MEDICAL TEAMS
purpose, structure and function

PURPOSE

Complicated accidents;

Specific accidents or disasters, (chemical, nuclear, fires and ferries);

Man-made disasters;

Naturally-occuring disasters

STRUCTURE

A-team: physician and/or nurse;

B-, C-, N- and H-team: medical specialists, specialized nurse and specialized technician;

D-team: two specialists (e.g. surgeon and anaesthesiologist) and two specialized nurses;

I-team: various medical specialists, physicians, nurses and auxiliaries.

A well functioning disaster organization affords the wounded a greater chance of survival. The availability of medical teams adds to the efficiency of such an organization. Experience gained in recent wars, in which the mortality rate among wounded fell markedly with the establishment of such field teams, bears this out.

Actual and imaginary situations in which such a team can be vital:

1. - Train disasters and multiple crashes generally involve trapped victims. Such casualties require optimal support since their extraction from the wreckage with the equipment available may take considerable time.
   - Disasters occuring on difficult terrain with consequent delay of the rescue operations.
   - Certain weather conditions such as ice and snow can delay considerably the recovery and transport by ambulances of casualties.
   - Widespread calamity - large numbers of casualties spread over a large area may cause an immediate shortage of ambulances necessitating drawing on the reserves of more distant regions, with further delays as a consequence.
   - Anticipated disasters, such as hijackings and the holding hostage of large numbers of persons (D-team).

Apart altogether from the above mentioned indications, a team may also be in a position to lend invaluable assistence in the following circumstances:

2. - When the situation at the disaster site is adequately catered for, this disaster team might well be directed to the nearest hospital in order to step up the so called "treatment capacity". Experience from recent wars and disasters indicated that the mortality among the injured increases by 1-3% per hour of delay in instituting surgical intervention. In order to reduce the surgical time lag the team should form a complete operating team in that hospital with a view to increasing capacity; after all, the capacity for mechanical injuries is dependant on the the surgical, anaesthetic, medical and nursing personel available (D-team).
3. - Such teams should exist also for availability in emergencies of an international nature, provided these teams could reach the disaster spot within a reasonable time (I-teams).
4. - On the other hand, accidents or so called single event situations necessitate also the availability of teams. Such complicated accidents, where casualties are trapped, e.q. in a carwreck, building trend or elevatorshaft, require a doctor and/or nurse only (A-team).

FUNCTION

alerting procedure

directly: from accident/disaster site to team
or
indirectly: via any central or regional office

phased: in one or preferably two steps

material support

carried by the team itself
or
obtained by a rendez-vous system

transportation

private car (with police escort)

