epidemic disease is an inevitable sequel to natural disaster but, in reality, epidemics have only rarely been observed. The risk of epidemic disease will be increased where people are crowded together without essential services, as in a refugee camp. But even here the risks of transmission of most diseases remain moderate if adequate water and sewage systems are provided.[53] [54] However, the possibility of epidemic must be borne in mind, particularly in developing countries where the standards of personal and environmental sanitation may not be high, even in normal times.

Psychological disorders do not appear to be important following disasters. They may fall into two categories: a "post-disaster syndrome" characterized by temporary confusion and disorientation, and various forms of anxiety/depression among those who are predisposed to such conditions. Hysteria is not common.

The risk of death from exposure after disaster on land appears to have been exaggerated. Food shortage may present difficulties In particular, it follows floods, which may salinate fields and damage stored or standing crops. It may also be an indirect effect in the sense that after an earthquake people may be giving priority to reconstruction rather than to working to prepare land for planting for the next season.

ASSESSMENT OF THE REQUIREMENT FOR HEALTH CARE

It is unavoidable that immediately after a disaster there will be little reliable, specific information on the extent of damage and of medical need, and particularly will this be so if the country does not have an established disaster preparedness programme. To plan an effective national relief operation, and to judge the need for international assistance, it is essential to have accurate information or, at least, estimates of a known degree of accuracy In addition to the general data about the extent of the area of damage, the population affected, the functional damage to public services, transport and utilities—data whose acquisition is dealt with in another section of this volume—health administrators will need specific medical, epidemiological and administrative information about the health problems being (or likely to be) experienced, the hospitals which remain in operation and whether their capacity has been impaired, and the availability of medical supplies.

Health administrators associated with the pre-disaster planning process should ensure that provision is made for this kind of information to be gathered together. Methods of acquiring it will naturally vary from country to country, and with the condition of communications facilities after the disaster. However, it will generally be necessary to establish:

(*a*) The number and proportions (or rates) of injuries. The most pragmatic classifications are based on the site of trauma (e.g. fractures of arms or legs) or its severity;

(*b*) The risk of outbreak of communicable disease. Even though the possibility of actual outbreak may be low, a rapid survey of the disaster area will provide baseline data for an epidemiological surveillance system in which suspected cases of selected diseases are reported,

(*c*) A detailed inventory of functional health facilities. This will include not only the status of hospitals and clinics, together with the numbers of medical and para-medical staff available for work, but also a review of any important drug manufacturing plant in the disaster area. This may affect the quantities of medical supplies available. The survey should also include the possibility of recovering urgently needed drugs and other materials from damaged stores, both wholesale and retail; and

(*d*) The condition of the water supply and sanitation systems, for these will have a direct and possibly rapid effect on the health of survivors of the disaster (figure 22).

---

[53] In the longer run, an increase in vector-borne diseases may occur in some areas because of disruption of vector control efforts Residual insecticides may be washed away from buildings and the number of mosquito breeding sites may increase As an example, 75,000 cases of malaria occurred in Haiti in the five months following the October 3-4, 1963, hurricane there

[54] See also the section "Health Problems due to Floods" in "Guidelines for Flood Loss Prevention and Management in Developing Countries" published by United Nations, New York, 1976

FIGURE 22

Natural disasters effects matrix

	Most common effects on environmental health	Earthquake	Hurricane/ Tornado	Flood	Tsunamis
Water supply and waste-water disposal	Damage to civil engineering structures	●	●	●	○
	Broken mains	●	◒	◒	○
	Power outages	●	●	◒	◒
	Contamination (biological or chemical)	◒	●	●	●
	Transportation failures	●	●	●	◒
	Personnel shortages	●	◒	◒	○
	System overloading (due to shifts in population)	○	●	●	○
	Equipment, parts, and supply shortages	●	●	●	◒
Solid waste handling	Damage to civil engineering structures	●	◒	◒	○
	Transportation failures	●	●	●	◒
	Equipment shortages	●	●	●	◒
	Personnel shortages	●	●	●	○
	Water, soil, and air pollution	●	●	●	◒
Food handling	Damage to food preparation facilities	●	●	◒	○
	Transportation failures	●	●	●	◒
	Power outages	●	●	◒	◒
	Flooding of facilities	○	●	●	●
	Contamination/degradation of relief supplies	◒	●	●	◒
Vector control	Proliferation of vector breeding sites	●	●	●	●
	Increase in human-vector contacts	●	●	●	◒
	Disruption of vector-borne disease control programs	●	●	●	●
Home sanitation	Destruction or damage to structures	●	●	●	●
	Contamination of water and food	◒	◒	●	◒
	Disruption of power, heating, fuel, water, or supply waste disposal services	●	●	●	◒
	Overcrowding	○	○	○	○

● Severe possible effect
◒ Less severe possible effect
○ Least or no possible effect

Source "A Guide to Emergency Health Management after Disaster", Pan American Health Organization, 1981

HOSPITALS AND DISASTER

Hospitals occupy a special place in the life of any community. Most of them are located in areas of high population density, or in places to which a scattered population has reasonably easy access. They form a focal point in the community to which people come for help; and they function continuously and respond to emergencies at any time. Moreover, they are generally self-sufficient in their internal services, although they should have reserve and independent sources of essential utilities (e.g electricity and water supplies) to maintain their ability to function in emergency.

