently for 8 hours at the most. Again this is an assumption, because after 8 hours of hard work by all personnel, fatigue and lack of material most likely will decrease the HTC considerably. Therefore, the capacities should be multiplied by 8 in order to obtain the total capacity (TC) of the medical services for a realistic period of time. Following a few hours of rest and the provision of new stocks the capacities could increase again. For calculation purposes, however, this unit (TC) is probably the best one to use.

In order to avoid stagnation during this chain of events, synchronization of MRC, MTC, and HTC is imperative, which implies that these capacities should be equal to one another.

One could have a situation with a large HTC but a small MTC, then the small MTC is determining the proper functioning of progressive medical care. Thus the lowest capacity determines the capacity of the whole chain.

For further reading see also the appropriate chapters.

A Retrospective Study of a Number of Calamities[a]

	N	S	TC[b] district/region	N x S / TC	
1973 Harfsen (car traffic)	20	1.0	24	20x1 / 24	= 0.8
1972 Prinsenbeek (car traffic)	30	1.0	65	30x1 / 65	= 0.4
1962 Harmelen (railway accident)	150	1.5	90	150x1.5 / 90	= 2.5
1975 Beek (explosion/fire)	90	1.5	200	90x1.5 / 200	= 0.6
1978 San Carlos (explosion/fire)	150	1.5	30	150x1.5 / 30	= 7.5
1977 Tenerife (air traffic acc.)	500	1.5	100	500x1.5 / 100	= 7.4
1953 Netherlands (floods)	1850	1.5	540	1850x1.5 / 540	= 5.0
1976 Guatamala (earthquake)	100.000	1.5	1000	100.000x1.5 / 1000	=150

a) As can be seen, the traffic accidents in Harfsen and Prinsenbeek and the explosion/fire in Beek cannot be considered as a disaster according to the criteria used.

b) Rough estimates.

N.B.: At the time this table was produced (1989) the S-factor has not yet been verified, as shown in the next chapter (1997).

Medical Severity Index

Once the casualty load (N), the severity of incident (S), and the total capacity (TC), of the medical services (MRC, MTC, and HTC) are quantified, the medical severity index $\frac{(N \times S)}{TC}$

can be defined. If N x S exceeds the local, total capacity of medical services (medical severity index > 1), problems will arise, and the calamity is called a disaster. This can be illustrated by the following example. A heavy explosion in a chemical plant occurs at night in a remote area during bad weather with an expected number (N) of categories 1 and 2 casualties of 230. Explosions usually give rise to many heavily wounded, therefore S will be scored as 1.5.

If three hospitals are located in this area, with 90, 140 and 180 beds, respectively, then the HTC altogether amounts to 12 (3% of (90 + 140 + 180)). For an 8-hour period the total capacity TC will be 96 (8 x 12). Because of the abnormal situation of roads, weather, and nighttime, fewer than 96 casualties can be dealt with, say 85. Thus, $\frac{N \times S}{TC} = \frac{230 \times 1.5}{85} = \frac{345}{85} = 4$

which is larger than 1, so the county cannot cope with this calamity, and assistance of neighbouring counties is necessary. Therefore, this calamity is called a disaster. By applying this model retrospectively to a number of calamities that occurred in the last decades, the methodology was tested as shown in the table. The total capacities applied are only rough estimates, since accurate figures of the number of beds, surgeons, anesthesiologists, and so forth are difficult to obtain, but approximate the kind of information that would be available in the midst of a crisis situation. As can be seen from this table, not all calamities could be classified as disaster because N x S did not exceed the total capacity of the medical services in these particular districts, regions, or counties.

