CONTENTS

PREFACE

Over the past decade, the scale of humanitarian crises has escalated dramatically. Natural disasters, war, famine or persecution have occurred in locations as diverse as the former Yugoslavia, Afghanistan, Columbia, Rwanda, North Korea and Liberia. These and many other emergencies have demonstrated the importance of humanitarian assistance given to those in need. It has also become clear that humanitarian assistance, in the context of a rapidly changing world, must be planned, organised and implemented on a professional basis. Since the early 1990's, both international and non-governmental organisations have instigated programmes aimed at guaranteeing the professionalism in humanitarian aid, which is essential in ensuring that the victims benefit.

The Network On Humanitarian Assistance (NOHA) was launched in 1993 as a contribution to a new and unique concept of higher level education in humanitarian aid. The project was jointly initiated by the European Community Humanitarian Office (ECHO), which finances the world-wide humanitarian aid of the European Community, and the Directorate General XXII of the European Commission (Education, Training, Youth). With financial support from and under the auspices of the SOCRATES programme, the NOHA programme is currently being taught at seven European universities: Université Aix-Marseille III, Ruhr-Universität Bochum, Universidad Deusto-Bilbao, University College Dublin, Université Catholique de Louvain, University La Sapienza Roma and Uppsala University.

The NOHA programme starts with a ten day intensive programme at the beginning of the academic year in September. This programme brings together all students from the NOHA universities, the lecturers, and representatives of international and non-governmental organisations. In the second part of the academic year, students study at their home universities, while in the third part, they are offered courses at one of the partner universities in the network. Finally, the students complete a practical component as the fourth stage of the programme.

The programme uses a multidisciplinary approach with the aim of encouraging interdisciplinarity in lecturing and research. There are five main areas which are taught in the second part of the academic year and these correspond to the *Blue Book* series, which are also commonly referred to as the *Module Books*. These module books are used throughout the network and contain the basic teaching material for the second period. The first edition was published in 1994. This second edition has been significantly revised, updated and, in parts, completely rewritten as a result of the teaching experience in the first 3 NOHA years. The volumes of the second edition are:

Volume 1: International Law in Humanitarian Assistance
Volume 2: Management in Humanitarian Assistance
Volume 3: Geopolitics in Humanitarian Assistance
Volume 4: Anthropology in Humanitarian Assistance
Volume 5: Medicine and Public Health in Humanitarian Assistance

In addition to the second edition of the five basic modules, two new modules have been published:

Volume 6: Geography in Humanitarian Assistance
Volume 7: Psychology in Humanitarian Assistance

All modules have been written by NOHA network professors, teaching at either their home university or other network universities. All NOHA universities, both past and present, have substantially contributed to the development of the *Blue Book* series. For each module at least two network university professors worked together to ensure a certain homogeneity of the text, although each author was responsible for a specific part. The table of contents outlines the specific contributions.

Special thanks go to all the authors and in particular to *Dr. Horst Fischer* from the Institute for International Law of Peace and Armed Conflict (IFHV), Ruhr-Universität Bochum, who has undertaken the role of editor throughout the whole process of producing this second edition *Blue Book* series. His staff, and in particular, *Mr. Guido Hesterberg*, prepared the manuscripts and layout of the books.

Information on the NOHA network and the *Blue Book* series can be obtained by accessing the ECHO's internet homepage (http://europa.eu.int/en/comm/echo/echo.html) or the IFHV internet homepage (http://www.ruhr-uni-bochum.de/ifhv).

As the NOHA course seeks to bridge the gap between theory and practice, I hope that these reference books will help to improve the quality of work for those involved in humanitarian assistance, especially because efficiency in the field is measured not only in financial terms, but above all, in number of human lives saved.

Alberto Navarro
Director of ECHO

NOTES ON THE CONTRIBUTORS

Reinhard Bunjes

Dr. Reinhard Bunjes is 52 years of age and a paediatrician. He worked for the "Committee Cap Anamur/German Emergency Doctors" on several emergency relief projects in Africa and Asia, subsequently being put in charge of logistics in the area of medical supplies, remaining in this position for a period of approximately 8 years. Today he works as a paediatrician at the Poison Control Centre, Berlin.

Anja Gebler

Anja Gebler studied statistics and theoretical medicine at the University of Dortmund. Between 1992 and 1993 she was a research assistant at the Department of Social Medicine and Epidemiology, Ruhr- University Bochum. In 1993 she began working as a research assistant in the Department of Biometry and Epidemiology, Ruhr-University Bochum, and since 1995 has been lecturing in "Basic Concepts of Epidemiology in Humanitarian Assistance".

Bärbel A. Krumme

Dr. Bärbel A. Krumme studied medicine at the University of Münster, specialising in internal medicine. After missions to Somalia, Uganda and Zaire, and two years as a consultant physician at the University of Bonn, she became a lecturer and examiner. In 1984 she became Acting Medical Superintendent and Country Representative for the "Committee Cap Anamur/German Emergency Doctors" in Uganda and afterwards, Vice Chairman of the same organisation, holding this post for 5 years. Since 1985 she has worked at the Bernhard Nocht Institute for Tropical Medicine (Hamburg), the Health Department of the German Foreign Office (Bonn), the Institute of Medical Parasitology (Bonn) and the Hamburg Federal Government Health Department, to name but a few.

Richard Munz

Dr. Richard Munz was born in 1953 in Besigheim, Germany. He lives and works in Marburg, where he is the head of the Department of Prehospital Emergency Medicine for that district. He is a physician, specialising in Prehospital Emergency Medicine and also holds a Master of International Humanitarian Assistance. He has 6½ years overseas experience, which have included field study work, becoming medical director of a district

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Dr D. Guha-Sapir is director of the Center for Research on the Epidemiology of Disasters (CRED), Professor at the Université Catholique de Louvain (UCL), Brussels and Adjunct Clinical Associate Professor, University of Tulane Medical Center, New Orleans. Following her studies in Calcutta, she completed a masters degree at the Johns Hopkins School of Public Health and doctoral work at the Department of Epidemiology and Preventive Medicine at UCL. Her research interests include health and nutrition issues in humanitarian crisis situations, currently focusing on problems related to displaced women and children. She has also been extensively involved in emergency programme and policy development in various countries, including China, Bangladesh, India, Ethiopia, Sudan and Mozambique, working in co-operation with WHO, UNHCR, and UNDHA. More recently, along with her team at CRED, she has been providing technical support to the European Commission in matters related to disaster prevention and preparedness, as well as relief links to development.

Benno M. Ure

Benno M. Ure, M.D., Ph.D., works at the Hospital for Sick Children in Cologne, Germany, where he is a paediatric surgeon and Assistant Professor of Surgery. His activities in humanitarian assistance began during a cholera epidemic, when he was working as a physician in Somalia in 1985. Since then he has co-ordinated projects and worked during emergencies in more than a dozen countries, including Liberia, Rwanda, Vietnam and Yemen. Benno Ure is the medical co-ordinator of the "Committee Cap Anamur/German Emergency Doctors" He lectures in disaster medicine at the University of Cologne and has been lecturing at the University of Bochum since the NOHA programme began in 1994.

CHAPTER 1
GENERALITIES

A. Overview of Main Issues in Health and Humanitarian Aid

Since 1980, over two million people have died as an immediate result of natural and man-made disasters. The refugee population has grown 500 percent since 1970 compared to a 20 percent growth in the world population, registering nearly 16 million refugees in 1992. This estimation does not include the internally displaced, of which there are 1.2 million in the Philippines alone. More than half of these are women and children. In the year 1992 alone, more than 300 million people have had their homes or livelihoods destroyed directly by disasters and UNICEF estimated about 4 million children to have been permanently disabled due to natural and man-made disasters. Nearly 40 million people eked out a living as refugees in camps or internally displaced in 1996. Even as this paper is being written, nearly 7 million people are homeless and displaced in Bangladesh due to severe floods.[1]

Other statistics on numbers affected, hectares of land flooded, harvests lost are equally alarming. But statistics, however alarming, will not help reduce disaster impact, unless they are seen by policy makers as a reflection of the human misery, economic deprivation and social injustice that it really represents. The key to reducing disaster vulnerability is to recognise that the impact of disasters are essentially the unsolved development problems of the world.

The human impact of natural and man-made disasters has evolved over the last three decades. Since the recent unfolding of the disasters in Somalia, Sudan, former Yugoslavia, Cambodia, Afghanistan, the world is recognising that economic dislocation, natural disasters, collapsing political structures, famines, mass displacements have all woven together to affect millions in ways both profound and prolonged.

In terms of the frequency of occurrence, floods and wind-related phenomena claim, by far, the largest proportion. They represent more than 60 percent of all disasters requiring external assistance (Figure 1). Famines and droughts, while fewer, have a greater and more profound impact on populations, generally affecting extensive areas and very large populations. Increasingly, since the 1970s, famines and droughts are linked to civil strife and armed conflicts. Pure famine, such as the Great Bengal Famine

[1] UN DHA Situation Report (1993).

in 1942, have become rare occurrences. Armed conflicts (generating famine) have started to claim larger and larger shares of the total disaster mortality. Figure 2 displays a combined chart of percent distribution by type of disaster and percent distribution of mortality due to these events. Civil strife and famines are the categories that affect populations, disproportionately to their share of events. Representing a little above 20 percent of all disasters, they account for nearly 70 percent of the direct mortality.