fire engine

police car - for local deployment

ambulance

helicopter for regional deployment

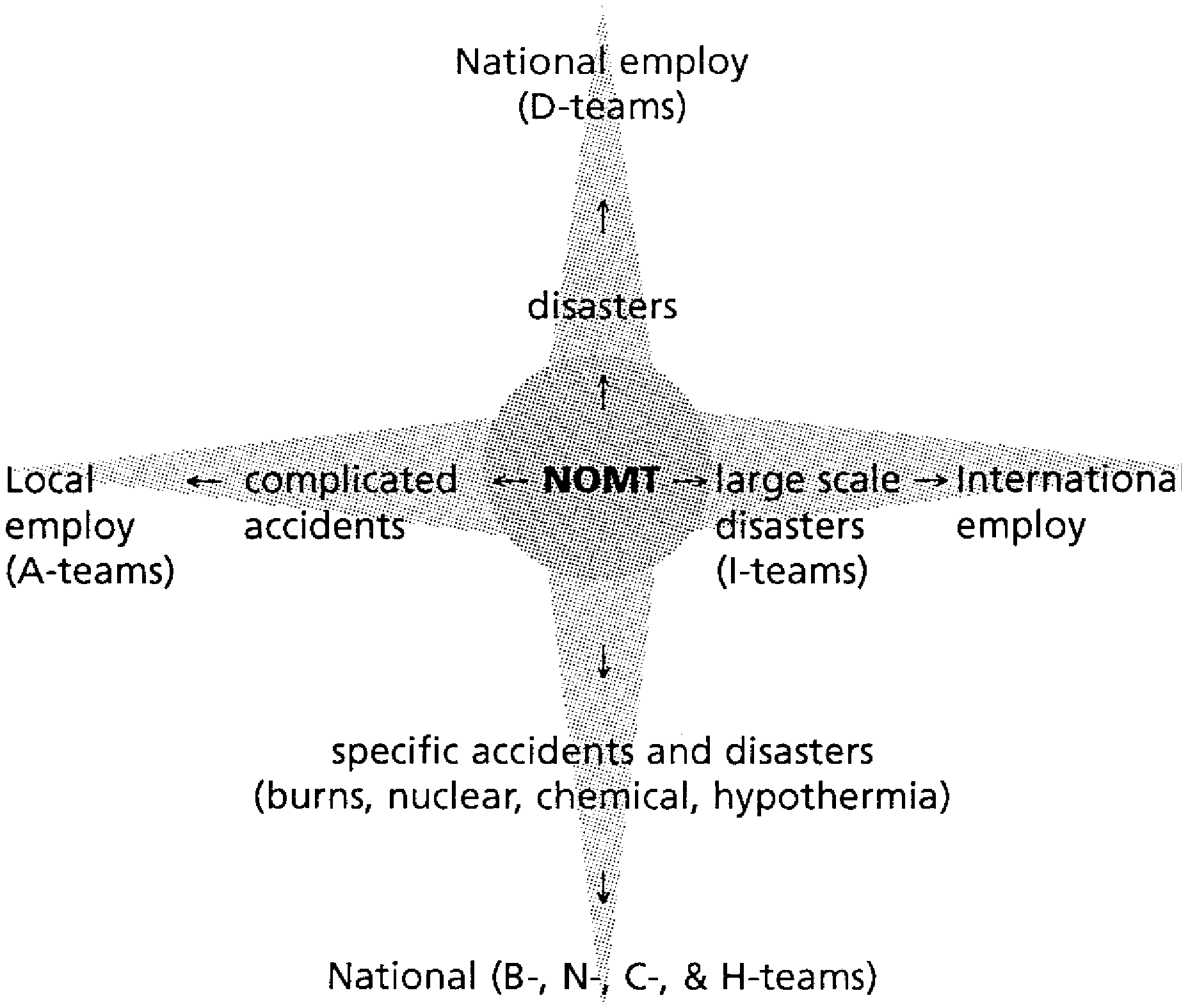
plane for international deployment

5. - For specific disasters, e.g. chemical and nuclear, specialized teams could be employed. The same holds for disasters with many burned patients or hypothermic casualties. These so called C-, N-, B- and H-teams are of a more advisory nature as compared to the other teams.
6. - Especially in the case of greater calamities such field teams are in a position to furnish expert and detailed information regarding the wounded and the nature of their injuries to surrounding hospitals and other instances concerned with the welfare of casualties.
7. - Moreover, a disaster always presents the opportunity for further criticism of the existing organization and its technical resources, as well as affording to the chance to conduct research into aspects of disaster medicine.

The composition of medical teams varies with its purpose: complicated accidents require a doctor and/or nurse only (A-teams), naturally-occurring disasters require larger teams (I-teams), including doctors, specialists and nurses, while specific disaster necessitate the utilization of specialists and specialized nurses.
As far as the composition of disaster teams is concerned, the aim should be that of an operation-room team comprising as a minimum a surgeon or experienced surgical resident, an anaesthesiologist or experienced resident, a trained theatre sister, and an experienced casualty sister. It should be possible to implement this permanent surgical/anaesthetic establishment with, for example, internal physicians, chest physicians and psychiatrists. It is important that such a four or five man team should be able to travel in one car or any other vehicle.
Ideally, the provision of such teams would be the responsibility of clinics entrusted with specialist training, each of these clinics participating in a duty roster. The only obligation would be that of quaranteeing the availability of a field team at the time indicated of the roster. For this purpose, the country should be divided into a number of regions, each with its own academic unit. This infers that one hospital in each region is on call at the time stipulated on a previously agreed duty list. Obviously, the greater the number of teams at disposal, the less frequent the necessity to be on call.

From an organizational point of view the simplest way to form a team is to enlist the duty surgeon or surgical resident, the duty anaesthesiologist or resident, and the duty theatre and casualty sister. Most hospitals with a teaching commitment also have a second-on-call roster. In the event of the team being called out their duties can be assumed by the reserves.

NATIONAL ORGANIZATION OF MEDICAL TEAMS



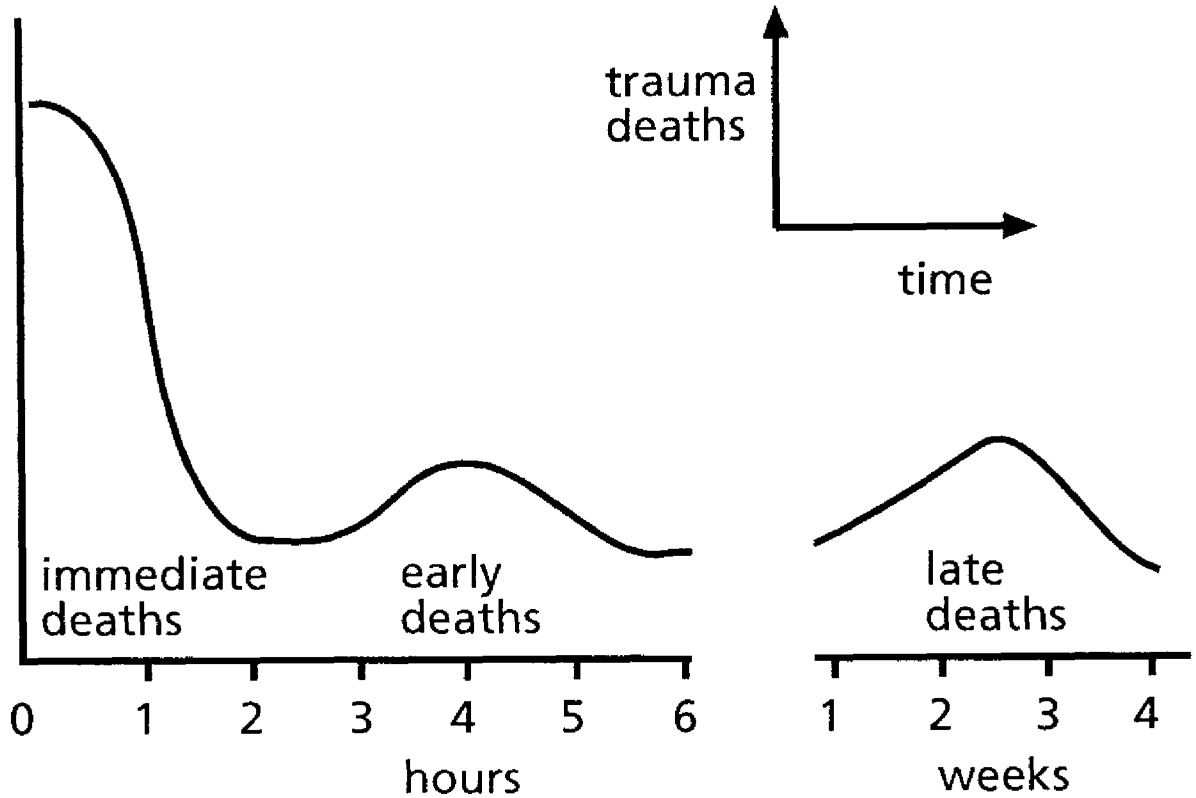
It is desirable that the hospital be alerted from a central office. This central office is also responsible for drawing up the duty rosters. The process of raising the alarm should be phased in order to obviate the unnecessary calling out of personnel who are not needed.
On receipt of the alarm the team is mobilized and preferably sets out in a private car under police escort. Helicopter transport is less attractive than it at first might appear: firstly, because few hospitals can boast of a heliport, and secondly, since the 24 hours standby of a helicopter is difficult to realize.