MSI could be applied:

1. for the disaster itself
2. for estimating the medical requirements in the disaster preparedness phase

Discussion

The proposed methodology will be of practical importance when handling disaster situations. When a dispatcher at the fire station, the police station, or the central ambulance post, receives a call reporting a calamity, it is most often possible to estimate the number of casualties by utilizing a few key questions. With experience and a knowlegde of the local situation the dispatcher can make a rough estimate of N, S, and TC and calculate the medical severity index. Thus the methodology offers the dispatcher a rapid instrument to estimate if a calamity should be called a disaster or not, that is to say, if the total local medical capacity will be sufficient or not to cope with the casualty load and severity of incident. The number of trauma teams and stand-by ambulances as well as the treatment capacity of surrounding hospitals should be well-known figures. All these factors must be updated periodically in order to keep MRC, MTC, and HTC synchronized. In this way the chain of progressive medical care from disaster site to hospital can be streamlined. For example the centralization of emergency medical care by closing down smaller emergency departments (increasing the distance to hospitals and thereby reducing the MTC) has to be counteracted, for example, by creating an ambulance helicopter service. Otherwise there will be an imbalance between the three links in the chain of capacities. In the same way, the need for trauma teams can be expressed in order to increase the MRC. Thus, in different ways, synchronization of the three links in the chain of capacities could be obtained. The methodology described could be of importance, not only for the disaster situation itself, but also in the disaster preparedness phase for estimating the requirements needed to produce a desirable capacity within the various links in the chain of progressive medical care from the disaster site to the hospital.

EVALUATION OF DISASTERS*

* ADAPTED FROM AN ARTICLE IN THE
EUROPEAN JOURNAL OF EMERGENCY MEDICINE (1997)

Classification and Scoring

Classification	Grade	Score
effect on infrastructure (impact site + filter area)	simple	1
	compound	2
man-made versus God made	man-made	0
	God-made	1
impact time	< 1 hrs	0
	1-24 hrs	1
	> 24 hrs	2
radius of impact site	< 1 km	0
	1-10 km	1
	> 10 km	2
number of casualties (N) (dead and wounded)	< 100	0
	100-1000	1
	> 1000	2
average severity of injuries sustained (S)*	< 1	0
	1-2	1
	> 2	2
rescue time (rescue + first aid + transport)	< 6 hrs	0
	6-24 hrs	1
	> 24 hrs	2
Total	**DSS**	**1-13**

$$*S = \frac{T_1 + T_2}{T_3}$$

Introduction

Since the number of particularly man-made disasters is rising significantly epidemiologic research is imperative. Epidemiologic research however of disasters is hampered by a lack of uniformity and standardization of describing these events. Recently, however, a definition, classification and scoring system, with an emphasis on the medical aspects, became available. This system could be utilized as a tool for evaluating disasters. First of all the event should be caracterized as a disaster by applying the two criteria : are there victims and is there a discrepancy between number and medical treatment capacity of these victims? Than a classification, utilizing seven parameters, is imposed. These parameters are: the effect on the infrastructure in the disaster area, man-made versus God-made, the impact time, the radius of impact site, the number of casualties, the average severity of the injuries sustained by the living victims and the rescuetime. These parameters are shown in detail in the table.

By attributing to the indvidual classification a grade 0, 1 or 2, the score itself increasing with gravity, duration, size, number or intensity, a figure is obtained which is the sum of the variously accorded scores and which lies between 1 and 13. The scale is called the Disaster Severity Scale (DSS).

With the aid of this methodology epidemiologic research might be feasible, while certain aspects of disasters can be compared to one another.

This chapter describes the attempts to evaluate some hundreds of disasters, again with an emphasis on the medical aspect. Only in this way could the methodology be tested. Some minor modifications are proposed for reasons of simplicity.