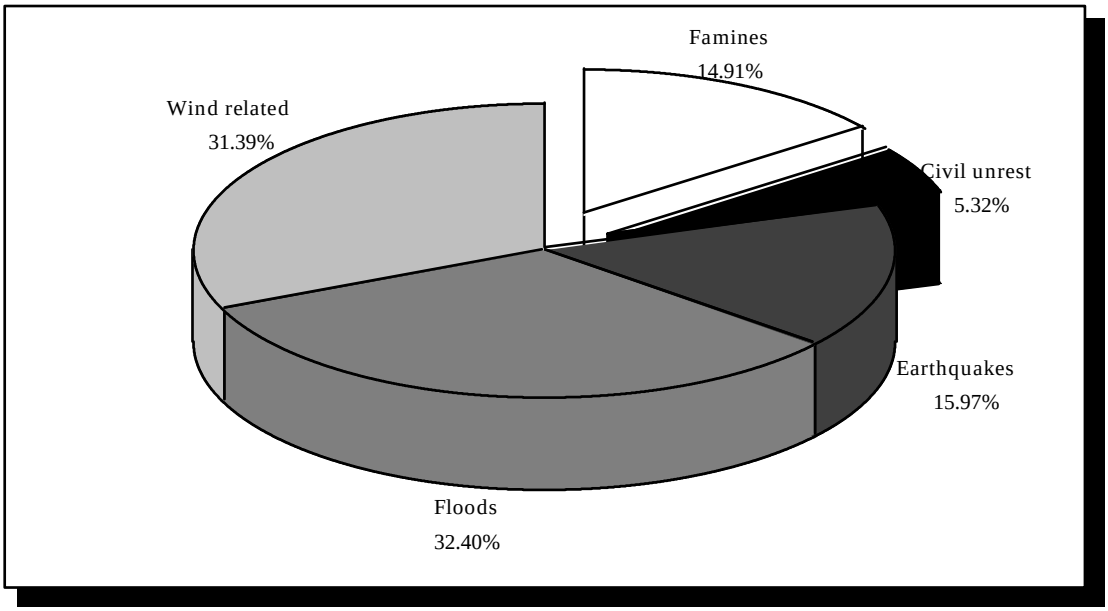

Figure 1. Percent distribution of disasters by type, 1960-1989

Source: EM-DAT database, WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED), Brussels

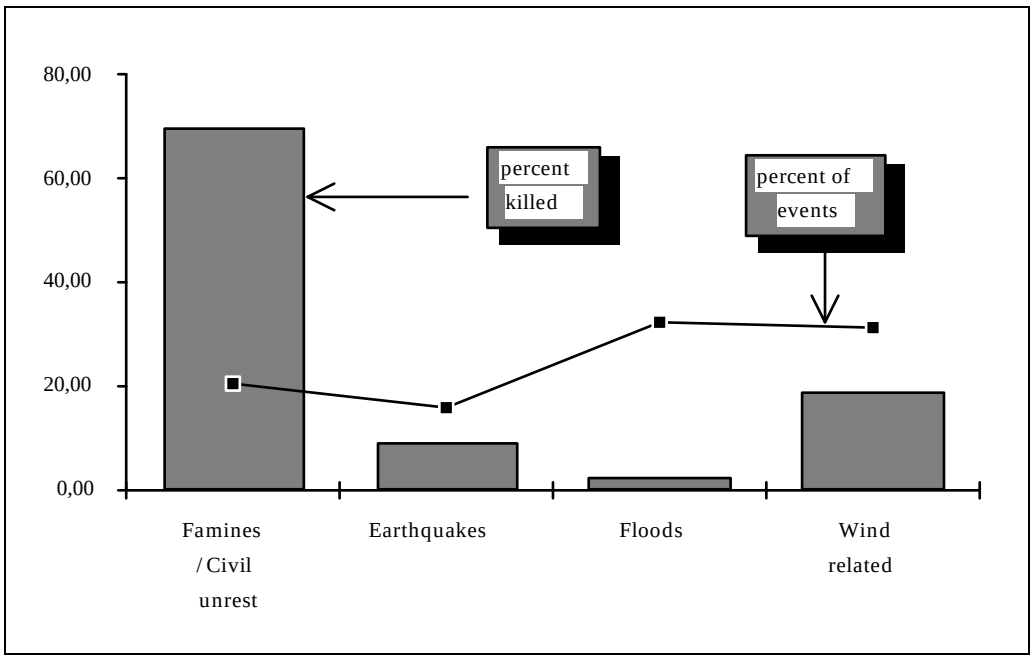

Figure 2. Distributions of disaster mortality and type as proportion of category total, 1960-1989

Source: EM-DAT database, WHO Collaborating Centre for Research on Disaster Epidemiology (CRED) Brussels, 1993.

The human impact of disasters consists of two elements: the catastrophic event and the vulnerability of people. While countries like Bangladesh and Philippines are geographically in vulnerable situations, there is no doubt, their main susceptibility comes from the weak social and economic structures. Housing quality, pre-existing health and nutritional status, social welfare infrastructure, economic resilience determines the magnitude of the disaster effect and its long term *sequelae.* Furthermore, broader ecological factors, such as population pressures on land, increasing urbanisation, unplanned land-use, marginalisation of populations are aggravating the potential for the increase of disaster losses when it does occur.

The scope of a disaster, in terms of the size of a population it affects, shows an increasing trend over the last three decades. Table 1 shows the mortality and affected population per event by type over time. Floods, although less fatal than earthquakes, affect much larger numbers of people and in long lasting ways. Harvests are lost, land is salinated, cattle are drowned, thus destroying people's means of livelihood. Similarly fewer people die as a direct result of famines/droughts but the scope of destitution is higher than in disasters such as earthquakes and cyclones.[2]

[2] *Sapir / Lechat* (1986).

Type of Disaster	1960-1969	1970-1979	1980-1989	Total 1960-1989 (number in millions)
Floods	5.4	30.0	64.5	100 (71)
High wind	12.5	24.9	62.6	100 (192)
Earthquake	8.0	31.8	60.8	100 (44)
Civil strife and famine	7.5	31.8	60.7	100 (598)
Others	5.7	5.3	89.1	100 (90)
Total	7.2	29.9	62.9	100 (1643)

Table 1. Distribution over last three decades of total affected population by type of disaster

In conclusion, it is important to recognise that the impact of natural or man-made disasters are not visited upon the affected community equally or at random. Certain characteristics and factors may be identified to define those at higher risk. Disaster relief has been traditionally based on policy formulated from charitable motives drawing on critical and emergency care. This approach is being replaced by a recognition that disaster relief and management is dependent on the socio-economic vulnerability of the country, to disasters and within it, the vulnerability of specific population groups at risk.

Whether the number of occurrences are increasing is still a matter of debate. The larger numbers of disasters in recent years may be a statistical artefact due to better reporting and media coverage. On the other hand, environmental degradation, dams and climate system changes (such as the El Niño phenomenon), are known to be provoking cyclones, typhoons and floods. Whatever the numbers of occurrences are, the scope of the disaster impact is increasing in terms of the size of population that they affect. Uncontrolled urbanisation, risky land use patterns, population pressures all combine to place millions more at risk of being destituted by a disaster today compared to 20 years ago.

B. Development, Armed Conflict and Humanitarian Assistance

I. International Humanitarian Law and Health

Relief assistance to war victims are governed by the four 1949 Geneva Conventions and the two Additional Protocols drawn up in 1977. On a different forum, Article 3 of the Universal Declaration of Human Rights proclaims the right to life, liberty and the security of person.

The relevance of these Conventions and Declarations has increasing significance in the complex emergencies that we witness today. By far the larger proportion of total victims of disasters in recent years are from civil armed conflict (Figure 1). In 1990, war related famine affected about 20 million people only in Southern and North-eastern Africa. In addition, armed conflicts have killed almost three times as many civilians as soldiers.[3] Of these, the great majority are women and children.[4] Protracted civil unrest leaves in its

[3] *Macrae/Zwi* (1992).

[4] *Cliff* (1988); *Ascherio* (1992); *Rivers* (1982).

wake dislocated people, disrupted economies, poverty and famine that are long term phenomena. Furthermore, direct actions to affect civilian populations, such as burning of harvests (e. g. western sub-Saharan African countries 1983-1987), contamination of wells or other drinking water sources (e. g. Southern Sudan 1990) or diversion of food aid to military (e. g. Ethiopia 1988, Somalia) are standard practices. Maternal and child health conditions that are precarious, in normal circumstances, are further aggravated by these actions. The escalating war in countries like Somalia or Ex-Yugoslavia and more recently in North Kivu (Zaire) are, in part, a consequence of the Cold War which has poured billions of dollars worth of arms into the regions. The sponsors of militarisation and arming of the Third World bear a great deal of responsibility in this rampant state of civil strife. The provision of arms to the government and rebels of the Southern Sudan while, at the same time, providing food aid to the children starving and handicapped as a result of the civil war, is a tragic example of this world dichotomy.

Apart from the direct effect of the arms and weapons on children and civilians, the cost of weapons and related military expenditures affect and kill people indirectly during normal times and limit the country's capacity to protect its people during disasters. As a result, countries with high military spending are often those who have the largest disaster affected populations (Table 2). For example, in 1984, the year of the most severe famine of the decade, Africa spent more on arms import than food import.[5] In addition, the most disaster affected countries are also those whose public welfare spending is lower than average. The UN Department of Disarmament Affairs estimated a current annual world military expenditure to be at 1.9 million a minute while 30 children die from lack of food, vaccines or other simple services in that time. Figure 3 displays health expenditure as a proportion of military expenditure of the ten most disaster affected countries. Liberia, Colombia, Philippines and Bangladesh spent more on health than the average developing country the proportion being about 25 percent of military expenditure. Sudan was the least, with about 2 percent of its military expenditure going to health.

[5] UNICEF (1986).

COUNTRIES AT HIGH RISK	Child mortality rate / 1,000 live births, 1989	Maternal mortality rate / 100,000 livebirths, 1980-1987	Health expenditure as % of GNP, 1986	Military expenditure / education and health, 1986	Arms imports (US$ mills, 1987)	GNP growth rate 1980-1988	Standardised mortality index*	Population affected by disasters (1966-1990) Rank order
Bangladesh	184	600	0.6	79	10	0.8	4.12	1
Ethiopia	226	-	1.3	172	1,000	-1.4	15.88	2
Iran	64	-	1.4	333	5,600	-	2.78	8
Iraq	89	50	0.8	711	1,500	-	NA	10
Liberia	209	-	1.9	35	10	-5.2	NA	7
Mozambique	297	-	1.8	-	120	-7.5	17.50	4
Philippines	72	93	0.7	55	40	-2.4	0.56	3
Somalia	218	110	0.2	71	20	-2.2	5.52	6
Sudan	175	660	0.2	140	50	-4.2	8.34	5
Turkey	90	210	0.5	148	925	3.0	0.46	9
LDC average	116	290	1.4	109		3.8		

Table 2. Indicators affecting vulnerability of populations to disasters for selected countries at high risk of disasters

* The index was calculated by dividing the number of dead by the mid period population of the country x 10,000 to reflect the loss of capital as a proportion of the nations human resource.