On arrival at the disaster or accident area priority assistance is offered to triage I casualties with respiratory and/or circulatory problems. Of course, the support of trapped victims also begins right away.
Apparatus and equipment, together with their transport to the site, are the responsibility of the central office mentioned. The need for withdrawal of resources from surrounding hospitals is thus obviated.
Emergency surgery on the site or at a nearby hospital calls for the instrumentation, drugs, disinfectants, bandages, anaesthetic apparatus and accessories, linen, emergency lighting, stretchers, and a host of other provisions according to a previously drawn up list. Additionally, it is recommended that one or more ambulances be designated and equipped as a first-aid post on the (disaster) site. Together with the above mobile equipment, these ambulances make up an ideal hospital unit.

The leader of the team, in addition to his funtion as a member, is charged with relaying information to the surrounding hospitals and supervising the conduct of casualties and helpers alike.
When the disaster or accident area has been cleared, the team could withdraw to any neighbouring hospital requiring assistence. In any case, it is desirable that a team which has been working for 12 hours should be relieved by a second group. Such a succeeding team might well come from a different region.
Finally, it is desirable that the proper agencies clarify the legal position of members of such a team, whether medical of nursing.

TRIAGE AND THE 1- AND 6- HOURS PERIOD FOLLOWING A DISASTER*

* ADAPTED FROM AN ARTICLE IN THE DUTCH TIJDSCHRIFT VOOR TRAUMATOLOGIE (1995)



Trimodal distribution of deaths
as a result of mechanical injuries

It is unknown whether or not deaths from other causes of injuries follow this pattern.

From the well known curve of Trunkey, the trimodel distribution of trauma-deaths, related to time, it appeared that the first peak represents people who die soon after injury. This "immediate deaths" group, amounting to 50 % of all traumadeaths, is caused by lacerations of the brain, the brain stem, the spinal cord, the heart or one of the major vessels.
Virtually none of these patients could be saved, even under the most favourable medical conditions.
The second peak, characterized as "early deaths", represents people who die within the first few hours after injury, usually due to major internal hemorrhages in one of the bodies' cavities, head, thoracic and abdominal cavity. Almost all injuries of this type are considered treatable by currently available medical procedures applied within one hour, the "golden hour", following injury.
These procedures should preferably be initiated at the accident site already and comprise basic and advanced (trauma) life support.
The third peak of so called "late deaths" corresponds to victims who die days or weeks after sustaining injury, usually due to multiple organ failure or infection caused by insufficient medical treatment. The second and third peak of trauma deaths - comprising around 50% of all deaths - could thus be prevented by proper prehospital and hospital treatment as soon as possible. The trimodal curve of Trunky is based on almost 2000 deaths caused by mechanical traumata. Whether deaths caused by chemical or thermal traumata follow the same curve is unknown.

Type of injury	mechanical/thermal
	chemical
	nuclear
	biological

The majority of disaster *types* leads to mechanical injuries, who may require surgical intervention.

TYPE OF INJURY

In this respect injuries can be of various origin:

mechanical leading to wounds, fractures, dislocations, hemorrhages (internal and external), lacerations, concussions and organ damages.

thermal high temperatures:
burns in various grades, varying from simple hyperaemia to complete charring;

low temperatures:
leading to hypothermia, starting with mild through moderate and finally deep hypothermia ($\leq$30°C);

chemical resulting in simple irritations of mucous membranes (nose, eyes, mouth and throat) to systemic effects in various organs; like lungs and central nervous system;

nuclear causing radiation injuries, either external, resembling burns, or internal by inhalation or ingestion of radioactive material with immediate, prolonged or late systemic effects;

biological either by infectious diseases, caused by pathogen micro-organisms, or by malnutrition as a result of deficient alimentations.

Triage

mechanical, thermal and chemical injuries

T1 ABC unstable victims due to obstruction of airway (A) or disturbance of breathing (B) or circulation (C). Immediate life support and urgent hospital admission.

T2 ABC stable victims to be treated within 4-6 hours, otherwise they will become unstable. First-aid measures and hospital admission.

T3 ABC stable victims with minor injuries not threatened by instability. Can be treated by general practitioners.