MAN-MADE		p	q
traffic	air	51	7
	road	6	4
	train	21	5
	sea	11	2
explosions		19	5
terrorism		121	19
fires		20	4
riots		62	5
panic		7	1
chemical		15	3
nuclear		2	2
TOTALS		**335**	**57**

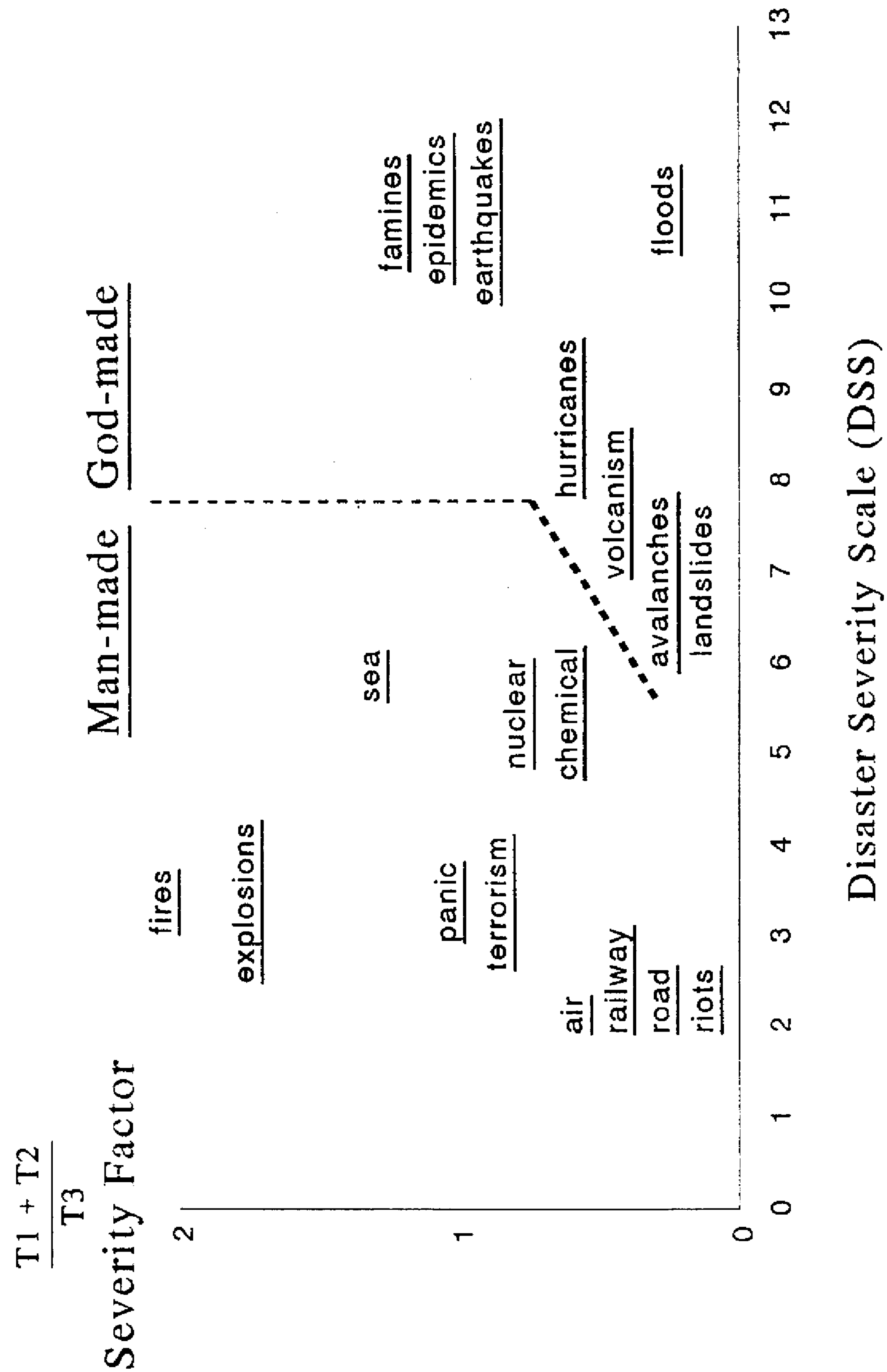
GOD-MADE	p	q
earthquakes	31	7
floods	15	3
hurricanes	14	5
volcanism	4	1
avalanches/landslides	8	2
famines	3	1
epidemics	6	3
TOTALS	**81**	**22**