Source: UNDP Human Development Report, 1991; CRED Em-dat database, Brussels

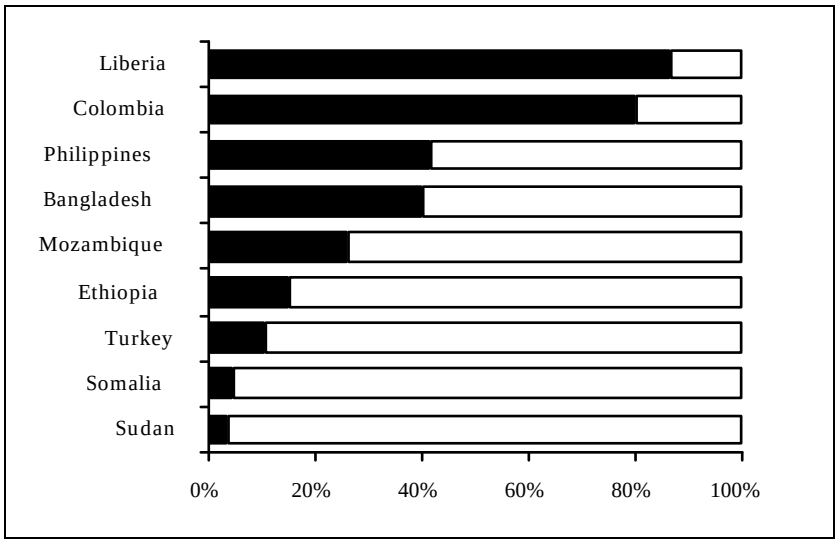

Figure 3. Health expenditure as percent of military expenditure* in countries most affected by natural and man-made disasters 1983-1992.

* Data from 1986
Source: Human development report, UNDP1991

Irrational government policies in the most affected countries undermine systematically the ability of the population to withstand severe adversity and reduce the possibility of the state to assist them. As a result international assistance has to step in or in default of this assistance, millions die or are disabled for life. Today, given the type of humanitarian crises, reducing vulnerability to disasters in the long term and responding effectively in disaster relief lies, partially, in the firmer implementation of human rights and of the Geneva Conventions. Since 1980, a Convention on the Rights of the Child is being drawn up by a working group of the Human Rights Commission. Although a necessary step towards the reduction of vulnerability of children in disaster situations, conventions and resolutions are by no means sufficient. These measures need to be accompanied by serious political will from all countries to operationalise these laws.

II. Food as Instrument of War

A specially reprehensible practice of primary significance for children, is the use of food as an instrument of war. Scorched earth policies, inhibition of passage for humanitarian food aid, diversion of food for military are all common occurrences in most of the conflicts experienced in recent times. Diversion of emergency food aid for vulnerable groups to the military is so common as to be, in some cases, counted into the calculation for needed supplies as the percentage reserved (or lost) to diversion. In Asmara (Eritrea), for example, the militia was paid in aid food grain.[6] In Somalia, *Askin*[7] estimated that only 12 % of the food aid reached the civilian victims for whom it was destined. Besides diversion, feeding centres for children and vulnerable groups are frequently bombed or at-

6 *Keen* (1991).
7 *Askin* (1987).

tacked. *Macrae* and *Zwi*[8] report that feeding centres were attacked in all of the study countries which included Sudan, Mozambique, Ethiopia, Angola, Liberia. Very few factual reports exist on these issues, partly because systematic reporting has been neglected and partly because the publication of such information could jeopardise the implementation of the action.

III. Mines and Disability

The use of mines, like direct atrocities, serve to remind the community that the rebel groups exist and command a certain power. They have a devastating effect on rural communities, particularly because of its power to disable and destroy for years following the war. It limits the ability of the community to migrate, which is, in many cases, tantamount to survival. The numbers of persons disabled from mine injuries are growing globally with the increasing use of this method of destabilisation. Save the Children Fund – UK (1991) reported that more than one million mines have been planted in Somalia and that Angola, Mozambique and Cambodia are now homes to the largest numbers of mine-disabled people in the world.[9]

Even today, the importance of physical handicaps from mine injuries is not taken into consideration when planning for disaster relief and rehabilitation. In Mozambique, only one artificial limb service operated in Maputo until 1986, when it saw a jump from 53 patients to 392, far beyond its capacity to manage.[10] Disaster relief and preparedness programmes should urgently consider training of local health personnel in fitting of artificial limbs and physical re-education.

IV. Rape and Sexual Violence

Sexual violence against women, (and apparently, men and children[11]) consequent pregnancies and their care have been thrown into the limelight in the recent Bosnia conflict, although it is far from being a rare occurrence in mass conflicts. Women are often forced to provide sex in exchange for food and shelter for themselves or their children and implications for sexually transmitted diseases, unwanted pregnancies and their termination are significant. Rape, sexual abuse, abortions and family planning were recently addressed in an editorial of The Lancet,[12] where the complete neglect of maternity care and family planning needs for refugees were highlighted. While data is recognised to be extremely limited on all issues related to sexual violence against women, high rates of pregnancy, sexually transmitted diseases and HIV are recognised as common in these situations and are considered indicative of the levels of desired or undesired sexual practice.

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8 *Macrae/Zwi* (1992).
9 *Macrae/Zwi* (1992).
10 *Cliff/Noormohamned* (1988).
11 *Black* (1993).
12 The Lancet, April 10, 1993.

In conclusion, demilitarisation and reduction in arms trade is a major factor in reducing the impact of man-made disasters, whose main effect is on children. About 75 percent of the arms traded internationally are destined for developing countries. As long as poor governments spent their resources on buying arms, there will not be enough to pay for food, health and education for the people. Sexual violence and family welfare issues, especially in refugee situations, are issues that are often neglected in relief programmes. Armed conflicts are tending to target women and children as their first victims and the application of the International Conventions and Laws seem, as of today, unequal to the task of controlling this trend.

CHAPTER 2
MEDICINE IN HUMANITARIAN ASSISTANCE

A. Malnutrition and Food Distribution

I. Assessment, Surveillance of Nutritional Status

Suitable methods must be adopted for the rapid and objective measurement of the nutritional status:

- of individuals eligible for special food relief (individual screening);
- of communities, in order to detect changes with time and decide priorities in food distribution (nutritional surveillance).

Weight-for-height is the best indicator for the diagnosis of nutritional status, nutritional surveillance, and individual screening. Weight-for-age and arm circumference are less reliable for assessment and screening but can be used to measure changes with time. Oedema rates are a valuable indicator when kwashiorkor is the prevalent form of Protein Energy Malnutrition (PEM) in the area.

Results of surveys and surveillance must be interpreted with caution. That can be misleading unless the individuals measured are representative of the whole population and the technique is standardised and properly used.

1. Why Measure Malnutrition in Emergencies?

During a nutritional emergency, the relief foods may be scarce and should be given to the people in greatest need. Since much of a population may be able to supply part or all of its own food, it is very useful to have an objective and quantifiable measure of nutritional status.

Measurement of nutritional status in emergencies relies mainly upon taking body measurements (anthropometry), particularly height, weight, and arm circumference. Valuable information may also be obtained from simpler methods, for example, monitoring clinic records or measuring the prevalence of oedema.

The most common reasons for measuring malnutrition in a relief program are:

- Initial assessment. A rapid survey of population should be done before initiating a relief programme, in order to identify the areas or groups that are most affected. Surveys of this type need to be carefully designed and conducted by an experienced team. They will not be considered further.
- Individual screening. Body measurements may be used to select the malnourished individuals eligible for food relief for themselves or their whole family.
- Nutritional surveillance of the population. The repeated measuring of entire communities gives an idea of differences among the various population groups and changes in nutritional status with time. It may be used to decide priorities in the distribution of relief and will also provide some information about the effectiveness of the relief programme. In nutritional surveillance, one is not interested in monitoring the progress of a child, but in knowing whether the overall nutritional condition of village (or camp) A is good or bad, is better or worse than that of village B and C (and so requires more supplies and personell), and whether it is improving or deteriorating with time. Nutritional surveillance should not be confused with the "surveillance" or follow-up of an individual child in nutrition centres or health services.

2. Indicators of Malnutrition

a) Clinical Signs of PEM or Specific Deficiencies

Clinical signs in this context are signs that can be rapidly assessed by touching or examining the child concerned rather than by instruments or tests.

- Oedema
- Clinical marasmus
- Night blindness
- Selected clinical signs

b) Body Measurements

Body measurements are used to detect malnutrition, but not food shortage, since malnutrition can also be caused by ignorance or faulty feeding habits in the presence of sufficient food. The results of body measurements can be misleading if considered in isolation.

Chronic undernutrition leads to a slowing in a child's rate of growth. A chronically malnourished child will be short for his age ("stunted") although he may be of otherwise normal proportions.

An acute episode of severe undernutrition results in a loss of muscle and fat which are used up to provide energy, and the individual becomes thinner without significant effect upon height ("wasting").

In an emergency what is important is the measurement of acute malnutrition, the effects of chronic malnutrition being of less concern. Because both stunting and wasting result in low weight-for-age, relating body measurements to age is not recommended. Two measurements are commonly used to access acute malnutrition ("wasting"):

- Weight-for-height
- Arm circumference (AC).

c) Presence of Diseases Associated with PEM

These, include measles, diarrhoea (defined for instance as three or more loose stools per day), whooping cough, etc.

d) Mortality Data

PEM is associated with increased mortality among young children (e. g., from measles, etc.).

The data collected should be expressed as rates: for example, the rate per thousand of marasmus among infants (aged 0-1) in a refugee camp is:

$$\frac{\text{Number of infants with marasmus in the camp}}{\text{Total number of infants in the camp}} \times 1000$$

3. Body Measurements

N. B. A very great effort should be made to measure children accurately. Small errors (e. g., 2-3 cm in height) in the measurement of a younger child may lead to significant errors in the classification of a child's nutritional status.

Select only one indicator:

- Weight-for-height. The recommended body measurement in times of emergency, is a sensitive indicator of acute malnutrition. It is fairly independent of sex, race, and age (up to about 10 years of age). It requires a sufficient number of robust scales and adequate training of personnel. Neither condition is easy to meet in an acute emergency situation.
- If ages are not known, arm-circumference-for-height is the best alternative. Measuring arm circumference instead of weight results in only a marginal saving of time compared to that required for travelling and assembling people. Several techniques such as the QUAC stick (Annex 5) have been devised to simplify field work and are useful for the screening of large numbers of children.
- As a second alternative, measurement of arm circumference alone (without measurement of height) is acceptable in situations where resources are extremely limited. Considerable time is saved by not measuring height. The sensitivity of the measure-

ment as an indicator is poor but is sufficient in situations where PEM is severe and widespread.