It may be, however, that the hospital is itself at risk, and some types of disaster which may be expected would require rapid evacuation of patients to other hospitals or, for the less seriously ill, discharge to their own homes. Thus, emergency plans should be framed not only to deal with circumstances in which continued operation, and operation under stress, will be foreseen, but also in anticipation of the need to co-operate with other hospitals in the area which may have to receive evacuated patients as well as to admit new casualties

The kind of hospital organization which will be needed to cope with the effects of disasters will vary widely according not only to the types of disasters expected but also to the environment in which the hospital itself operates. A plan suitable for a major hospital which forms part of a centrally directed national health service will be very different from that written for a mission hospital in a developing country. None the less, some general principles will bear repetition, even if the hospital's resources will not permit the adoption of every one. The establishment of a hospital Planning Committee is recommended in a short and succinct volume[55] which cites with approval earlier American work on the subject. The Committee would:

(*a*) Develop the hospital disaster plan;

(*b*) Develop departmental plans in support of the main plan;

(*c*) Allocate duties to hospital staff;

(*d*) Establish standards of emergency medical care;

(*e*) Conduct and supervise training programmes;

(*f*) Supervise drills to test the hospital plans; and

(*g*) Review and revise the plan at regular intervals.

It will be apparent that the Committee should include doctors and nurses as well as administrative staff: the numbers, specializations and seniority of Committee members will be decided according to need, but as junior staff may well be required in emergency to assume responsibilities greater than those normally placed upon them, it would be well to include representatives from their number in the planning process.

Two categories of plans will probably be found necessary, but both should be as simple as possible, and designed to establish the best distribution and layout of personnel and matériel to meet the expected needs. A *minor plan* will be required to be put into operation for a small caseload not requiring extensive surgery; this plan should allow the extra load to be dealt with while the hospital continues its normal operations. A *major plan* will be implemented when it is necessary to stop the normal work of the hospital, and expand surgical capacity, etc., to handle the rush of disaster-related injuries (see figure 23). Large hospitals may find it appropriate to introduce an intermediate phase, in which one or more parts of the hospital's facilities, but not all of them, are placed on emergency routine.[56]

While it is not possible when planning hospital facilities to take into account every possible disaster, it is desirable to use existing facilities to the full in the event of a catastrophe. Planners should remember that hospitalization is a process of reception, sorting of patients according to urgency, diagnosis, treatment and housing and that at each stage problems are likely to occur. Therefore, the prerequisite for maximum utilization is that the disaster plan should include a study of each of these stages as well as the passage from one stage to another (see figure 24). Planning may also usefully envisage the later admission of numbers of patients suffering from secondary or induced effects of the disaster.

[55] "Disasters—Hospital Planning, A Manual for Doctors, Nurses and Administrators", by P. E. A. Savage, published by Pergamon Press Ltd, Oxford, England, 1979.

[56] The dividing line between "minor" and "major" cannot be fixed, and will move according to the circumstances. For example, a hospital with 190 beds and 2 operating theatres in Mackay, Queensland, Australia, regards the sudden arrival of more than 6 stretcher cases, or more than 2 cases requiring urgent resuscitation and surgery as a situation which would demand special mobilization of staff and equipment. "Planning for People in Natural Disaster", edited by J. I. Reid, Department of Behavioural Sciences, James Cook University of North Queensland, Australia, 1979.

FIGURE 23

DISASTER SITUATION	HOSPITAL RESPONSE
1. *Internal Disaster* — disaster within the hospital, e.g. fire, explosion.	EVACUATION of patients from threatened and affected areas.
2. *External Disaster, minor.* — minor disasters involving a small number of casualties, e.g. fire, flood, autobus accident, explosion.	EXPANSION of treatment areas to care for casualties.
3. *External Disaster, major.* — community disasters involving large numbers of casualties, e.g. hurricane, flood, fire, explosion, aircraft accident, epidemic.	EXPANSION of reception and treatment areas to care for inpatient and outpatient casualties. EVACUATION of some in-patients to free beds for casualties.
4. *Disaster threats* — Disaster threatening either the hospital or the whole community, e.g. impending flood, hurricane etc. on a major scale.	Precautionary EVACUATION, either partial or total. Preparation of reserve equipment and supplies. Alert of staff.