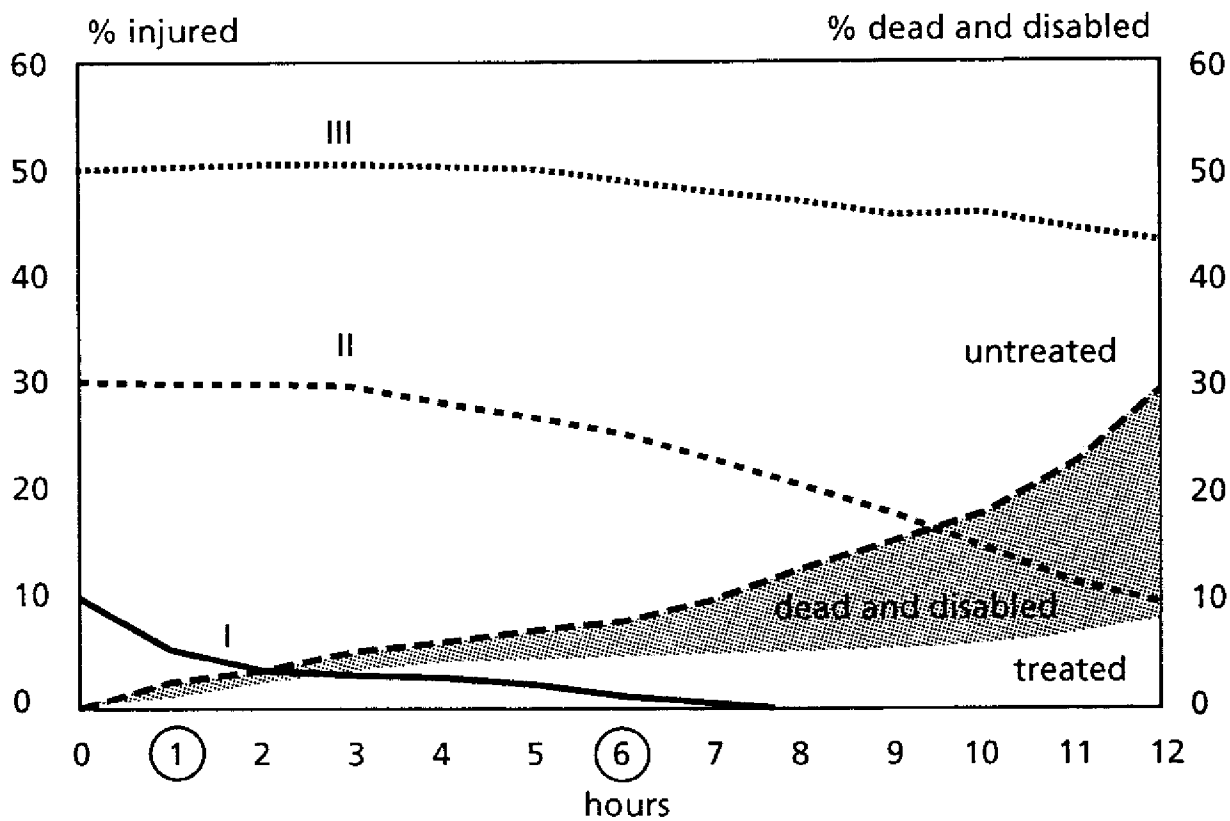
T4 ABC unstable victims who cannot be treated under the circumstances given.
This classification should be performed by experienced medical personnel!

TRIAGE

During the Napoleontic wars warsurgery was introduced and the sorting of casualties became common practice. In French "trier" means sorting and triage therefore stands for sorting-out or the classification of, in this case, the wounded.
As a general rule the treatment of casualties in disaster situations had to be carried out under conditions of scarcity - scarcity of manpower, materials and time. Therefore, optimal use of all available resources is essential.
In assessing individuals for appropriate classification, the nature, extent and severity of the injury, the urgency of treatment, and the existence of co-existing lesions should all be taken into consideration. In any case classification should meet the following requirements:
a. it should be to the benefit of the victim,
b. it should fit into the existing disaster organization.

As described in the chapter "an introduction to disaster medicine", triage can be defined as the classification or sorting of victims according to the injuries sustained. As can be seen from the above list the sorting of victims in a mass casualty situation should be ideal when one uniform methodology could be utilised, which however is not (yet) available.
So far, only for so called mechanical, thermal and chemical lesions a uniform methodology has been introduced, which is based on the condition of the vital functions, ventilation and circulation. These functions are in fact the representatives of the state of body health. When disturbances of vital functions feature this state of body health following a mechanical, thermal or chemical injury, the prognosis is poor. An example of an uniform and standardazid triage system for victims with mechanical, thermal and chemical lesions, which was introduced in 1987 in The Netherlands, is shown.
In view of the fact that the condition of a given patient is subject to alteration or deterioration it is of the utmost importance that classification of the injured be subjected to continuous reassessment. The danger lies in the fact that a score, once determined, is not subjected to reappraisal.
The uniform character of the triage described renders possible classification according to a number of factors including the urgency of treatment, transportability and prognosis, bearing always in mind that reassessment is essential, especially when the delay time is prolonged.