4. Other Indicators for the Evaluation of Relief Programmes

The following indicators can be useful in evaluating a relief programme:

- Age distribution of children attending relief centres compared with the age distribution from census data.
- Monthly attendance rate of children registered. This is obtained by dividing the monthly average number of those attending by the total number of children registered.
- Malnutrition rates in people attending relief centres compared with similar rates obtained by an occasional survey of random samples and house-to-house visits in the same area. This indicator is essential in confirming cards or growth charts:
    - Percentage of children losing weight over 1 month. Weight gain over a long period of time is no proof of a successful programme. Undernourished children may gain some weight and still fall into a lower nutritional category.
    - Percentage of children shifting to another nutritional category in a given period of time (e. g., from 70-80 % weight-for-height up to 80-90 % or down to 60-70 %). This information can easily be taken from the simplified growth chart.
    - Weight gain processed as weight gain as a proportion of last weight, the results being expressed as g/kg.

II. Nutritional Relief: General Food Distribution, Mass and Supplementary Feeding

1. Food Distribution

The are four ways in which food relief may be organised:

1. General food distribution. Dry food is distributed to people who are able to prepare their own meals.
2. Mass feeding. Prepared meals from a central kitchen are served to the population.
3. Supplementary feeding. In addition to the ration (dry foods or meals) for the whole family, vulnerable groups receive an extra meal or ration to meet their particular needs.
4. Intensive or therapeutic feeding of PEM cases.

Food must be nutritionally valuable as well as acceptable to the local population. Remember that foods that are not consumed have no nutritional value!

Average rations must be calculated to provide at least 6.3 MJ (1500 kcal)/person/day for a few weeks and 7.5 MJ (1800 kcal)/person/day for longer periods.

Organisation and planning (ration cards, distribution schedule) are the keys to the success or failure of a relief programme.

The are four ways in which food relief may be distributed:

1. General food distribution (dry rations);
2. mass feeding (cooked meals);
3. supplementary feeding of vulnerable groups;
4. therapeutic feeding.

The type of food distribution employed will depend entirely upon local circumstances. A refugee camp, where individuals have cooking facilities, may be adequately served by the distribution of dry rations alone, possibly with supplementary food for the vulnerable groups. Where a large rural population is affected but can find a proportion of its food locally, a range of programmes will be needed, e. g., some people with full rations, some with partial rations and selected groups with supplementary rations.

- Wherever possible, assist people at their homes and avoid setting up refugee camps.
- Distributing food to nomadic groups is difficult, and no easy way of doing so has been found. Points at which people congregate (e. g., water sources) may be selected as the best places at which to distribute food.

a) Basic Considerations in Selecting Foods

The food must:

1. correspond to the nutritional needs and food habits of the beneficiaries;
2. fulfil special logistic requirements, i. e. be easy to transport, store, and distribute; and
3. be available in sufficient quantities.

b) Calculating Dry Rations

This is best done on a family – rather than an individual – basis, since in this way the number of people attending distributions will be reduced and administration simplified.

c) Organising a Distribution

The key to running a successful food distribution programme is to be well organised. If rations are to be given out to, say, 5000 people, it is unrealistic to expect them to form a queue quietly and take food from openly exposed sacks – chaos would result.

The participation of the community in the relief programme and in decision-making will help towards an orderly distribution. However, responsible posts (store keeping,

administration) must be given to reliable individuals outside the community to rule out personal bias, preferences, or vulnerability to pressure.

People should be lined up for distribution and be called, e. g., four at a time by the guards (villages) or have to pass check-points (camps). If the ground is dry, they should be seated in lines. This will prevent pushing and is much less tiring than standing for hours, perhaps in the sun.

1. Distribution to villages, refugee camps and to nomads
2. Identifying individuals – ration cards
3. Food supplies

d) Mass Feeding (Cooked Meals)

Mass feeding is usually limited to institutions and refugee camps.

- Choice of food
- Calculating food rations
- Organisation of cooking facilities

1. Kitchens
2. Personnel and equipment
3. Fires and fuel
4. Hygiene and food storage

2. Therapeutic Feeding

PEM is treated by giving food of high nutritional value. Give 0.6-0.8 MJ (150-200 Kcal) and 2-3 g of protein per kg body weight. Reduced feeding is recommended for the first few days.

For the first few days, close supervision and feedings every three hours on a 24-hour basis are necessary. Mothers should co-operate and feed their sick children themselves.

Medical treatment and drug administration must be limited to essential items. Infection and dehydration are the major causes of death, which often occurs within the first four days. Antibiotic treatment of infectious and close supervision are essential. Immunisation against measles is recommended.

Criteria of recovery are:

- Oedema loss
- Weight gain
- Improvement of general condition

Failure is mainly due to faulty feeding or to infection.

3. Major Deficiency Diseases in Emergencies

PEM is the most important health problem during a nutritional emergency. Severe PEM can present several forms:

- Nutritional marasmus is characterised by a severe wasting away of fat and muscle ("skin and bone"). It is the most common form in most nutritional emergencies.
- Kwashiorkor is characterised by oedema, usually starting at the lower extremities.
- Marasmic kwashiorkor is a combination of wasting and oedema.
- Mineral and vitamin deficiencies may also be important.
- Severe anaemia is common and requires a daily intake of iron for an extended period of time.
- Vitamin A deficiency, the most important vitamin deficiency, is characterised by night blindness and/or eye lesions which may lead to permanent total blindness. The severe forms are usually associated with PEM.
- Other deficiency conditions are less common: beriberi, pellagra, scurvy, rickets.
- Mineral and vitamin deficiencies must be identified and the individuals affected or at risk treated by administration of the missing nutrient.

a) Protein Energy Malnutrition (PEM)

PEM is a problem in many developing countries, even in normal times.

In times of nutritional emergency it is primarily the more acute forms of PEM that have to be dealt with. These are characterised by a rapid loss of weight and may be evident in a much wider range of age groups than usual. For example, significant numbers of older children, adolescents, and adults may also be affected.

Past experience has shown that many emergencies affect the supply of food to only a proportion of the population concerned. The situation will obviously vary from place to place, but it is often the case that only a small proportion of the total population presents clinical signs of severe PEM. For each case of severe clinical PEM there may well be 10 moderate cases and 100 children of "near normal" nutritional status. Progression from moderate to clinically severe forms is rapid.

b) Severe Forms of PEM

The severe forms of PEM are:

- Nutritional marasmus
- Kwashiorkor
- Marasmus kwashiorkor

c) Nutritional Results from Prolonged Starvation

The main sign is a severe wasting away of fat and muscle. It is the most frequent form of PEM in cases of severe food shortage.

d) Kwashiorkor

The main sign is oedema, usually starting at the lower extremities and extending, in more advanced cases, to the arms and face. The child may look “fat” so that the parents regard him as well-fed.

e) Vitamin A Deficiency and Xerophtalmia

Vitamin A deficiency is the leading cause of permanent blindness in pre-school children. It is almost always associated with some degree of PEM. Xerophtalmia is the term used to describe the eye signs caused by vitamin A deficiency.

Vitamin A deficiency is most likely to be a problem in areas where the diets of the very poor, even in normal times, do not meet requirements.

Since vitamin A is stored in the liver, a sudden deterioration in the diet does not necessarily produce an immediate sharp rise in the incidence of cases, and there may well be a delay of several months until vitamin A deficiency occurs.

B. Drugs and Medical Equipment

Anybody responsible for the provision, distribution, or administration of medicines is at risk of implementing harmful treatment practices just by proceeding as he is used to in Europe. The difference between the standard we are used to and which we consider normal – individual medicine with virtually all imaginable resources immediately available – and the situation in areas, where humanitarian assistance is required and provided – “mass medicine” with restricted technical support and budget, limited supplies, and often shortage of qualified staff – is tremendous.

In such situations resources will always be limited. This applies almost regularly to available means of transport – as well for medical materials such as drugs as for the staff to be brought into the operational area. In situations such as disaster relief operations where the need is greatest, restrictions will usually be even more pronounced. Inevitably priorities must then be set. Assigning larger shares of available logistics, e. g. transport facilities, to the transfer of “luxury” pieces of equipment or using up available funds for few expensive drugs is of little value and indeed counterproductive since an advantage for few patients will be paid for by many who may have to do without essential medicines.

From the very beginning of any medical project in humanitarian assistance some rules concerning the provision and use of medicines should vigorously be followed:

1. It should be checked, whether a national “standard drug list” or “essential drug list” exists before ordering or allocating medicines, especially drugs.
   Today almost all countries have a national drug list, which is often legally binding. Importation of drugs not included in this list may even be prohibited by law.
   In many countries these lists contain guidelines as to which drug is to be used on what level of medical care. As an example, medicines distributed by village health workers are usually limited to five to ten essential drugs like aspirin, chloroquin, or paracetamol. The provision and use of sophisticated and expensive drugs is usually restricted to hospitals with adequate diagnostic facilities.
2. Only drugs included in this “standard drug list” should be ordered, provided and used. Eventual guidelines as to which drug is to be used on what level of medical care should be followed strictly.
   This may sometimes be very difficult for medical staff from Europe, used to having a perfectly equipped hospital pharmacy available at virtually all times. But ignoring these rules will create needs which can not be satisfied. It must be kept in mind that expatriate medical teams are often setting an example. And it should be considered that medical projects in humanitarian assistance will usually only be maintained for a rather limited period of time.
3. If however there is no national “standard drug list”, only drugs should be ordered, provided, or used that are included in the “Model List of Essential Drugs”.
   This list is updated regularly by an independent multinational expert committee under the auspices of the World Health Organization. Although the model list contains only some 300 drugs, adequate therapy of all acute diseases is possible. To give an example, you find below the anti-infective drugs entered into the list (table 3).

1. Anthelmintics
   Albendazole, diethylcarbamazine, ivermectin, levamisole, mebendazole, metrifonate, niclosamide, oxaminiquine, praziquantel, pyrantel, suramin sodium.
   Antibacterials
   Penicillins: Amoxicillin (orally), ampicillin (by injection), benzathine benzylpenicillin, benzylpenicillin, cloxacillin, phenoxymethylpenicillin, procaine benzylpenicillin.
   Other antibacterials: Ceftazidime, ceftriaxone, chloramphenicol, ciprofloxacin, clindamycin, cotrimoxazole, doxycycline, erythromycin, gentamicin, metronidazole, nalidixic acid, nitrofurantoin, spectinomycin, sulfadimidine, tetracycline, trimethoprim, vancomycin.
   Antileprosy drugs: Clofazimine, dapsone, rifampicin.
   Antituberculosis drugs: Ethambutol, isoniazid, isoniazid + ethambutol, pyrazinamide, rifampicin, rifampicin + isoniazid + pyrazinamide, streptomycin, thiacetazone + isoniazid.
   Antifungal drugs
   Amphotericin B, flucytosine, griseofulvin, ketoconazole, nystatin, potassium iodide.
   Antiprotozoal drugs
   Antiamoebic and antigiardiasis drugs: Diloxanide, metronidazole.
   Antileishmaniasis drugs: Amphotericin B, meglumine antimoniate, pentamidine.
   Antimalarial drugs: Artemeter, chloroquine, doxycycline, mefloquine, primaquine, proguanil, quinine, sulfadoxine + pyrimethamine.
   Antitrypanosomal drugs: Benznidazole, eflornithine, melarsoprol, nifurtimox, pentamidine, suramin sodium.
   Repellents: Diethyltoluamide.