Source: Disaster Plan of the Queen Elizabeth Hospital, Barbados.

MANAGEMENT OF MASS CASUALTIES

The management of mass casualties can be divided into four phases: rescue, first aid, transport and definitive treatment. Few global solutions can be offered to the problem of providing services in these phases, given the great range of resources, types of disaster, and risks in different countries and regions of the world. In the wake of large-scale disasters, the rescue in most instances must of necessity be performed by the survivors themselves, as it would be beyond the ability and resources of any central organization to accomplish this task.

With regard to first aid delivery at the site, a reduction in mortality in the severely injured can be achieved by early first aid; the better the immediate aid, the greater will be the reduction. Improved knowledge in the community of basic first aid (e.g., the arrest of haemorrhage) and better use of local medical and paramedical personnel are extremely important, especially as improper treatment may result in further injury or even permanent disablement.

FIGURE 24

Casualty flow in a major disaster

CASUALTY FLOW	PERSONNEL	FUNCTIONS
Disaster Scene Temporary Morgue First Aid	1. Casualty Consultant in charge 2. Doctors 3. Nurses 4. Other staff as considered appropriate by Casualty Consultant	1. Triage—initial sorting and diagnosis 2. Emergency life-saving and First Aid.
Casualty Queen Elizabeth Hospital	1. Snr. Surgeon in Charge 2. Casualty Registrar 3. Surgical and Medical Doctors 4. Nurses 5. Other staff as appropriate	1. Initial treatment 2. Admission 3. Discharge
Admission to wards for Medical, Surgical, Shock, Burn, Fractures, Obs. and Gynac. Treatment	1. Head of Dept. in Charge 2. Duty staff on service supported by all Off-duty staff.	Further specialized treatment.
X-Ray, Laboratory and other Diagnostic Procedures	1. Heads of Dept. and all staff.	Diagnostic Procedures
Continual Diagnostic Procedures, Treatment and Convalescence	Ward staff	Hospitalization
Discharge Release		

Source: Disaster Plan of the Queen Elizabeth Hospital, Barbados.

TRIAGE

The classification of the injured, known as "triage", is undertaken by medical or paramedical personnel on site on the bases of seriousness of the injury and the chances of recovery. There is as yet no widely-agreed standard for classification: some methods are based on the organs affected, and others use a trauma index with a number scale. To deal with a maximum number of patients in the minimum time it is unlikely that more than 2 or 3 minutes will be available for each patient. In the earthquake at El Asnam, Algeria, in November 1980, four categories were used in the triage process: I—vital functions affected;

II—serious injuries needing operation but which could wait up to 12 hours after receiving adequate first aid; III—those hopeless cases needing comfort as much as treatment; and IV—slightly injured needing to be kept apart from other groups to avoid the spread of panic or chaos. While some medical staff must give full attention to the triage process, much if not all of the actual treatment at the first aid stage can be given by nurses and trained volunteers working under general supervision. One-to-one care is not possible in the immediate aftermath of a major disaster.

TRANSPORT

Just as in the initial stage after the impact of a major disaster much of the rescue and first aid work is carried out by the people on the spot, so will (in most cases) transport be organized for the most seriously injured, using locally available vehicles. This natural response can bring its own difficulties for hospital staff, difficulties which may range from an overloading of the facilities of one of a number of hospitals in the area, to the arrival in the casualty receiving area of numbers of bodies of injured persons who have died during transport. Unless there are sufficient ambulances or other "official" modes of transport, such as helicopters, available for despatch to the disaster site (and, once there, sufficient to deal with the numbers of casualties) the first-aid and triage teams should be prepared to utilize the private vehicle resource to best advantage, ensuring that volunteer drivers are given as clear instructions as possible about where they should go and the importance of delivering records of immediate treatment given to patients to the casualty receiving officer.

DEFINITIVE TREATMENT

In the initial stages after a disaster has occurred, it may be necessary to relax the standards of clinical care normally given to patients, in order to cope with the influx of a large number of casualties. Savage (*op. cit.*) relates standards to the time required to complete the initial definitive treatment, suggesting five categories ranging from optimum care, where treatment can be completed within 12 hours, to extended austere care, where mass casualty standards have to be in force for more than 48 hours. The establishment of standards and the issuing of related instructions to medical staff is the responsibility of the hospital's disaster planning committee.