Injuries and Time

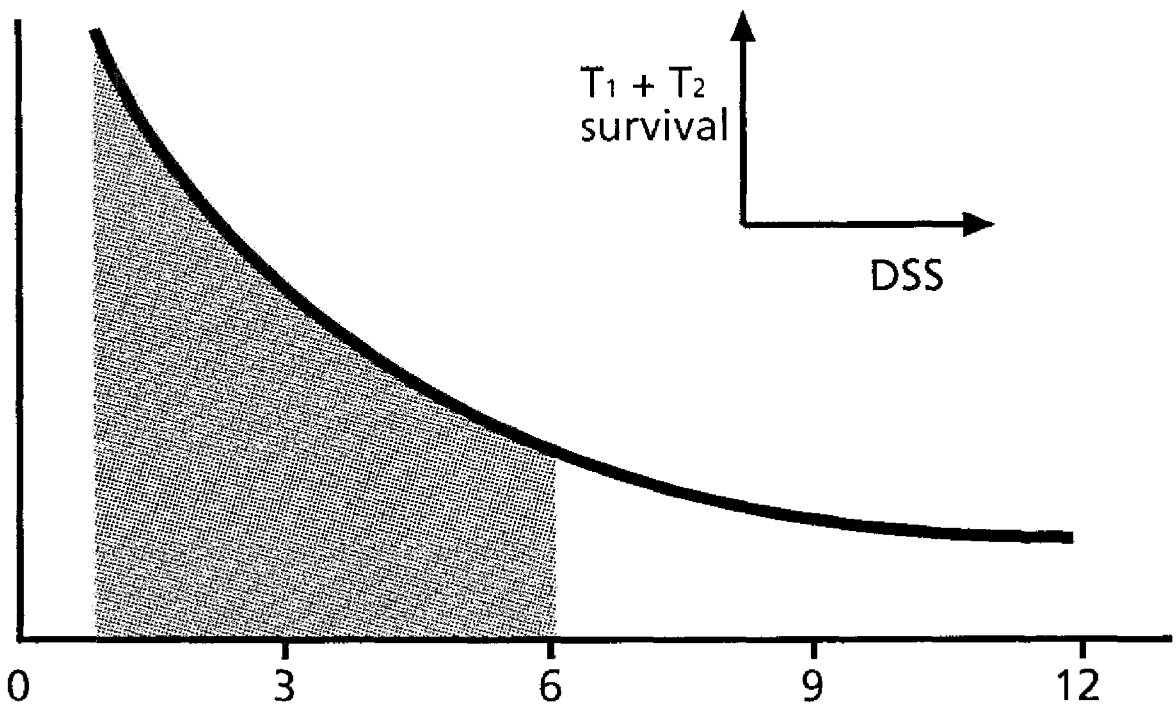


Relations between time and number of injured or dead (and disabled) in %

Triage, the golden hour and Friedrich's time

Those victims showing disturbances of vital funtions, usually expressed as A (airway), B (breathing) and C (circulation) instability, are classified or sorted as priority 1 or triage 1 (T1) patients. Within this T1 group there is a certain variation possible and therefore this group can be subdivided - if some time is available - into subgroups with the aid of the so called revised trauma score (RTS). The subgroup with the least chances of survival, under the given circumstances, should be addressed as T4. Unless certain life-saving measures could be installed within the shortest possible time, mortality, morbidity an disability is increased considerably in this group. This period should not exceed 1 hour and is therefore called the "golden hour", a well-known concept in traumatology and emergency medicine.
A substantial number of victims is moderately injured; in other words those patients who could develop disturbances of vital functions or could develop infections. Untreated fractures or organ damages are continuously seeping blood, while open wounds can be contaminated with microorganisms.
These victims may therefore develop a state of shock (=disturbance of circulation) and insufficient breathing (= disturbance of ventilation). From surgical experience this group of mechanically wounded victims should preferably be treated within 4-6 hours after injury. This so called "Friedrich's time" should not be exceeded, otherwise, as mentioned, disturbances of vital functions may develop resulting in a considerable increase of mortality, morbidity and disability. This group of initially, moderately injured victims may become ABC instable within 4-6 hours and are classified as T2.

Another substantial number of victims is only slightly injured and even under the most unfavourable circumstances they will not develop disturbances of vital functions. This group is classified as T3. Therefore, in a so called " mass casualty situation", victims of mechanical, thermal or chemical violence can be classified or sorted, apart from the deaths, as T1, T2, T3 and T4 and should be treated accordingly.



The higher a disaster on the Disaster Severity Scale (DSS) the less $T_1 + T_2$ survivals!

This implicates a different medico-organizational approach of disasters scaled, say 6 and lower as compared to disasters scaled 6 and higher.

In a mass casualty situation the least mortality, morbidity and disability can be obtained by providing the T1 victims basic and advanced (trauma) life support within 1 hour and the T2 victims those first-aid measures within 4-6 hours so that worsening of their condition can be prevented. Cumulative calculations show a considerable increase in mortality, morbidity and disability of up to 30%, if T1 and T2 victims are untreated for 12 hours. When T1 victims are stabilized within 1 hour and T2 victims receive adequate first-aid measures within 4-6 hours, mortality, morbidity an disability can be kept as low as 5%-10%.

Also the T3 victims should receive medical attention, however profit can be achieved only in morbidity and disability and not in mortality. It is thus clear that (medical) rescue should focus its attention, in the first hour after a disaster has occurred, to T1 victims and in the following hours to T2 victims and meanwhile directing T3 victims towards medical provisions further away. This, of course, holds for the smaller type of disasters, say DSS ≤6, however, disasters of a higher magnitude will show a different pattern. In a disaster situation when the stricken area is large and/or the rescue procedures will be timeconsuming, the golden hour and Friedrich's time will be exceeded by many hours, resulting in a high mortality as mentioned before. Meanwhile, however a number of T2 victims has become T1 and will die ultimately, until only the T3 group will remain and perhaps some borderline T2/T3 victims. It is unknown, however, how long it will take until the total T1 and T2 group will be extinguished completely. Among others, this will be determined by the type of injury, average age, underlying diseases and external circumstances, like temperature.

RUTHERFORD'S RULE*

and estimating numbers of disaster victims

* ADAPTED FROM AN ARTICLE IN ISDM-PROCEEDINGS (1995)

A reliable estimation of the number of casualties is of paramount importance in disaster management!

Rutherford's Rule

	Man-made	→	overestimated	
disaster				number of casualties
	God-made	→	underestimated	

It was William Rutherford, a surgeon from Belfast, who pointed out his experience that in man-made disasters the numbers of casualties were always exaggerated, while naturally occurring disasters usually provided figures, which were initially too low. In a series of disaster in 1994 and 1995 this observation was confirmed.

In honour to this true pionier in disaster medicine this general experience should be named after him. Thus, according to Rutherford's rule, the number of victims of so-called man-made disasters is always overestimated, while numbers are underestimated in God-made disasters. Recent examples are the cargo plane crash in the Bijlmermeer, at the outskirts of Amsterdam, and the earthquake at Kobe in Japan, respectively. Exceptions to this rule are cases in which there is a known number of victims, such as in ferryboat disasters and passenger plane crashes.

Estimating the number of disaster victims is never an easy task, however a more accurate approach to this issue is an essential part of contingency planning, for the following reasons:

- an underestimation of numbers could result in too little emergency aid, which policymakers would certainly not wish to have on their conscience;
- an overestimation, however, means an unnecessary deployment of people and material;
- too many aid workers obstruct operations on the site itself, not only by their physical presence but also by the surplus of material they have with them;
- although it cannot be proven, it may be said that the presence of too many aidworkers is as detrimental as too few.