Table 3. List of anti-infectives contained in the WHO "Model List of Essential Drugs" (according to the draft of the seventh list – to be published in 1997).

4. If at all possible, only the INN (*I*nternational *N*onproprietary *N*ame) should be used. Drugs should be labelled with their INN whenever possible. When prescribing or using drugs, the INN should be preferred as well.
   The INN is a term which relates closely to the chemical structure of a given drug. It is supposed to be used all over the world, thus reducing dependency of the (fantasy) names selected and attributed solely for commercial reasons by the company producing or distributing a given drug. Although these brand-names may be quite beautiful and easy to remember (if it is a name in your language), simply the multitude of different names already brings about a substantial risk of errors in drug administration. This can be prevented by the consequent use of the INN. Furthermore the use of generic drugs (drugs named by their INN) prevents dependency on the product of a particular company which may not be constantly available. Very important is the fact, that generics are less expensive. And that difference is substantial, many generics are up to 98 % cheaper than brands!
5. Before buying or ordering disposable materials, alternatives should be carefully considered. Reusable materials should be preferred whenever possible.
   Disposable material is not only much more expensive to buy, more costly in transport and bulky to store, it creates as well a waste problem.

6. In setting up a medical station, simple rather than sophisticated medicines and equipment should be considered.
   Even in the beginning of medical projects there will often be a large number of patients while diagnostic and therapeutic facilities are still being established.
7. Any disaster type situation imposes a limited choice of drugs and medical materials; the more demanding the emergency, the less complicated the medical procedures and patient management need be.
   Often only simple and standardised treatment schedules will allow to cope with the huge number of patients to be treated. The "New Emergency Health Kit" (table 4) is often used as basic equipment for disaster management. This kit is available immediately e. g. from IDA and from UNIPAC. Looking into its contents and considering its possible shortcomings beforehand may be helpful.

The "New Emergency Health Kit" consists of ten "Basic Units" and one "Supplementary Unit".

- 10 basic units (for basic health workers), each unit for a population of 1,000 persons for 3 months.

Each unit contains drugs, renewable supplies and basic equipment, and is packed in one carton (approximately 45 kg).

- 1 supplementary unit (for physicians and senior health workers), for a population of 10,000 people for 3 months (approximately 410 kg).

Basic Unit (for 1,000 persons for 3 months)

Drugs		
Acetylsalicylic acid, tab 300 mg	tab	3,000
Aluminium hydroxyde, tab 500 mg	tab	1,000
Benzyl benzoate, lotion 25 %	bottle 1 litre	1
Chlorhexidine (5 %)	bottle 1 litre	1
Chloroquine, tab 150 mg base	tab	2,000
Ferrous sulfate + folic acid, tab 200 + 0.25 mg	tab	2,000
Gentian violet, powder	25 g	4
Mebendazole, tab 100 mg	tab	500
ORS (oral rehydration salts)	sachet for 1 litre	200
Paracetamol, tab 100 mg	tab	1,000
Cotrimoxazole 480 mg	tab	2,000
Tetracycline eye ointment 1 %	tube 5 g	50

(continued)

Renewable supplies		
Absorbent cotton wool	kg	1
Adhesive tape 2.5 cm x 5 m	roll	30
Bar of soap (100-200 g)	bar	10
Elastic bandage (crêpe) 7.5 cm x 10 m	unit	20
Gauze bandage 7.5 cm x 10 m	roll	100
Gauze compresses 10 x 10 cm, 12 ply, nonsterile	unit	500
Ballpen, blue or black	unit	10
Exercise book A4, hard cover	unit	4
Health card + plastic cover	unit	500
Small plastic bag for drugs	unit	2,000
Notepad A6	unit	10
Thermometer Celsius/Fahrenheit	unit	6
Protective glove, nonsterile, disposable (10 pairs)	unit	100
Treatment guidelines for basic list	unit	2
Equipment		
Nail brush, plastic, autoclavable	unit	2
Bucket, plastic, approx. 20 litres	unit	1
Gallipot, stainless steel, 100 ml	unit	1
Kidney dish, stainless steel, approx. 26 x 14 cm	unit	1
Dressing set (3 instruments + box)	unit	2
Dressing tray, stainless steel, 30 x 15 x 3 cm	unit	1
Drum for compresses, approx. 15 cm H, diam. 14 cm	unit	2
Foldable jerrycan, 20 litres	unit	1
Forceps Kocher, no teeth, 12-14 cm	unit	2
Plastic bottle, 1 litre	unit	3
Syringe Luer, disposable, 10 ml	unit	1
Plastic bottle, 125 ml	unit	1
Scissors straight/blunt, 12-14 cm	unit	2

Supplementary Unit (for 10,000 persons for 3 months)

One supplementary unit contains:

- drugs (approximately 130 kg): Anaesthesics (ketamine, lidocaine), analgesics (e. g. pentazozine), anti-allergics (e. g. prednisolone), anti-epileptics (e. g. diazepam), anti-infective drugs (e. g. chloramphenicol), cardiovascular drugs (methyldopa, hydralazine), dermatologicals (e. g. polyvidone iodine), diuretics (furosemide), gastro-intestinal drugs (promethazine, atropine), oxytocics (ergometrine maleate), psychotherapeutics (chlorpromazine), anti-asthmatics (aminophylline, epinephrine);
- essential infusions (approximately 180 kg): Ringer's lactate, glucose;
- renewable supplies (approximately 60 kg): e. g. needles and syringes, scalp vein infusion sets, i. v. placement cannulas, spinal needles, sutures, feeding tubes;
- equipment (approximately 40 kg): e. g. sphygmomanometers, stethoscopes, scales, otoscope, scissors, forceps, sterilizer, water filter.

(continued)

> *Important:* The supplementary unit does not contain any drugs and medical supplies from the basic unit. To be operational, the supplementary unit should be used together with ten basic units.

Table 4. Basic drug requirements for 10,000 persons for 3 months, as contained in the New WHO Emergency Health Kit

The composition of the New Emergency Health Kit is based on epidemiological data, population profiles, disease patterns and certain assumptions borne out by emergency experience. These assumptions are:

- The most peripheral level of the health care system will be staffed by health workers with only limited medical training, who will treat symptoms rather than diagnosed diseases and who will refer to the next level those patients who need more specialised treatment.
- Half of the population is 0-14 years of age.
- The average number of patients presenting themselves with the more common symptoms or diseases can be predicted.
- Standardised schedules will be used to treat these symptoms or diseases.
- The rate of referral from the basic to the next level is 10 %.
- The first referral level of health care is staffed by experienced medical assistants or medical doctors, with no or very limited facilities for inpatient care.
- If both the basic and first referral health care facilities are within reasonable reach of the target population, every individual will, on average, visit such facilities four times per year for advice or treatment. As a consequence the supplies in the kit, which are sufficient for approximately 10,000 outpatient consultations, will serve a population of 10,000 people for a period of approximately three months.

Selection of the drugs:

- Injectable drugs:
  There are no injectable drugs in the basic unit. Basic health workers with little training have usually not been taught to prescribe injections neither are they trained to administer them. Moreover, the most common diseases in their uncomplicated form do not generally require an injectable drug. Any patient who needs an injection must be referred to the first referral level.
- Drugs not included in the kit:
  The kit includes neither the common vaccines nor any drugs for communicable diseases such as tuberculosis or leprosy. In addition, drugs in the kit do not cover some specific health problems occurring in certain geographical areas, e. g. specific resistant malaria strains.

8. Logistic problems due to difficult climate or “technical” conditions (rains, road conditions, fuel shortages, war, etc.) should be taken into consideration beforehand.

It is usually advisable to order and to supply all materials needed for at least three months. This implies that there is sufficient space for safe storage prior to the arrival of the first shipment.

- Vaccines should only be bought or ordered after a functioning cool chain has been established.
- With the exception of measles vaccinations mass vaccinations are of no or doubtful value during the acute stage of natural disaster.
- Syrups, ointments or liquid preparations intended for use in moderate climates will often become a mess in hot climates: containers may start leaking.
- Initiation of long-term treatment (e. g. tuberculosis or leprosy) under difficult conditions such as mass migration in time of turmoil or natural disaster is usually not recommendable, drugs used for these diseases must therefore not be provided in first line.
- In hot climates, stock rotation is a much more crucial issue than in Europe. Using a perished antituberculosis drug may have disastrous consequences. Astonishingly, little hard facts are available on the degree of deterioration of drugs in hot climates. Many drugs lose their potency rapidly if exposed to sunlight. Some information about the stability of drugs and how to recognise perished drugs is listed in table 5. Some information about the stability of vaccines is listed in table 6.

Drug	Stability characteristics	Signs of perishment
acetylsalicylic acid tabs	very stable	acetic acid odour
chloroquine tabs	very stable <37°C	
chlorpromazine gluconate inj.		brown or violet colour
dapsone tabs		discoloration by light
epinephrine inj.		red colour
ferrous sulfate + folic acid tabs		discoloration, change in consistency
isoniazid	<25°C stable for 1 year	
insulin (depot) inj.	<25°C stable for several months	
	<37°C stable for at least 1 month	
lidocaine inj.	very stable	
oral rehydration salts		dark brown colour
oxytocin (synthetic) inj.	<25°C stable for years	
tetracycline tabs		brown colour
water for injections		cloudiness

Table 5. Stability characteristics and signs of perishment of some drugs

Stability at a storage temperature of:			
	2-8° C	*20-25° C*	*37° C*
BCG (lyophilised)	12 months	4 weeks	1 week
diphtheria (toxoid)[1]	2-6 years	6-12 months	2-6 months
hepatitis B[1]	3 years	1-3 months	?
measles			
– lyophilised	1-2 years	1-4 months	1-4 weeks
– dissolved in water	1 day (?)	4-24 hours	1 hour
meningococcus	2 years	1-2 months	?
pertussis[1,2]	18-24 months	1-2 weeks	1-3 days
polio (oral)	3-12 months	1-2 weeks	2 hours
rabies (lyophilised)	1-2 years	2-4 weeks	?
tetanus (toxoid)[1]	2-6 years	6-12 months	2-6 months
tuberculin (ppd)		6-12 months	?