p: number of references
q: number of useful references

Material and Methods

In a previous paper a definition, classification and scoring system for disasters has been described. By applying this methodology, an analysis could be performed of more than 400 disasters, which occurred in the last 40 years. The necessary data were obtained from the literature and from historical yearbooks. The disasters were divided grossly into naturally-occuring and man-made ones. A further division was made into various types as shown in the table.
Not all parameters necessary to perform the scoring for the Disaster Severity Scale could be traced in the literature references. In these cases as many additional literaturereferences as possible were acquired in order to complete the classification and scoring. When this was at all impossible the disaster was eliminated as such.

In order to obtain a reliable measure of the average severity of the injuries sustained the severity factor S was utilized expressing the ratio between T1 + T2 and T3 victims or those victims who were hospitalized and the non-hospitalized ones. Particularly, the search of this S factor was difficult to perform and as a consequence the majority of references could not be used for a reliable scoring. Only a minority of references resulted in a sufficient number of each type of disaster from which some preliminary results could be obtained.



DSS versus S for man-made and God-made disasters.

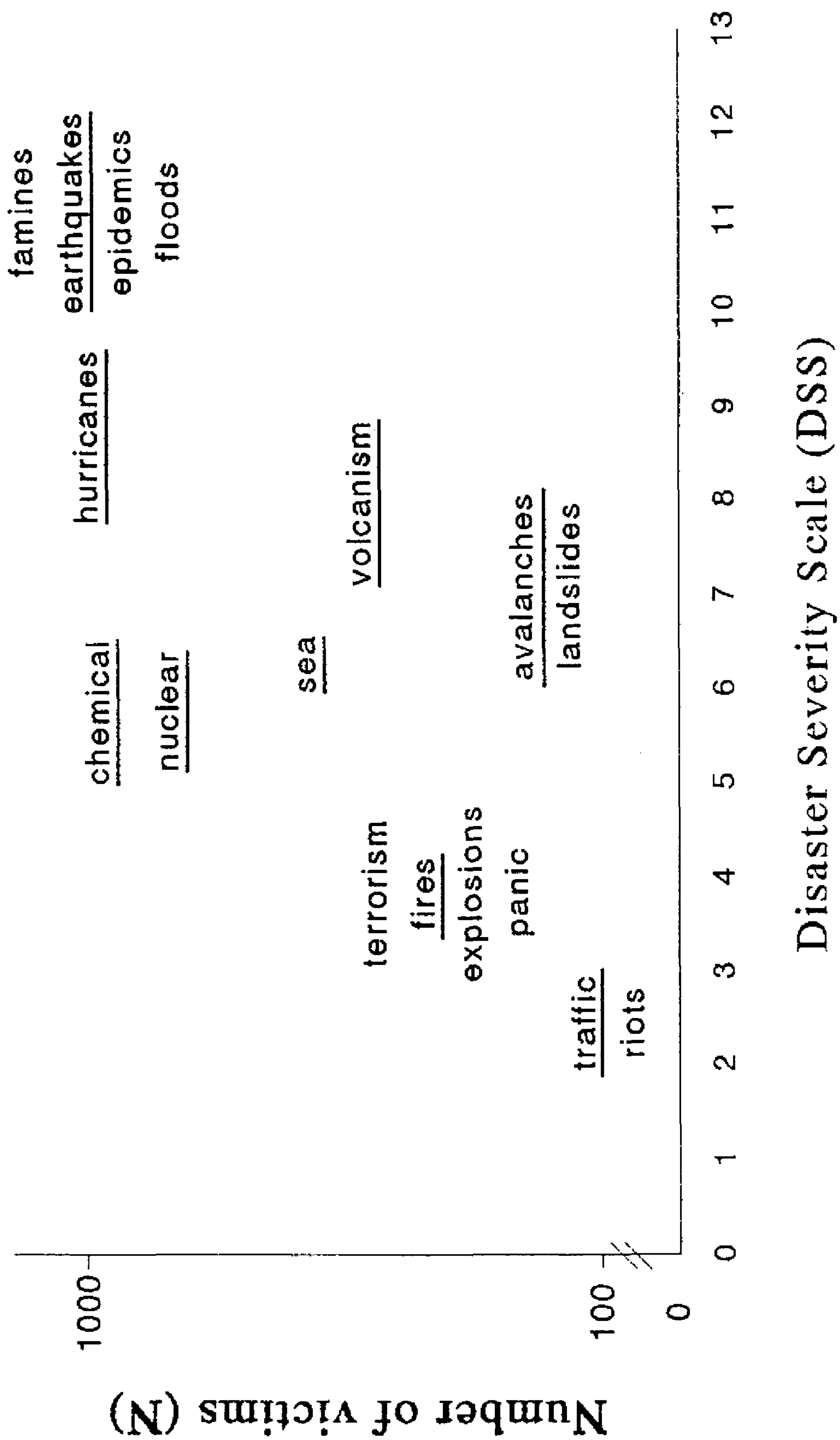
RESULTS

As shown in the table 57 out of 335 references were useful for determining the disaster severity scale for man-made and 22 out of 81 references for God-made disasters.
Since the number of each type of disaster was too small for most types to perform any statistical analysis, the man-made and God-made disasters were clustered and compared. However, aircrashes, terrorism, riots and earthquakes provided enough numbers to perform an individual analysis.
Furthermore, the disaster severity scale of the usefull references were plotted against the severity factor S, which is the ratio between the hospitalized and non-hospitalized casualties. This was also done against the number of victims, dead and injured (N). Both graphs are shown.