STANDARD DRUGS AND MEDICAL SUPPLIES

Major difficulties are often experienced because there is not enough general agreement about the needs for medicines and simple equipment. A standardized drug list has been developed by the World Health Organization (WHO) in consultation with the Office of the United Nations High Commissioner for Refugees (UNHCR), the United Nations Children's Fund (UNICEF), the International Red Cross and non-governmental organizations involved in disaster relief. This is now available as a pre-packaged kit designed for the urgent needs of 10,000 persons over 3 months. Besides essential drugs, the kit also includes standard clinic equipment.[57]

WHO has also established a model list of essential drugs[58] with the aim of generalizing the supply and use of necessary medicaments of known value at lower cost. WHO encourages the use, whenever possible, of these drugs, and a short list selected from them has been established particularly for emergency situations.[57] To facilitate and rationalize emergency action, requesting countries and donor agencies are encouraged to use these standard lists.

---

[57] "WHO Emergency Health Kit: Standard Drugs and Clinic Equipment for 10,000 persons for 3 Months". Lists available from Emergency Relief Operations, WHO, Geneva, Switzerland. Prepackaged kits available from UNIPAC, Unicef, Copenhagen, Denmark.

[58] See WHO, Technical Report Series, No. 641, 1979, "The selection of essential drugs: second report of a WHO Expert Committee."

A centralized inventory of available medical supplies and of those which are received as immediate relief is desirable for better co-ordination of supply and distribution within the disaster area. The delivery of drugs to the affected country is less of a problem than is the subsequent distribution of the right drugs to the right places.

Preparedness plans should also include instructions about the reception, storage, and distribution of medical supplies, and the sorting and distribution (or disposal) of those supplies which arrive as unsolicited contributions. The difficulties experienced by the authorities in Guatemala after the 1976 earthquake are probably the best known example of the waste of effort inherent in sending unsuitable drugs, but even where supplies correspond to the reported needs they are not always handled correctly. To illustrate the need for careful planning it is only necessary to cite one case, that of a country whose international air services were extremely limited in scope and thus made necessary the trans-shipment of consignments at major airports in the region. An investigation after one disaster disclosed that:

(*a*) Consignors had used addresses which were insufficient or incorrect (despite clear instructions having been given to them);

(*b*) The responsible authority in the country did not receive advance notice of the arrival of consignments;

(*c*) The receiving airline did not notify the responsible authority of the actual arrival of consignments;

(*d*) Air waybill numbers of individual consignments were changed at the airport of trans-shipment, and the new numbers were not reported to the consignor or consignee.

This, however, is not the whole extent of the problem. Certain kinds of vaccines have to be maintained in controlled conditions during transport and storage, and indeed up to the point of use, and if the necessary precautions are not observed the vaccines will be rendered useless. Advice of the appropriate conditions for each vaccine should be noted on the container, and on the shipment documents, in the languages of the carrier and of the recipient country: if trans-shipment must take place in a third country, its language too should be used. The documents themselves should bear an indication that immediate notification of arrival should be given to the consignee, by telephone or messenger.

EPIDEMIC EMERGENCIES

This section has so far considered the health care aspects likely to have to be dealt with following a sudden disaster, and in so doing has indicated the areas in which general and purely medical planning and preparedness should attract attention. However, an epidemic caused by factors other than natural disaster may itself assume the character of a local, regional or national emergency. Preparedness planning here too, if properly undertaken, can serve to ease the later work of health authorities.

DEFINITIONS

An *epidemic* of infectious disease is defined as the occurrence of an unusually large or unexpected number of cases of a disease known or suspected to be of infectious origin, for a given place and time. It usually evolves rapidly, and requires an equally rapid response.

A *threatened (or potential) epidemic* is defined as a situation in which the epidemic occurrence of a specific infectious disease may reasonably be expected, including (*a*) a receptive human population; (*b*) the presence or impending introduction of the disease agent; and (*c*) a means for extensive transmission such as a contaminated water supply or a vector population.

An *emergency* is a disease situation which necessitates taking urgent and sometimes unusual action for its control. It can be defined only within the context of the social, political and epidemiological circumstances in which it occurs. These circumstances significantly affect the urgency of the problem, the action that must be taken, and the need for external assistance. However, the characteristic elements of an

emergency epidemic or threatened epidemic include the following, although not all need be present, and judgement must be exercised in the interpretation of their importance:

(*a*) The disease involved is of such severity as to lead to serious disability or death;

(*b*) A "large" or increasing number of cases is observed or may reasonably be expected to occur ("large" being relative to the disease and the circumstance);

(*c*) There is a risk of introduction or spread of the disease which will involve new cases or population groups;

(*d*) There is a danger of international transmission;

(*e*) There is a risk of social or economic disruption from the introduction, continued presence, or spread of the disease;

(*f*) National authorities are not able to cope adequately and in timely fashion with the situation due to lack or insufficiency of:

(i) Technical and/or professional personnel

(ii) Organizational experience

(iii) Necessary supplies of equipment (drugs, vaccines, laboratory diagnostic materials, vector control materials, etc.);

(*g*) The disease is a "new" condition as yet not recognized among the known clinical entities.