Table 6. Stability characteristics of some vaccines
[1] freezing will cause significant loss of potency immediately
[2] higher stability in combined DTP vaccines

9. Before asking for or accepting drug donations, benefits ought to be weighed carefully against disadvantages.
   A good guide are the "Guidelines for Donors and Recipients of Pharmaceutical Donations" of the Christian Medical Commission (table 7). It should be kept in mind, that time and money necessary to collect, check (for expired preparations), sort, and relabel donated drugs and higher transport costs (due to smaller and usually less suitable drug units) may well make up for the financial gain compared to the price to be paid for perfectly suitable medicines procured by suppliers specialised in this field (see below).

1. Donations should consist *only* of drugs of known good quality that are included in one of three lists: the list of essential drugs supplied by the recipient, the national drug list of the country concerned, or the WHO model list of essential drugs.
   Reasons:
   - donors should respect national drug policies, as well as the WHO essential drugs concept and the rationale behind it;
   - adherence to the above lists, with very few exceptions, automatically excludes fixed-ratio combination drugs for which there is no scientific justification;
   - donors should support the implementation of the WHO Certification Scheme.

   Note: Any substitutions to the recipients' list should be made only with their approval and should be accompanied by adequate prescribing information in a language understood by the recipients.
   Donated drugs should be labelled by their generic names (INN = International Nonproprietary Names).

(continued)

Reasons:

these names are internationally known and understood in any country where Roman script is used;

receiving the same drug (active ingredient) under different names, as can happen with brand-names, is confusing to local health personnel and potentially dangerous;

most health workers know generic names from their training;

this prevents the creation of brand-name loyalty.

If a drug is sent to the same place or programme regularly, preferably the dosage strength of the drug should remain constant.

Reasons:

workers at different levels of the health care system have been trained in their use in relation to a particular dosage strength, and treatment schedules have been developed accordingly;

health workers have often had insufficient training in making the necessary calculations to modify treatment schedules.

Large-quantity packing units (e. g. 1000 tablets) are more suitable than small-quantity units.

Reasons:

these are better suited to the workflow in health care facilities;

drug shipments thus are less bulky and therefore easier and cheaper to transport and easier to store.

This should not be understood as an encouragement to repack drugs into the same container from small packaging units of different batches and expiry dates.

Drugs should have a shelf-life of at least one year after the estimated arrival in the country of destination and should be sent in quantities previously agreed between recipient and donor.

Reasons:

many countries have logistical problems in distribution;

the drug delivery system is often based on certain intervals (e. g. three months) and does not allow for immediate distribution;

the climate (hot and humid in many countries) can shorten the actual shelf-life of products;

this facilitates planning for future supplies and avoids oversupplies and possible wastage.

To enable local purchase or manufacture of drugs a financial contribution or donation of raw materials may be more appropriate.

Reasons:

it is sometimes cheaper to buy the drugs locally; this involves only a fraction of the transportation costs and encourages setting up of a revolving drug funds;

support of local industry is a more development-oriented approach.

(continued)

In 1996 “Guidelines for Drug Donations” were published jointly by WHO, UNHCR, UNICEF, ICRC, MSF, OXFAM and others. Basically there is no difference to the publication above.

Table 7. Extracts from: Guidelines for donors and recipients of pharmaceutical donations issued by the Christian Medical Commission, World Council of Churches, 150 Route de Ferney, CH-1211 Geneva 2 (copies in several languages are available free of charge).

10. Drugs and medical equipment should be obtained from renowned companies specialised in the procurement of materials for developing countries.
    It is too little known that there are several companies which have specialised in the production and supply of high quality drugs and medical equipment for developing countries. Medicines are supplied under their INN in larger units and labelled in several languages (choice of languages may be adapted to actual needs). In addition, these products are provided in galenic preparations and packages suitable for tropical climates. The containers of syrups and ointments, for example, have larger space to extend without causing the container to start leaking than products manufactured for temperate climates. This is quite important in the tropics, where drugs will often be exposed to temperatures exceeding 40°C. Prices are astonishingly low compared to actual prices in European pharmacies. It must be stressed, that these drugs are of best and regularly controlled quality. This can be recognised by the statement that a drug is manufactured e. g. “according to B. P.” or “according to U. S. P.”. This indicates that the pharmacological quality of the drug has guaranteed properties which are specified in the British Pharmacopoeia (B. P.), the United States Pharmacopoeia (U. S. P.), or similar works. In these pharmacopoieas there are clear-cut rules as to drug content (usually 97 % to 103 % of the declared amount must be in the particular medicament), bioavailability, stability, etc.
    Most companies procuring drugs can also supply medical equipment, dressing material, syringes etc.
    Using the expertise of these companies may help to avoid a lot of frustration. A good example is the choice of an operating table for hot and humid climates: Few of the those available in Europe are suitable, while even very good and very expensive ones will start rusting within few months.
    Furthermore there is a rapidly increasing risk of acquiring counterfeit drugs, often with fatal consequences to the patients, as soon as drugs are obtained from doubtful sources. Examples of the last years are the sale of a vaccine against meningococcal meningitis without any protective effect in Niger, and the distribution of a paediatric cough syrup containing diethylene glycol instead of glycerol as solvent in Haiti. While a quantitative assessment of the disastrous consequences of an ineffective vaccination against an often lethal epidemic disease is hardly possible, it is known that the cough syrup caused the death of at least 50 children.
    Consult table 8 for prices of drugs and medical materials.
    Consult table 9 for addresses of some efficient and reliable suppliers.

Acetylsalicylic acid	500 mg	1,000 tabs	3.00 US$
Ketamine	500 mg	25 vials	17.00 US$
Mebendazole	100 mg	1,000 tabs	8.00 US$
Amoxicillin	500 mg	1,000 tabs	55.00 US$
Amoxicillin syrup	1.500 mg	50 bottles	30.00 US$
Cotrimoxazole	400+80 mg	1,000 tabs	12.00 US$
Doxycycline	100 mg	1,000 tabs	16.00 US$
Erythromycin	250 mg	1,000 tabs	45.00 US$
Cloxacillin	250 mg	1,000 tabs	30.00 US$
Penicillin G	1M IU	50 vials	12.00 US$
Metronidazole	500 mg	25 vials	24.00 US$
Dapsone	100 mg	1,000 tabs	5.00 US$
Chloroquine phosphate	250 mg	1,000 tabs	9.00 US$
Isoniazid	300 mg	1,000 tabs	9.00 US$
Ferrous sulphate	200 mg	5,000 tabs	9.00 US$
Multivitamins		5,000 tabs	13.00 US$
Vitamin A	200,000 IU	1,000 tabs	26.00 US$
Povidone-iodine sol.	10 %	1 l	6.00 US$
Povidone-iodine ointm.	10 %	250 g	8.00 US$
Syringes 2 ml		100	3.00 US$
Injection needles		100	2.00 US$
Scalp vein infusion sets		100	10.00 US$
i. v. placement unit		100	40.00 US$
Latex gloves		100	5.00 US$
Gauze bandages 5 cm x 5 m		100	14.00 US$
Emergency Health Kit		(complete)	11,000.00 US$

Table 8. Approximate prices for some often used drugs

- UNIPAC UNICEF procurement and assembly center, UNICEF Plads DK-2100 Copenhagen-Freeport, Phone: (0045) 35-273527, Fax (0045) 35-269421, E-mail: supply@unicef.dk.
- Sanavita, P. O. Box 1252, D-59355 Werne, Phone:(0049) 2389-79720, Fax:(0049) 2389-797259, Telex 820830, E-mail: sanavita@rocketmail.com.
- action medeor, St. Toeniser Str. 21, D-47918 Toenisvorst, Phone: (0049) 2156-97880, Fax: (0049) 2156-80632, E-mail: action.medeor@t-online.de.
- ECHO, Ullswater Crescent, Coulsdon Surrey CR5 2HR (GB), Phone: (0044) 181-6602220, Fax: (0044) 181-6680751, E-mail: cs@echohealth.org.uk.
- Stichting IDA, P. O. Box 37098, NL-1030 AB Amsterdam, Phone: (0031) 20-4033051, Fax:(0031) 20-4031854, E-mail: ida_sale@euronet.nl.

Table 9. Addresses of some companies procuring drugs and medical materials/equipment

C. Control of Communicable Diseases in the Context of Humanitarian Aid

I. Introduction

The incidence of tuberculosis (TB) in Europe began to decrease even before drugs were used against the disease. We know today that this was the result of improved living conditions and nutrition. Similarly, we observe an increase in the incidence of TB today in regions of the world where war, floods of refugees and poverty produce a deterioration in living standards and people are forced into cramped living quarters. AIDS, too, is predominantly a disease of the poor – especially in countries of the southern hemisphere. And since an HIV infection creates favourable conditions for an opportunistic TB infection, we observe a general increase in the incidence of TB world-wide.

The relationship between a cholera epidemic and the context of poverty, war and other disasters is very obvious. Cholera is transmitted via water and food that have been contaminated with infectious faeces. Thus it is a disease caused by unhygienic living conditions which become particularly dangerous in times of natural and man-made disasters.

> Most people will remember the catastrophic cholera outbreak in 1994, when more than one million refugees, mostly Hutus, crossed the border into neighbouring Zaire.

Thus, some knowledge of communicable diseases – especially those with epidemic potential, their mode of transmission, their clinical picture, as well as possible control measures is indispensable for relief workers in the field of humanitarian aid in emergency and disaster situations.

This chapter does not aim at giving a complete overview of infectious diseases. In other words, it does not intend to replace the many excellent books on the subject, some of which are listed and recommended for further reading at the end of this chapter. Instead, just a few typical infectious diseases have been selected in order to discuss appropriate control measures by way of *example*. The epidemics discussed here were experienced by the author under conditions of war and national disaster. Hence, this material is intended to serve as a starting point, based on practical experience. It should be complemented by the lectures and deepened by personal reading.

People with medical training tend to concentrate on the infectious agent, its virulent properties, the dosage which causes infection, and the immune response of the subject. And these matters are in fact essential for a correct understanding of the interaction between the infectious agent and the infected subject. However, these factors cannot be isolated from the geographical and social context. In particular, the quantity of infectious substrate causing infection in humans and the condition and immune response of the human subject depend to a considerable degree on the environment of the subject. Especially the geographical and social environment in which human beings are forced to live and move about during war and disaster situations should be given more attention.