SOME EXAMPLES MAY ILLUSTRATE IN DETAIL THE METHODOLOGY UTILISED.

The air crash of a cargoplane on an appartmentbuilding in the outskirts of Amsterdam on a sundaynight (1992) did not affect the infrastructure (1), was a man-made disaster (0), the time while the crash was operating was very short (0), the radius of the area where victims were located, was small (0) the number of victims dead and alive was set at 65 (0), the severity of the injuries sustained or T1 + T2 versus T3 amounted to (1) and the time for medical rescue operations took less than a day (1). This disaster was therefore scaled as 3.

The hurricane which hit the island of St. Maarten in the Carebean (1995) took place on wednesday and did affect the infrastructure (2), was a natural disaster (1). The impact-time took many hours (1), the radius of the area where victims were located was several kilometers (1), the number of victims, a few dead, many slightly wounded and some severely injured was set for some hundreds (1) and therefore the ratio T1 + T2 versus T3 amounted to (0), while the medical rescue time took more than a day (2).
This disaster was scaled as 8.



DSS versus N for man-made and God-made disasters.

Conclusions and discussion

Disasters have always frightened people, on the other hand they have intrigued them too. Each disaster yealded dozens of stories, the majority of which described the horrors only.

In 1983 a definition and classification was proposed and in 1990 a scoring system for disasters was added to it, which could be utilized to standardize the description of these events. And this in turn could lead to epidemiologic studies. This paper is an attempt to study the usefulness of this system as a tool for evaluating disasters. From the references traced only a minority could be used to obtain the necessary parameters to produce a scale. For hurricanes, terrorism and aircrashes data were found in some excellent review articles, which could either confirm or readjust the findings.

For each type of disaster a range on the Disaster Severity Scale was determined. In other words types of disaster are clustered in such a way that man-made disasters are varying between 1 and 6, while God-made disasters are scaled between 6 and 13 on the disaster severity scale.