In order to illustrate the types of disease situations which might justify a request for emergency assistance, examples are given in figure 25. These examples do not define the minimum or maximum requirements for a request in connection with any disease cited because other criteria for an emergency must also be met; each incident must be judged from experience and in the light of the facts.

In general, what could constitute an epidemic emergency depends on two local factors: (*a*) the pre-existing state of endemicity of that disease; and (*b*) the presence or absence of the means for transmission. Therefore, the examples are given separately for non-endemic and endemic situations, where applicable.

PREPAREDNESS

Preparedness for epidemics is needed for: (*a*) diseases which have already caused epidemics in the region, and (*b*) diseases occurring in other parts of the world which may be imported through intercontinental travel.

EPIDEMIOLOGICAL SURVEILLANCE

Planning emergency services to cope with disease epidemics should not be viewed as a one-time static activity but rather as a continuing process of preparedness, to be updated regularly to meet locally-changing situations. Consideration must be given not only to probable epidemics, but also to making the best use of locally available resources. A permanent infrastructure for surveillance is not only necessary to provide the necessary basis against which the significance of observed changes in disease patterns can be assessed, and a threshold for alert observed. Its existence also enables the impact of an epidemic to be absorbed, rather than requiring emergency arrangements to be made.

Nationally, the work of surveillance must be planned, effective and regular, and must cover morbidity, mortality and, where appropriate, vector density. Weekly reports must be assessed promptly, with feedback to the appropriate authorities when there is evidence of abnormal trends. Routine surveillance may need to be modified and intensified when epidemiological information from WHO and neighbouring countries warrants it. Access to up-to-date and pertinent epidemiological information is normally available through the WHO regional office and/or the *Weekly Epidemiological Record* and the Automatic Telex Reply Service of WHO, both of which provide rapid information

FIGURE 25

Examples of communicable diseases which may create an emergency*

Disease	*In non-endemic areas*	*In endemic areas*
Cholera	One confirmed indigenous case	"Significant" increase in incidence beyond seasonal expectation particularly if multi-focal and with deaths in 10-year-olds
Malaria	A "cluster" of cases, with a rising incidence rate in a "defined geographical area"	Rarely an emergency; increased incidence requires programme strengthening
Meningitis, meningococcal	An incidence rate of 1 per 1,000 in one week in a "defined geographic area" is ominous; that rate for two consecutive weeks is an emergency	
Plague	One confirmed case	(*a*) A "cluster" of cases apparently associated by domestic rodent or respiratory transmission; or (*b*) a rodent epizootic
Rabies	One confirmed case of animal rabies in a previously rabies-free country	"Significant" increase in animal and human cases
Salmonellosis	A "large cluster" of cases in a limited area, with a single or predominant serotype, or a "signficant" group of cases occurring in multiple foci apparently related by a common source. (Note: several countries may be involved.)	
Smallpox	Any strongly suspected case	Not applicable, as no endemicity
Typhus, Louse-borne	One confirmed case in a louse-infested, receptive population	"Significant" increase in the number of cases in a "limited" period of time
Viral encephalitis, mosquito-borne	"Cluster" of time- and space-related cases in a receptive population (a single case having warning value)	"Significant" increase in the number of cases with a single identified etiologic agent, in a "limited" period of time
Viral haemorrhagic fever	One confirmed indigenous or imported case with an etiologic agent in which man-to-man transmission may occur	"Significant" increase in the number of cases with a single identified etiologic agent, in a "limited" period of time
Yellow fever	One confirmed case in a community with a receptive human population and an "adequate" vector population	"Significant" increase in the number of cases in a "limited" period of time

* It is understood that in many situations the base-line incidence of disease in endemic areas is not well established and a "significant" rise will depend on the judgement of local health authorities.

CONTINGENCY PLANNING

The contingency plan for potential epidemic situations should fit into the existing national administrative structure and foresee the best use of locally available resources, with ultimate responsibility for planning and co-ordination resting with one responsible person in the health service. An organizational plan is suggested in figure 26.