The spread of an infectious disease within a certain population, or within a population group, where the disease is *endemic* (i. e., the number of cases remains more or less constant) or during an *epidemic* (where the number of new infections increases rapidly within a given time) is linked to factors that influence, for example, the human-vector contact, where the disease is spread by a vector. (Vector = an animal which transmits the infectious agent to humans.) It is also linked to factors which influence the infection rate among vectors, such as climate, vegetation, altitude, working and living conditions of the human population – to name but a few.

Thus, a better understanding of the causes of infectious diseases and an intelligent management of public health issues requires co-operation between the different professions and mutual respect in order to learn from one another. The group of people for whom this book has been written are in an excellent position to contribute to such a dialogue.

II. The Effects of War on the Health of the Civilian Population, in Particular on the Spread of Contagious Diseases

There are 6 main scenarios associated with wars, refugee movement and the breakdown of infrastructures:

1. Refugees in the Periphery of a Neighbouring Country

When refugees enter the periphery of a country, they are often confronted with poverty among the indigenous population as it is usually an area of low income, sparcely populated, with few natural resources and a weak infrastructure. Until aid is given on a large scale, there is a lack of food and medical care. If this aid is concentrated exclusively on the refugee community, tensions are often created between the indigenous population and the refugees because of the general poverty of the region. Before the introduction of humanitarian aid, infectious diseases (a sudden outbreak of cholera, followed by shigellosis and typhoid fever) have already caused deaths in the area. This is the result of inadequate sanitation and water, lack of hygiene, poor housing, and insufficient or unbalanced nutrition.

2. Displaced Persons in an Urban Setting

People who become “displaced” as the result of a civil war generally show a preference to flee to a large town, where they have relatives who can take them in.

During the recent civil wars in Liberia and Sierra Leone, the international security forces also created areas which offered more stability than the rest of the country.

This phenomenon produces overcrowding, the infrastructure is unable to cope with the sudden influx, and food supplies become inadequate as the surrounding countryside is not able to keep up its production. The extended family, suddenly concentrated in the town, is dependent on just one or a few breadwinners. Under these conditions, infectious diseases, such as tuberculosis, are very likely to spread.

3. The Few Remaining Centres Become a Draw-Factor

Areas of a country that have suffered severe destruction during a civil war become unsafe. As people flee from the danger, structures break down: health centres are closed when staff no longer receive their pay or medical supplies run out. The only centres which continue to function in such a situation are those belonging to church and foreign organisations. Patients bear down on the few remaining centres from far and wide. Many of them walk through the countryside for several days. If they have a communicable disease – especially one transmitted by a droplet infection, such as measles – the outbreak of an epidemic is inevitable, especially since preventive measures, such as immunisation, have almost certainly been discontinued for some time. The health centre has more work than it can cope with. More patients than usual have to remain for treatment as their homes are too far away for them to return to the centre within a few days. Thus, they have to be given accommodation. In these circumstances, provisions of water and sanitation are generally inadequate, the accommodation quickly becomes overcrowded, and food supplies are insufficient. These factors, in turn, create a health threat and can lead to the outbreak of communicable diseases. Furthermore, the reduction in the number of health centres often means that patients seek help too late. Some of them will die when they eventually do reach one of the remaining health centres, and this creates even more stress for the health workers. This scenario may also occur when humanitarian aid organisations are forced by the local political authorities to restrict their activities to the towns.

This was the case in Ethiopia under *Meguisto Haile Miriam,* whose intention was to conceal human rights violations in this way. Some observers then blamed the relief organisation, operating in one of the Ethiopian towns, for the outbreak of cholera, and the health workers probably were at fault for they should have foreseen that their activities would create a draw-factor, leading to overcrowding in a town without adequate sanitation and water.

4. Forced Resettlement of People into Other Parts of Their Country During Political Unrest

(E. g. in former Ethiopia, at present in Burundi) Under the pretence of providing protection for specific population groups, people are resettled against their will. Particular ethnic groups, thought to be directly or indirectly involved in a conflict, are generally singled out in this way in order to prevent them from organising themselves. They are resettled in areas without a functioning infrastructure, which also causes severe health hazards for them (e. g. the outbreak of louse-borne typhus in the so-called regrouping camps of Burundi). In addition, they could be exposed to diseases from which they do not have any immunity.

5. Refugee Camps

The general health situation and the threat of epidemics in refugee camps depend on different factors: the available space within the camp, the number of newcomers at a given time, the resources in the surrounding countryside and their availability to the refugees (relations between the refugees and the indigenous population, the official political status of the refugees). Under the worst imaginable circumstances, one can expect communicable diseases to occur in a sequence: first cholera, then measles, followed by shigellosis, typhus, and scabies; then trachoma and respiratory infections, aggravated by malnutrition. Exposure to adverse climatic conditions, the lack of immunity to certain diseases that are prevalent in the region, and the absence of medical services can add to the problem. The overcrowded living conditions also lead to the spread of tuberculosis and the disruption of therapy gives rise to drug resistance.

6. Returnees

The vulnerability of returnees depends on the following factors: their nutritional status, the medical care they have received as refugees (e. g. immunisation and early treatment in the case of disease), the amount of food they are given until they are able to grow their own crops again, and the situation with which they are confronted on their return home. They will often discover that the infrastructure has been weakened or even completely destroyed in their absence. There is often a lack of water and adequate health care. (Sanitation will be less of a problem, provided the refugees return straight home and do not have to stay in reception centres for a long time. The conditions in reception centres are often similar to those in refugee camps.) Malnutrition may cause particular susceptibility to infections. The interruption of medical supplies will be a problem, especially in individual cases of TB. This becomes a problem for the community when TB spreads after drug resistances developed.

These scenarios must be foreseen in good time. They can be averted by prompt and appropriate action.

When an acute disaster occurs, it can best be managed by organisations already operating in the region and familiar with the circumstances, if they have the capacity to re-

spond immediately. The time it takes an international agency to negotiate an agreement with the local government can often be saved by providing direct support to partners locally. In the event of a cholera epidemic, relief workers and their equipment from abroad will arrive too late anyway.

> In the autumn of 1996, when half-a-million Hutu refugees returned home to Rwanda from Eastern Zaire within just a few days, it was possible to prevent the outbreak of an epidemic because the country was already receiving humanitarian aid and the relief workers were well-organised and prepared for the return of the refugees.

On the other hand, it can be an important gesture of solidarity when a foreign agency promptly sends one or more aid workers into a disaster area. And if the peripheral structures of the local partner organisations are weak or even non-existent or if their equipment is inappropriate, such aid workers can provide significant support. Foreigners, who are outsiders in the civil war, can also protect the local partner from being too exposed in a politically sensitive situation.

The following qualities are essential in people who are engaged in disaster management, especially in epidemics: they must be well-informed about the local situation, they must have relevant experience, they must be able to work together with others, they must be ready to accept responsibility, they must be able to listen and adapt quickly, and they must be politically impartial.

III. Examples of the Control of Communicable Diseases

1. Malaria

Malaria is a parasitic disease caused by plasmodium species of different types: *Plasmodium falciparum* causing "malignant malaria"; *Plasmodium vivax* and *ovale, "malaria tertiana";* and *Plasmodium malariae* (very rare), *"malaria quartana".* It is transmitted to humans by the bite of an infected female anopheline mosquito, that injects the parasite with its saliva after biting through the skin and before taking the blood meal. The parasites have different geographical preferences and display different clinical pictures. The most common in tropical Africa and the most dangerous disease in humans is "malignant malaria". It causes many deaths if untreated. *"Malaria tertiana"* shows a tendency to relapse irregularly some time after successful treatment. "Malignant malaria" *(P. falciparum),* on the other hand, shows at most so-called "recrudescences" after an insufficient or inappropriate regime of treatment.

During January and February 1997, a malaria epidemic was reported from the refugee camp "Tingi Tingi", near Lobutu, in Eastern Zaire. Some weeks before, thousands of Rwandian refugees, who had lived for 2 years in the camps near Goma and Bukavu, were expelled to this area in the course of the war.

Not only small children were affected by malaria, as was usually the case in the plains around Lobutu where malaria transmission occurs throughout the whole year. Suddenly adults, too, fell ill with malaria, and there were also deaths reported among them. How was it possible that the refugees reacted differently from the indigenous population?

The explanation is simple. The newcomers came from the mountainous area around the Kivu Lake, where malaria is not generally found. It is only sporadically seen there, due to the altitude and a cooler climate. In contrast to the local population, the refugees therefore lacked a protective "semi-immunity", that only exists in people who permanently live in areas with continuous malaria transmission.

Semi-immunity requires constant renewal by infection. People don't have it for life, as is the case for example with immunity after having measles.

The epidemiological expression for this type of malaria is *"stable malaria"*, whereas *"unstable malaria"* occurs in areas with only seasonal malaria. The latter often has different annual intensities of transmission or only sporadic local epidemic outbreaks in different years. Unstable malaria affects therefore children and adults, because the population is only able to acquire a low level of immunity.

These expressions, "stable" and "unstable", refer to the degree to which the spleen is affected among different age groups within a population. Besides this criteria, however, morbidity and mortality rates must certainly also be considered when measuring the severity of clinical malaria and deciding on control measures.

But the expressions "stable" and "unstable" are nevertheless helpful in understanding the usual connection between mosquito density, rate of mosquitoes infected with the parasite, and the age group in which the disease most frequently occurs and where complications and deaths are most commonly observed.

In "holoendemic areas", a subdivision of "stable malaria" areas, which provide the most effective conditions for transmission throughout the year, mostly children under the age of 5 years suffer severely from the disease. These children have an enlarged spleen in more than 75 % of the cases. In older children, the disease becomes less severe, whereas adults are often hardly aware of their infection because of their acquired "semi-immunity".

If such a person leaves the area where he has lived, he loses his semi-immunity within months (to a few years). Returning home, he might well experience severe malaria again. The same happens to migrants and relief workers from Europe who can fall ill, no matter how old they are, because they lack immunity.

This is the phenomenon which added malaria to the numerous other health problems of the refugee community in the Tingi Tingi Camp as it does in many other war zones in tropical countries under similar conditions.

After the discovery of chloroquine (a medicine that is effective against the parasite in a particular stage of its development) and DDT (a residual insecticide), the World Health Organization made plans to eradicate malaria completely. It was decided to organise regular spraying campaigns of the entire walls of houses in areas with effective transmission of malaria through anopheline mosquitoes every 6 months. After taking a meal, mainly in the evening and at night in (or near) human habitats, the mosquitoes tend to rest on walls inside the house while digesting the blood. If they come into contact with DDT, sprayed on to the walls, the mosquitoes die. However, this project was a failure as the mosquitoes quickly developed a resistance to DDT.