Also, the same types of disasters were related to the severity factor S, which is the ratio between the hospitalized and non-hopitalized victims. As can be seen from the figure fires and explosions give rise to many seriously wounded victims who need hospitalization. On the other hand riots, avalanches/landslides, floods and to a lesser extent also traffic result in many slightly wounded as compared to those who have to be hospitalized. Finally, the same types of disaster were related to the number of victims, dead and wounded, N. As shown in the figure the

CLASSIFICATION	GRADE	SCORE
effect on infrastructure (impact site + filter area)	Simple Compound	1 2
impact time	< 1 hrs 1-24 hrs > 24 hrs	0 1 2
radius of impact site	< 1 km 1-10 km > 10 km	0 1 2
number of dead	< 100 > 100	0 1
number of injured (N)	< 100 100-1000 > 1000	0 1 2
average severity of injuries sustained (S)*	< 1 1-2 > 2	0 1 2
rescue time (rescue + first aid + transport)	< 6 hrs 6-24 hrs > 24 hrs	0 1 2
Total	**DSS**	**1-13**

$$*S = \frac{T_1 + T_2}{T_3}$$

highest numbers were seen in famines, earthquakes, epidemics, hurricanes and floods; the lowest in traffic accidents (road, train, and air) and riots.
The problem encountered in analyzing the useful references was the lack of standardization in the description of victims: number of dead, of seriously wounded and hospitalized, of the non-hospitalized wounded and of the non-wounded.

Nevertheless, the useful references showed at least the possibility to obtain in an standardized way a score of the disaster. Most types of disaster could thus be scaled by applying the classification scheme as proposed in 1990. During this investigation, however, it became clear that the parameters "effect on infrastructure" and "man-made versus God-made" are identical, because naturally occurring disasters are so severe that they always lead to a compound effect on infrastructure. Moreover, a separate parameter "number of dead" should be introduced, since a number of disasters only lead to dead without wounded.
Therefore, a slight modification of the classification scheme is proposed by deleting "man-made versus God-made", introducing "number of dead", and changing "the number of victims" into "number of injured". The number of dead should then be graded $<100=0$; and $>100=1$. In this way, the scale itself still runs from 1 to 13. The proposed classification is shown in the table. Utilizing this modified classification and scoring system did not alter the results very much.

FIRST ACTS AT THE DISASTER SITE

for doctors, nurses and paramedics

A C T T T !

ANTICIPATION

measures to be taken in order to protect

↓
- yourself
- others
- victims

CONTROL

S U R V E Y
- nature
- size
- victims

A L A R M

P A N I C   C O N T R O L

Doctors, nurses and paramedics are educated and trained to help any patient in need. However, should they be involved in a mass casualty situation the approach is different; because of scarcety in personnel, material and methods. This implies that priorities should be set in order to save as many lives as possible under these circumstances.

The first act, therefore, is the anticipation of escalation. This is achieved by taking those measures to protect yourself first (a dead doctor, nurse or paramedic is of no use!) than others and finally the victims. This means that a certain switch has to be taken in the minds of these people, whose attitude towards the individual patient is purely altruistic. Being confronted with a mass casualty situation, doctors, nurses and paramedics, are inclined to approach the first screeming victim they encounter. Under these circumstances, however, this is a blunder!

Following anticipation some control measures must be taken. First of all a survey of the situation: the nature, extent and estimate of the number of victims. Secondly, this information should reach the "outside world" as quickly and as reliable as possible. Thirdly, panic should be prevented at all cost.

AIRWAY
BREATHING — VITAL FUNCTIONS
CIRCULATION

CONCIOUSNESS
HEMORRHAGES
WOUNDS

FRACTURES
BURNS
HYPOTHERMIA

↓

TRIAGE

trier = french for sorting

= **classification of casualties according to the injuries sustained.**

T1
ABC instability
immediate life support
(urgent hospital treatment)

T2
ABC stable
to be treated within 4-6 hours,
otherwise ABC instability
First-aid measures
Hospital admission

T3
ABC stable
minor injuries, not threatened by ABC instability
Can be treated by general practitioners

The next act at the disaster site for the first arriving doctor, nurse or paramedic should then be a so called sweeping triage: a quick round in order to locate those who are in urgent medical need. Following this sweeping triage, either a second round should be made, or first-aid measures should be given to those who have been classified as T1. This decision depends on the availability of more doctors, nurses and paramedics rushing in at the scene of disaster. When they are available in the meantime, the first should continue their/his/her triage, while others perform first-aid. If not available the first should start provisional treatment of the T1 victims.