The following elements should be considered:

(*a*) Emergency budgetary provisions;

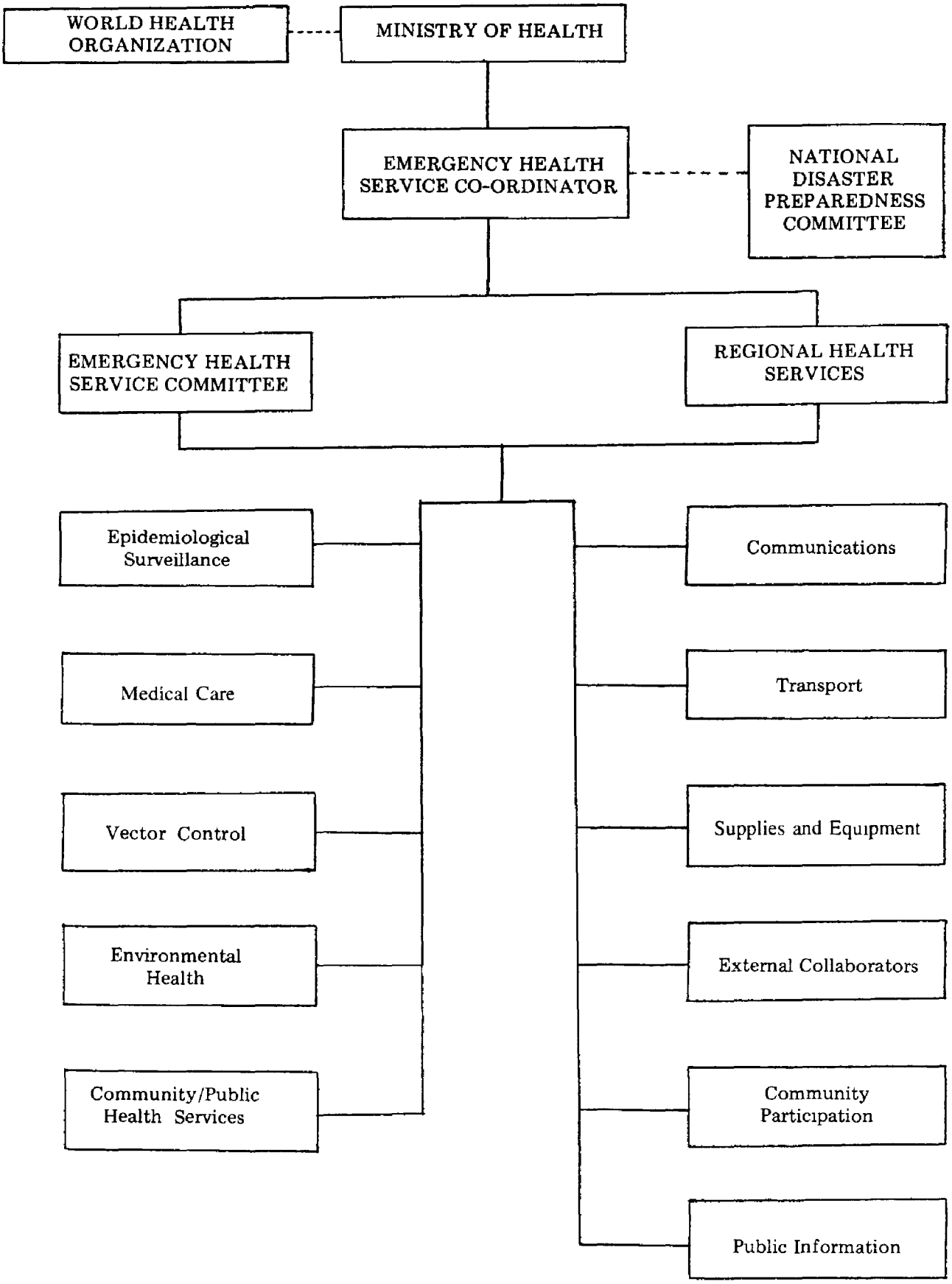
(*b*) Personnel involved in hospitals, primary health care, surveillance, laboratories, environmental sanitation and vector control;

(*c*) Development of an emergency plan in general hospitals and peripheral facilities;

(*d*) Procurement and storage of vaccines and drugs, and the logistics for immunization programmes and the distribution of drugs;

FIGURE 26

Organization of a national emergency health service



(*e*) Vector control facilities;

(*f*) Environmental sanitation equipment;

(*g*) Transport and communications;

(*h*) Utilization of community participants; and

(*i*) Utilization of the media.

COMMUNITY PARTICIPATION

Community participation is valuable and necessary in all the major aspects of first aid. In epidemics it is also useful in the detection of cases and the implementation of control measures during an outbreak of a communicable disease. Information about the outbreak should be given to the general public, and suggestions of ways in which individuals and groups might contribute to containment measures should be sought. How people can assist in control measures will depend in large measure on the extent to which the effort is organized and the participants are briefed or trained.

People can also help in case-finding, particularly in respect of patients exhibiting mild illness: common signs and symptoms can often be recognized by the lay public. Furthermore, valuable information can be derived from reasons for absenteeism from school. Parents, teachers, district nurses or primary health care workers can be useful points of contact. Selected volunteers can help with a variety of simple tasks in primary health care centres or hospital out-patient departments. Another aspect of community participation is to be found in the use of suitable women for simple home nursing, arranging isolation of infectious cases at home, and for undertaking disinfection procedures in the home.