Aside from these arguments, which are related to repressive contingency planning, in the preparatory stage an accurate estimation of the number of victims is clearly going to be advantageous, as it allows for structural preparation and drills facilitating full utilization of the entire chain of medical care, and guaranteeing continuous transportation of the injured - from rescue at the disaster area itself to the hospital bed.

ESTIMATING NUMBERS OF DISASTER VICTIMS

Basic figures for contingency planning

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

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

The importance of creating order in chaos, i.e. a disaster, is gaining increasing recognition. Mathematical models of disasters not only provide methods of gaining further insight into the processes inherent to disasters, but also provides instruments with which to control these processes. One of the necessary parameters is a general estimation of the numbers of victims and, in particular, the number of injured for hospitalization. The word 'injured' has been chosen to include victims of chemical,nuclear or biological disasters and not only mechanical disasters.

A more accurate estimation of numbers of victims constitutes the basis of calculations toward establishing the capacity of the entire chain of medical care. Capacity is determined by the quality of the aid workers, their material and methods, while they, in turn, are dependent on the nature of the injuries, as mentioned above: usually unknown variables, awaiting a great deal of research.
The table attempts to show as accurately as possible the number of victims using various base figures of minimum and maximum numbers. The following examples serve to illustrate this table. Of course, the figures in the table vary from country to country and perhaps also even from region to region; however, this table may serve as an example of how to produce these data.

Each country, region, city or district may produce tables of occupancy for mobile and immobile objects. Based on Rutherfords' Rule these tables can provide more accurate estimates of the number of victims (N).

This is of paramount importance,
not only in the repressive,
but also in the preparedness phase of disaster!

Example 1*

Take a multiple collision of 150 metres long at peak hour on a national trunk road. In this example, the maximum number of victims, both dead and injured is 90, that is 150 metres divided by the length of a car (5 meters), multiplied by the number of lanes, multiplied by 1.5, the average seat occupancy per car during peak hours.

It may be assumed that of these ninety people, 5-10 will be dead and that there will be 30-35 seriously (10%) and moderately (20%) wounded, who need to be hospitalized. The 40-60 other people involved will be either slightly wounded or not wounded at all. Supposing that those slightly wounded do not need ambulance transportation we may assume that 15-20 ambulances are required for hospitalization of those more seriously wounded within a clearance time of one hour.

Example 2*

Take the derailment of a double-decker train -3 carriages- on Sunday morning. Since the Dutch Railways refuse to publish seat occupancy figures we can only make a rough estimate of a few dozen victims. Probably half of those need to be hospitalized by means of 6-9 ambulances within a clearance time of one hour.

Example 3*

Take a plane crash on a block of flats in the Amsterdam Bijlmermeer on Sunday evening. It soon becomes apparent that the plane involved is a cargo plane and that 40 apartments have been destroyed. According to the table, apartments in the Netherlands are occupied by an average of 2.2 people, which, in this particular disaster, would mean a total number of 88 victims. The majority of these victims, say 80%, will be fatally injured due to the gigantic impact of the crash, as well as the fire. The expected number of wounded is 20 and these will be either seriously or moderately wounded and need to be hospitalized. Since the victims will be difficult to extricate the clearance time will be 4 hours at least, which means that no more than a few ambulances are required. (However, 72 ambulances actually turned up!)

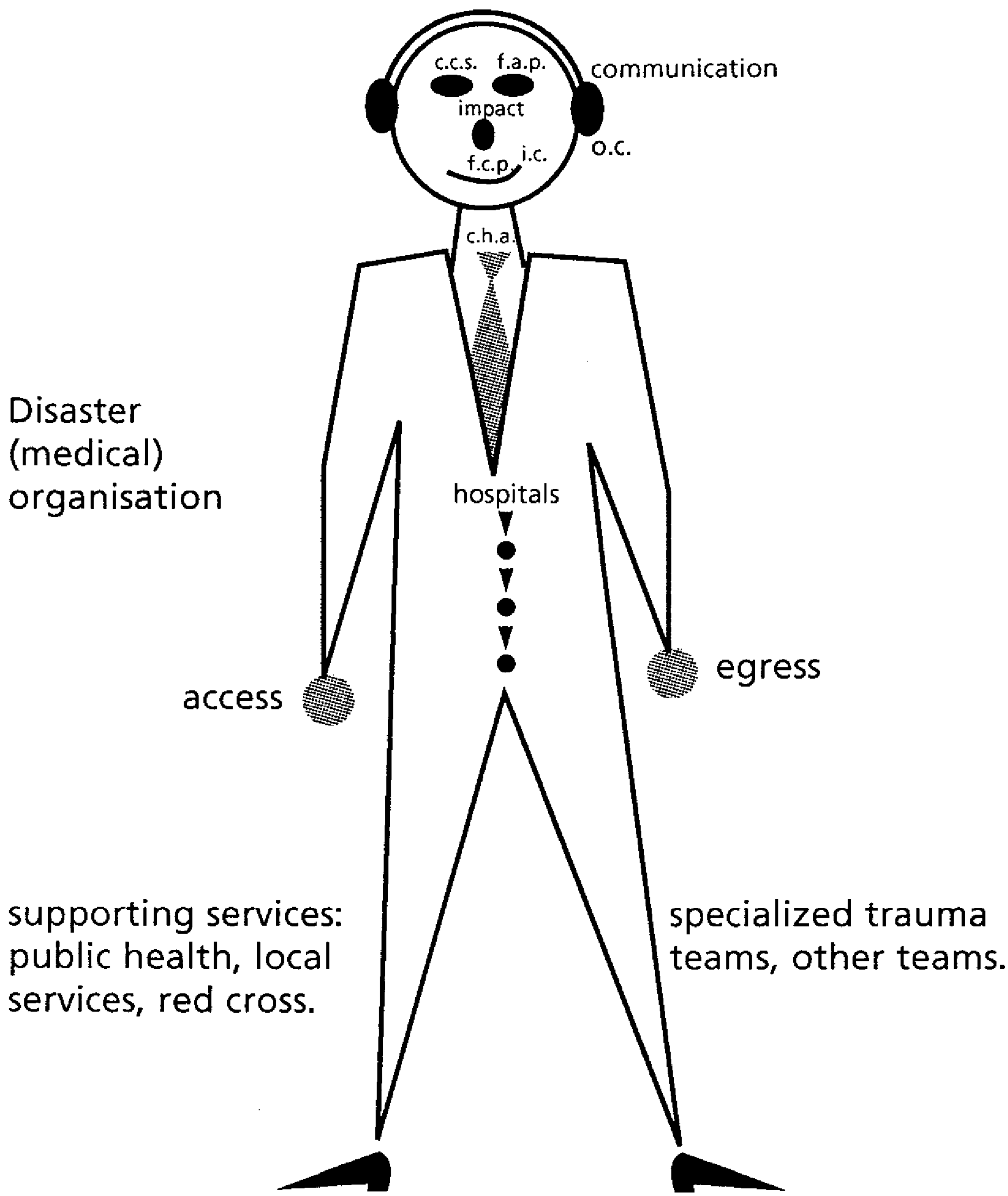
* For calculations see appropriate chapters.