It is likely that a severely injured victim (T1) will not screem or holler, while T2 and T3 victims will draw anyone's attention, especially from the rescuers. Non-wounded relatives of slightly hurt victims will do the same. It is a well-known experience that those relatives are sometimes capable of forcing ambulance crew to drive a T3 victim to hospital. There are also stories of ambulances being hijacked by them.

Triage itself is a very difficult medical process, even a well experienced surgeon-traumatologist could have difficulties with it; not only emotional, but also technical and managerial aspects will continiously influence the decision-making process of triage.

This repeated process in the chain of medical care should be a uniform one: from the disaster site to the hospital bed.

An example of such a triage methodology, which can be applied for mechanical (including thermal) and chemical types of injury and which can be utilized in the entire chain of medical care, is shown here.

The only critirion being used is time: T1 victims with disturbances of vital functions need medical help within one hour, the so called golden hour, otherwise the whole T1 group will be eliminated within a couple of hours. T2 victims need first-aid measures at the site with subsequent treatment in hospital, preferably not exceeding more than 4-6 hours otherwise complications are introduced which are irreversible. For further reading see the appropriate chapter.

FIRST-AID MEASURES

- Positioning: prone, supine + legs-up, stable side position, sitting and Trendelenburg
- elimination airway obstruction
- cardio-pulmonary resuscitation
- hemorrhage control
- wound care
- fracture immobilisation
- psychological approach

The next act is a first-aid treatment, which must be provided in an orderly manner. Without any supportive means, like drips, tubes, ventilators or medicines much can be done if properly trained.

Firstly, the victims should be positioned in an appropriate way, whereby the stable side position is meant for unconcious patients in order to prevent aspiration when vomiting. The sitting position is particularly relevent for thoracic injuries, while the supine position with the legs up could be utilized for victims with shock. The latter, however, should be done with caution, since this may lead to adverse effects. Drowning cases have to be positioned in a Trendelenburg manner when feasible. Following the positioning the first-aid measures proper are to be taken.

Without any supportive means certain measures can still be taken, like elimination of airway obstruction, where a proper positioning may improve already patient's condition. Whether or not cardio-pulmonary resuscitation has to be applied depends on the availability of medical personnel. In a mass-casualty situation with a shortage of medical personnel cardio-pulmonary resuscitation is time consuming and should therefore be left-out. On the other hand, hemorrhage control with the application of pressure by any means on the right place is simple and can be done quickly. The same holds for wound care and fracture immobilization. All these techniques are described extensively in first-aid manuals and will not be discussed any further.

- carrying techniques
- transport by ambulance, car, heli, airplane, train, ship
- immobilisation of drips
patient
fractures
- pain relief
- psychological approach

A C T T T

The final act now is transportation of the victim from the site to any musterpoint, where ambulances are able to load them. Certain carrying techniques by one, two or more persons, with or without the use of strechers, have to be utilized before the victim can be transported by other means, like ambulances, cars, helicopters, planes, trains or ships. These techniques are usually also described in first-aid manuals. Transporting patients means the immobilization of drips, fractures, and even the patient himself. Of course pain relief is of importance, particularly when long distances have to be covered in which case long-acting analgesics should be administered. The administration of these drugs, however, is contraindicated in the presence of head, chest and abdominal injuries, leaving only serious injuries of the extremities as indication for their use. Last but not least a proper psychological approach of the victim is of paramount importance