At the precautionary level, these women could also help by persuading people to accept immunization, and to observe the principles and practices of hygienic living. The community as a whole can be very helpful in reducing sources of infection by directing efforts at domestic mosquito vectors and environmental sanitation

THE PRINCIPLES OF OUTBREAK CONTROL

Once an epidemic (or probable epidemic) is identified no delay should occur before initiating the specified course of action The objectives are to prevent further transmission, to provide treatment and to obtain clinical, laboratory and epidemiological information which may further the knowledge of the disease and the methods for its control The action taken is dependent on the disease, its transmission potential, the morbidity and case-fatality rates, the emotional response in the population, and the available national and community resources.

The following are considered to be essential elements for the control of an outbreak, and all of them are matters which can be dealt with in the context of preparedness planning.

(*a*) The designation of a person in authority to be responsible for the investigation and control of the outbreak;

(*b*) The establishment of a chain of command which takes into consideration the health units, national ministries and international agencies which may be involved. An organigram showing the structure and defining the functions of the epidemiological services may be useful;

(*c*) The staff should be fully briefed and have the requisite personnel, material, administrative and financial support to implement the activities for which they are responsible;

(*d*) The preparation of a written plan of action indicating how the epidemiological services will be deployed in the specific emergency The plan should be specific for a given disease or diseases, including any which could be a potential threat to the country. Criteria for initiating special investigations and control measures should be in the plan, as should algorithms for guidance in making diagnoses and taking specific actions

(*e*) A mechanism for prompt dissemination of information to medical personnel, the public and the international community should exist.

CONTAINMENT MEASURES

Containment measures must be planned in detail and implementation must be strict and disciplined when the disease is of recognized public health importance. Steps to be taken include: (*a*) administrative—e.g. isolation of patients and quarantine; delineation of geographic areas; provision of adequate personnel, supplies, transport, and money; (*b*) technical—e.g. drug treatment, vector control, environmental sanitation, immunization, disinfection during and after isolation and treatment of cases; and strict enforcement of food and water sampling and testing procedures for bacterial toxic contamination.

In planning containment measures the following matters should be considered: (*a*) number of cases and deaths (to be brought up to date each day during the acute stage of the outbreak); (*b*) the incubation period, source of infections, reservoir, vector; (*c*) attack rates; (*d*) rapidity of spread and potential to infect non-endemic areas; (*e*) effectiveness of specific control measures; (*f*) need for continuing surveillance; and (*g*) criteria for defining when the epidemic is over.

TRAINING

Training is part of the planning for national emergency epidemic control services, and has two major components:

(*a*) Preparatory training—provided when no emergency exists, in order to prepare health workers for emergencies that may be expected; and

(*b*) Emergency training—provided in the context of an existing emergency and therefore adapted to it.

These two aspects of training cover the same activities, and differ principally in approach and urgency. General training covers all aspects of preventive public health services. As much as possible of the general training programme should be in the field and on the job. Emergency training is, by its nature, given largely on the job, reinforcing what should have already been learned and applying it to a specific problem. The trainees must be motivated to recognize the importance of this work.

The training plan must highlight the following points:

(*a*) The trainee should so far as practicable understand the management system for emergencies, in order to appreciate his role in it;

(*b*) The concepts and techniques of disease surveillance are of paramount importance;

(*c*) An early warning system based on alerts from informal health facilities is part of surveillance but deserves separate emphasis;

(*d*) Safety precautions, for the protection of self, patients and the public, must be taught;

(*e*) Co-ordination meetings are important to ensure that all parties with a role in facing an emergency develop and follow an integrated plan;

(*f*) Staff must be trained in public relations. Accurate and reliable information must be disseminated to the public, but in an orderly manner so as to avoid fear and confusion, and in such a form as will make it clear to the target population;

(*g*) Staff need training in health education of the public since community participation is essential in emergency management,

(*h*) Procedures for the assessment of the training programme must be built into the programme itself, and it must be recognized that

(*i*) Training is a continuous activity because of staff changes and new recruitment.

After most natural disasters, the rapidly changing environment produces a general disruption of patterns of life; in turn this may give rise to stress in individuals and the weakening of health throughout the population particularly in cases where the health status was low prior to the incident Moreover, people may be forced into crowded, unsanitary conditions, which could lead to outbreaks of epidemic diseases.

For the public health administrator, sanitarian, entomologist, epidemiologist and vector control specialist, the management of health relief and related responsibilities involves knowledge of the prevailing local health conditions and careful planning based on them, and on the available resources.