THE CHAIN OF MEDICAL CARE*

and its capacities

* ADAPTED FROM AN ARTICLE IN THE DUTCH TIJDSCHRIFT SPOEDEISENDE EN RAMPENGENEESKUNDE (1994)

f.c.p. = forward control point
i.c.. = inner cordon
o.c. = outer cordon
c.h.a. = central holding area for ambulances
c.c.s. = casualty clearing station for T1 and T2 victims
f.a.p. = first-aid post for T3 victims



The aid chain of medical care refers to the medical and nursing care of casualties at every stage from the scene of the disaster to their admission to hospital. The chain has two sub-chains: one for the deceased, which is of relevance for the Victim Identification Team, and one for ambulatory patients not requiring hospital treatment, who should be referred to GPs.

Organisationally, this chain of medical care can be divided into three more or less self-contained links:

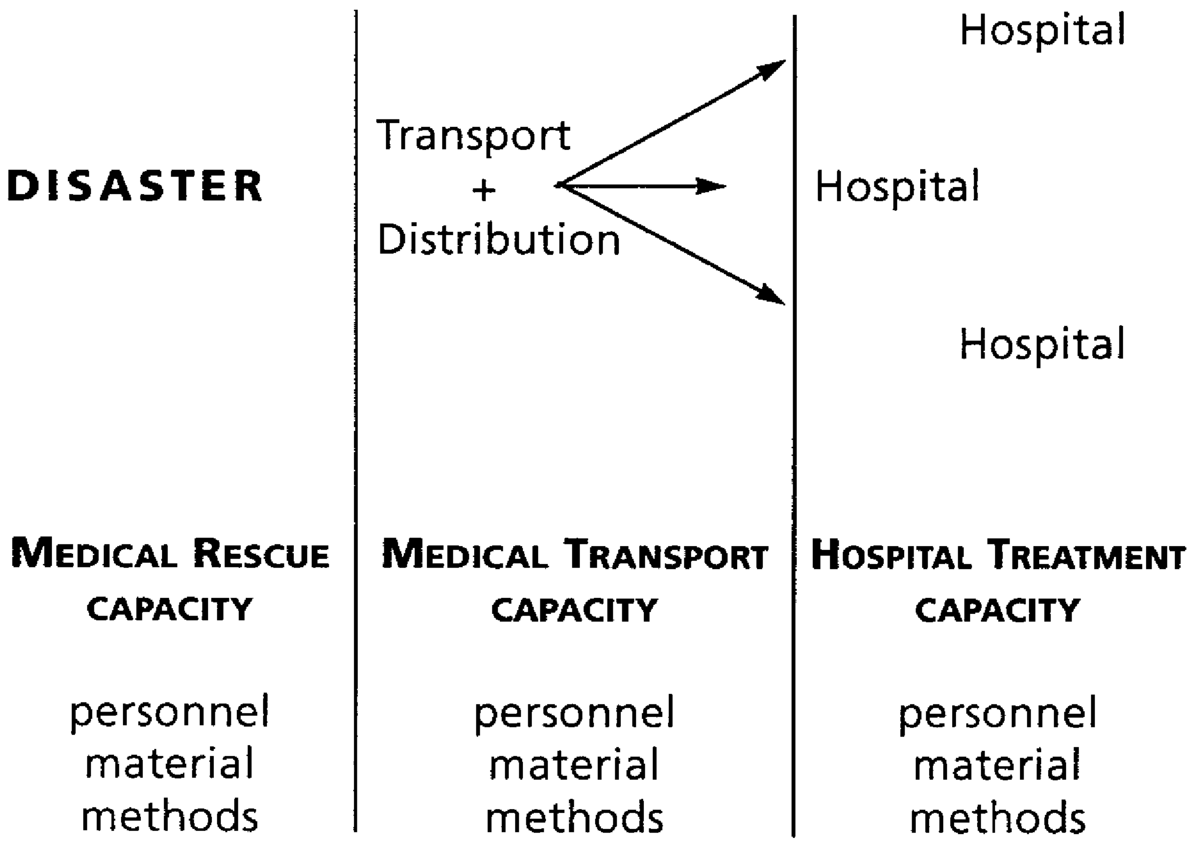
1) Medical organisation at the scene of the disaster;
2) Transport and distribution of casualties to the various hospitals;
3) Organisational procedures in hospital.

Re 1

The scene of the disaster and the immediate surrounding area is characterised by an impact area, i.e. the place where the actual disaster occurred, a filter area, through which organised and non-organised aid is channelled, and beyond this, an organised community aid area where the provision of primary aid is organised.

The police should close the impact area by means of an inner cordon. At the edge of the impact area the first ambulances to arrive should establish a forward control point to function as a first command, communication and coordination point. At suitable points nearby the impact a casualty clearing station for T1 and T2 victims and a first-aid post for T3 victims should be established. Around these an outer cordon should be laid. At the edge of this outer cordon a central holding area for ambulances is positioned. The area in between the two cordons is than the filter area as mentioned. In the organized community aid area, outside the outer cordon, the hospitals are situated and access and egress to and from the disaster area take place.

As a rule, primary aid is provided by local services such as the police, fire brigade, public health including, ambulance service, doctors and nurses (working either as individuals or in teams) and, usually at a later stage, the Red Cross or any other specialized service. If the disaster extends beyond the municipal boundary, the regional services will lend assistance. If it extends beyond the regional boundary, the point at which provincial and then national services are called in is very soon reached.


DISASTER
Transport
+
Distribution
Hospital
Hospital
Hospital
MEDICAL RESCUE CAPACITY
personnel
material
methods
MEDICAL TRANSPORT CAPACITY
personnel
material
methods
HOSPITAL TREATMENT CAPACITY
personnel
material
methods

It will be clear that, from the organisational viewpoint, things must run smoothly to enable all the medical and non-medical activities in the disaster area to be carried out in an orderly fashion. Every public health service or specialized other services responsible for providing medical assistance in such a situation must have a disaster relief plan.

Re 2
The transportation and distribution of casualties to the various hospitals, which will usually be located in the surrounding area, is the second self-contained link in the chain. In the event of emergencies, these tasks are the responsibility of the Central Ambulance Post (CAP). In a disaster a CAP will put two plans into operation: one for allocating casualties to the various hospitals according to their treatment capacity (the casualty allocation plan) and one for obtaining assistance from other ambulance posts nearby (the ambulance assistance plan).

When disasters occur, the Red Cross or any other organisation also has a role to play by providing its own vehicles for transporting casualties. These are usually somewhat more basic than the CAP ambulances.

Re 3
Organisational arrangements in hospitals are a complex business. Broadly speaking, each specialism has its own procedures. The daily "supply" of patients gives the overall picture. Admissions may reach peak levels at certain times but these peaks are never as extreme as in a disaster situation. When a disaster occurs, the arrival of large numbers of casualties will disrupt normal organisational procedures to the extent that chaos will result unless a contingency plan can immediately be put into effect. A plan of this kind is characterised by an alert and preparation phase. If it is properly implemented and exercised, large numbers of casualties can be handled in ten to twenty minutes.

MRC depends on

- Types of injury - mechanical
  - chemical
  - nuclear
  - biological
- $S = \frac{T_1 + T_2}{T_3}$
- Number of doctors, nurses and paramedics and their education and training
- Essential supplies

MTC depends on

- Number of ambulances
- Clearance time
- Accomodation per ambulance
- Distance & speed

HTC depends on

- Types of injury (see MRC)
- Number of essential specialists and nurses and their training in disaster procedures
- Utilities and supplies.

The capacities in the chain of medical care

Medical rescue capacity (MRC)

Since the T1+ T2 / T3 ratio is known for the various types of disasters resulting in various types of injuries, the MRC can be estimated (see chapter on Evaluation of disasters).
Also, the MRC with and without education and training of personnel is known; the same holds for doctors and nurses alone or as teams.
As a result of this, the demand of supplies is also known!

For futher reading see the next chapter.

Medical transport capacity (MTC)

In a mass casualty situation the number of ambulances needed (X) is directly proportional to the number of victims to be transported (N) and to the transport time (t) and inversely proportional to the number of victims per ambulance (n) and to the required clearing-time of the disaster site (T).

For further reading see one of the next chapters.

Hospital treatment capacity (HTC)

Hospital treatment capacity refers to the number of victims that can be treated in a hospital within a given period of time, e.g. one hour. If the casualties have mechanical or burn injuries, HTC is determined by the number of surgeons, anaesthesiologists and specialist nurses and by the operating theatre and intensive care facilities available. These variables are as a rule related to the number of beds in the hospital. Research of both a theoretical (see table) and an empirical approach has shown HTC to be about 2-3%, i.e.2-3 casualties per 100 beds per hour. Thus a medium-sized district hospital containing a minimum of 300 beds could treat about 6-9 casualties an hour. Taking account of fatigue on the part of the staff and the fact that the hospital would run short of supplies, its total capacity for a period of 8-10 hours would be about 50-70 victims.

$$MRC \approx MTC \approx HTC$$

The lowest capacity in the chain will determine the capacity of the whole chain!

	MECHANICAL	CHEMICAL	NUCLEAR	BIOLOGICAL
MRC	+	-	-	-
MTC	+	±	±	±
HTC	+	-	-	-

As can be seen in this summarising table only the capacity for casualties with mechanical lesions (incl. burns) are known so far.

The three separate parts of the chain of medical care must be about the same in terms of capacity, i.e. MRC ≈ MTC ≈ HTC, otherwise the capacity of the entire chain will be determined by the lowest common denominator. For example, there is absolutely no point in expanding MTC by means of additional ambulances if the HTC of the surrounding hospitals remains the same. This will inevitably cause chaos in the delivery of casualties to hospital.

So far, the discussion was based on casualties with mechanical lesions, including burns.
In case of chemical, nuclear and biological lesions the capacties are unknown!!
This should be a stimulus for futher research.

Application of the above principles to a municipality, province or indeed the whole country makes it possible to make a rough estimate of disaster preparedness for mechanical lesions. For a detailed description and a precise calculation reference should be made to one of the next chapters.