He will need to influence health programmes, which may have static inflexible administrative procedures, so as to make possible the exercise of greater innovation and flexibility in disaster situations which by their nature call for urgency in decision making and implementation. A disaster contingency plan will assist in alleviating this problem. In addition, disaster managers must guard against misdirection, confusion and waste, regardless of how well organized and adaptable the programme is. It is difficult to predict actual future needs which may be generated by a natural disaster and its secondary consequences. This is particularly relevant in high profile, high-cost programmes such as vector control programmes. This should be recognized in resource planning so that the most effective use may be made of available resources.

Disasters do not generate "new" diseases but, by altering the environment, they may increase transmission of diseases that already exist in a region through·

(*a*) Direct effect of the physical event itself, such as fecal contamination;

(*b*) Indirect effects which result in such conditions as overcrowding and poor sanitation;

(*c*) Promoting or causing increase in the movement of populations;

(*d*) Disrupting routine vector control programmes;

(*e*) Altering the distribution of vector species.

The increased risk of transmission of vector-borne disease must be seriously considered after any natural disaster. Early steps should therefore be taken to assess the potential of transmission of vector-borne disease. It is important to note, however, that natural disasters do not necessarily lead to outbreaks of infectious diseases This is particularly true of the mosquito-borne diseases, since the larval habitats and adult resting sites of mosquitoes often suffer from wind and water damage. As a result, such diseases as malaria, dengue and encephalitis may not appear until several weeks after the disaster, if they appear at all.

THE VECTOR CONTROL SUB-COMMITTEE

Within the national emergency preparedness framework, a vector control sub-committee should be established in the health sector It should be responsible for updating information concerning the status and distribution of the vector-borne diseases that are endemic to the country as well as nearby regions. Current information should always be available on entomological surveillance of vector populations and on the location and status of manpower, insecticides and application equipment. The subcommittee should be responsible for implementing the emergency vector control operations. To accomplish this, it must have power to act without the bureaucratic constraints that are usual in normal circumstances. The subcommittee may include staff from a number of agencies within the Ministry of Health, as well as those from other ministries and the private sector. Its chairman may be the officer responsible for epidemiology, for malariology or for environmental health.

In areas where there is a high risk of recurrent natural disasters, vector control personnel should attempt to rehearse disaster emergency control operations in order to refine procedures and develop expertise and a more effective state of alertness. Even without a Vector Control Subcommittee, insect and rodent control personnel can develop a system of alertness to function during and after disasters.

Continuous in-service training of all members of the staff should be included in all control programmes. Training and programme evaluation services offered by the World Health Organization can assist administrators in identifying and resolving problems in control programmes.

The vector control programme should keep information current about:

1. The status of all instruments, aids and activities necessary for surveillance, evaluation, and control activities, including:

   (*a*) Distribution maps of areas of high risk of disease transmission which delineate the sizes of vector populations, increases in larval breeding sites and the locations of potential reservoirs of disease;

   (*b*) The distribution of all cases of malaria of autochthonous and foreign origin;

   (*c*) Maps of the phases of progress in malaria and *Aedes aegypti* control programmes;

   (*d*) Population indices for *Aedes aegypti*, malaria vectors and other important species;

   (*e*) Graphs of monthly variation in vector density per year and according to changes in rainfall and temperature;

   (*f*) Graphs showing changes in the incidence of vector-borne and rodent-borne diseases;

   (*g*) Status of seaport and airport *Aedes aegypti* and rodent surveillance programmes.

2. The inventories of insecticides and vehicles and other types of equipment, and lists of personnel and variable funds, including:

   (*a*) Breakdowns for each vector and rodent control programme;

   (*b*) A list of similar or related programmes that exist in other ministries, such as Agriculture and Defence, and an inventory of their equipment and insecticides that could be used for public health purposes,

   (*c*) A list of private fumigation and agricultural spray companies that have ultra-low volume (ULV) and other application equipment (which might be owned by resorts or cities in tourist areas);

   (*d*) A list of the names, telephone numbers and addresses of contacts in the Ministry of Health and other ministries and, in addition, of companies that supply and manufacture insecticides and dispersal equipment, and of international representatives;

   (*e*) A list of other known, local sources of expertise, supplies and material.

3. The status of transport, communication and intelligence, and other maps and reports that might assist in reconnaissance and other types of surveys, including:

   (*a*) Road maps of larger political divisions and street maps of cities and towns.

   (*b*) Geographical and topographical maps;

   (*c*) Aerial photography surveys of high risk areas of vector-borne diseases;

   (*d*) Distribution maps of agricultural products;

   (*e*) Telephone directories, airline schedules and ham radio operators, and radio, television and newspaper services

4. Guidance on how to obtain interdepartmental and international aid, and a list of agencies which might be approached.

It should go without saying that there should also be readily to hand an up-to-date, fully amended operational contingency plan.

Further information may be found in Volume 8 "Sanitation Aspects" in the present series or may be obtained from the World Health Organization.