Parallel to this development, the parasite also developed a resistance to chloroquine. This created a huge health problem in many tropical countries, where malaria was temporarily weakened, only to return in full force a short time later.

Today we would consider it a considerable success if malaria could be just effectively controlled. Various organisations have tried to create more effective treatment centres in the areas where the patients live, but not surprisingly in areas of war, migration, and great poverty, these programmes tend to fail again and again. An additional problem is that the population density in some areas makes irrigation schemes necessary to increase the crops, and these schemes also create new breeding sites for the anopheline mosquito.

The mosquitoes are able to fly greater distances (e. g. compared with tsetse flies). This explains why malaria-free areas can be re-invaded when the conditions are opportune. The mosquito needs stagnant water to deposit its eggs. The time for maturing into an adult mosquito is dependent on temperature. The development of the parasite within the infected mosquito also depends on temperature.

The mosquito becomes infected when it takes a blood meal from an infected person. When this blood, containing female and male gametocytes, reaches the mosquito's gut, these parasitic stages unite there. After going through different stages of development, the parasite multiplies into sporozoites which invade the mosquitoes salivary glands. The salivary fluid, containing anticoagulants, is injected into the bite wound in order to avoid blood clotting in the mosquito's proboscis. The sporozoites then enter the human blood stream and invade the liver cells within 30 minutes (except in the case of *malaria malariae*), where they multiply until the liver cell bursts. The parasites (called merozoites), thus released into the circulating blood, invade the red blood cells (erythrocytes), where they continue their asexual multiplication.

When the sporozoites invade the human blood steam, the infected person experiences an outbreak of shivering, followed by fever, headache, backache and general malaise. In *malaria tertiana,* fever tends to reappear periodically, at the beginning of the infection, on the first day, the third day, the fifth day etc., and continues in this way if un-

treated. (The name *"tertiana"* describes the fever rhythm which occurs in this type of malaria.)

On the other hand, the fever in malignant malaria is usually irregular or even continuous. And while death as the result of *malaria tertiana* is extremely rare, in untreated malignant malaria severe and fatal complications quite frequently develop. In children it can cause severe anaemia which can lead to death either in the same or in consecutive infectious episodes. It can also cause cerebral malaria, hypoglycaemia and acidosis. Cerebral malaria is one the most frequent complications among adults. In addition, renal failure, liver involvement with jaundice and lung oedema may also occur. These conditions are due to the breakdown of microcirculation in the capillaries of the internal organs through uninhibited parasitic multiplication and pathological changes of red blood cells and endothelian cells (cell covering the inner surface of blood vessels).

In pregnant women semi-immunity often leads to a mild clinical course of malaria. But anaemia often develops as well as foetal death, miscarriage or delivery of "small-for-date" babies (babies with a low birth weight after a normal pregnancy period).

A child can be born with malaria. On the other hand, provided the mother is semi-immune, a baby that is fully breast-fed is generally protected during the first months of its life through maternal antibodies and the chemical composition of the mother's milk. (Milk does not contain any para-amino-benzoe-acid which the parasite needs to grow.)

Malaria infections may also occur in humans as the result of blood transfusions, needle prick accidents and oculation of infectious blood.

Unfortunately the treatment of malignant malaria is becoming increasingly difficult, as in most areas where it is common, resistance has developed to chloroquine and other less costly antimalarial drugs. In describing the degree of resistance we distinguish between 3 stages:

Resistance I: Malaria infection reappears (recrudescence) after a successful response to treatment.

Resistance II: The parasites are reduced but not eliminated, thus they multiply again after treatment.

Resistance III: Parasites continue to multiply as though no treatment had been given. (They are not suppressed by the antimalarial drug.)

Resistance may also occur in the case of some of the more expensive drugs. Although restricted at present to particular areas, multidrug resistance is on the increase, e. g. in Southeast Asia (it is especially severe on the Cambodian-Thai border). Often a combination of two drugs is recommended, placing an additional burden on the health services and health budgets of poor countries.

In most countries the oldest antimalarial drug, quinine, is still used to treat complicated malaria, but it is administered in combination with doxycycline except for smaller children under the age of eight. Fansidar® was given to children instead of doxycline in Zimbabwe.[13]

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[13] *Mioska, K.*, Personal communication, Würzburg (1997).

For drug-resistant areas, a Chinese antimalarial drug (artemisinin) and its derivatives (fast-acting) are recommended in combination with mefloquine (slow-acting), with a single oral dose on the second day of treatment (or when the patient's condition allows.).

As wide-spread prophylactic treatment would be likely to encourage the development of drug resistance, prophylactic consumption of artemisinin and its derivatives is prohibited on ethical grounds. Unfortunately, however, this drug is very widely available, e. g. you can buy it in every supermarket in Kenya. It is therefore doubtful if this promising drug will be helpful in curing complicated malignant malaria for very much longer.

The development of resistance is especially worrying as no malaria vaccines are yet available on the market.

The more resistance there is to the drugs, the more attention we have to give to the old simple, well-known barrier methods which decrease malaria transmissions by reducing contact between human beings and mosquitoes. The traditional methods include bed nets (most effective if impregnated with pyretrum, permethrine or deltamethrine, which must be done annually); window screening; or by wearing protective clothing especially in the evening. Especially for small children, who are put to bed early, mosquito nets can be very effective in reducing the frequency of infection and thus diminishing the severity of childhood anaemia.

However the question remains: under conditions of poverty and political unrest, where the houses are built of mud and grass and have leaky doors and window frames, whether these measures are really appropriate.

Furthermore, other methods to fight the mosquito do not seem to be particularly effective, especially in view of the fact that global heating – resulting in the increase of average temperatures world-wide – will favour the further spread of malaria. Methods used so far, besides the residual spraying of the walls of houses, include the treatment of water surfaces with little polystyrene balls to prevent the depositing of eggs, the introduction of larvae-eating fish into infected waters, and the sterilisation of mosquito males, to mention just a few.

For the treatment schedule please consult one of the books recommended at the end of this chapter.

2. African Trypanosomiasis (Sleeping Sickness)

> Today, in 1997, we again hear reports of civil unrest in northern Uganda, which could be the beginnings of renewed civil war. The "Lord Resistance Army", which is evidently supported by Khartoum, is terrorising the civil population.
> This population still remembers the last Ugandan civil war only too well, where nearly the entire population from that area had to seek refuge in neighbouring Sudan. They were only willing to return home when the political situation had stabilised, after *Museveni's coup d'état* in 1986. But in the meantime the Sudanese conflict had deteriorated, which resulted in the enforced repatriation of the Ugandans. During their 6 years of absence, their fields had lain fallow, and the bush savannah had encroached and taken possession of their land. Especially along the rivers, the dense vegetation had become an ideal habitat for tsetse flies, and there was a growing population of them.
> When the UNHCR (United Nations High Commissioner for Refugees) prepared the reception centres along the border for the repatriation of the refugees, the lorry drivers had to close their windows in order not to be immediately eaten up by the flies. However, they facilitated with their lorries the wider distribution of tsetse flies along the road parallel to the border. Without transport, the flies are usually restricted to a small area as they cannot fly long distances.

The tsetse fly *(glossina)* is the vector responsible for the transmission of the sleeping sickness, also called *African trypanosomiasis*, which is caused by parasites named *trypanosomes*. Three different types are known: *Trypanosoma b. brucei*, which only infects animals; *Trypanosoma b. rhodesiense*, a zoonosis with its reservoir in wild animals, which occasionally affects humans; and *Trypanosoma b. gambiense*, the reservoir being human beings and also pigs (possibly other domestic animals too). The three different types are morphologically identical (i. e., they are not distinguishable under the microscope).

While *Trypanosoma rhodesiense* is not well adapted to humans, the infection follows a severe and rapid course. It quickly involves the brain and ends fatally. On the other hand, *Trypanosoma gambiense* has become quite well adapted to its human host during its evolution, and creates mild and unspecific symptoms for months and sometimes years. But also this type will finally affect the brain and lead to death. Because of its chronic course, it is often only in that late stage that the disease can be diagnosed easily.

For the early stage of both types of trypanosomiasis, treatment with less severe side-effects is available (suramin and pentamidin). But after passing into the cerebrospinal canal, the parasites are much more difficult to eliminate. The preferred drug at present is melarsoprol, a toxic substance causing arsenical encephalopathy in some cases. This can result in the patient's death (in about 1-5 % of cases; death is to some extent related to the physical condition of the patient). On the other hand, without treatment in that late stage, the patient would die anyway. Difluoromethyl ornithine (DFMO) is used at present in treating single cases. For mass treatment the drug is not appropriate, as it is

far too expensive, more difficult to apply, and production of the drug still falls far below the enormous demand.[14]

Therefore the solution cannot be to wait until the final stage of the disease, responding only then with diagnosis and treatment. One must actively search for cases in the early stages, which not only helps the individual but also – importantly – reduces the reservoir. Parallel to this activity, attempts to reduce the tsetse fly population should also be made, e. g. by the use of fly traps.

Despite the fact that a tsetse fly and trypanosomiasis control programme was already functioning in Southern Sudan at the time when the Ugandan refugees returned home, no exact infection rates were known for trypanosomiasis in the indigenous population. This was due to great differences from place to place and even among the population of one village. The occupation of the individual and the radius of his mobility strongly influenced the degree of exposure and hence the risk factor. One could only estimate an infection rate of between 1-2 %. This infection rate was also assumed to be valid for the refugee population. Only infections with *Trypanosomiasis b. gambiense* with its slow development were diagnosed in that area where the refugees had lived for the past 6 years.

Thus the repatriation meant, in effect, that infected people would be coming into an area of heavy tsetse fly infestation. One could assume that the flies, which until then had not had much contact with humans, could easily become infected. Even if it is true that the rate of infection within tsetse fly populations themselves is usually low, the great number of flies in the area would greatly facilitate the spread of infection among the returning population in this case. Furthermore, the entomological examination showed that the species of fly found in the area was well able to transmit gambiense sleeping sickness to human beings (pigs were not kept in the area and domestic animals were rare).

Uganda has had a lot of experience with sleeping sickness in the past. Even the British colonialists ran an effective control programme, aimed at reducing the tsetse fly populations and detecting and treating early cases in the animal reservoirs and in humans. In the south-east of Uganda *Trypanosomiasis rhodesiense* had been a common health problem in the past, then successfully controlled until, at the end of the civil war, it reappeared in epidemic proportions. The same was thought to happen in West Nile, North-eastern Uganda, but exclusively with the *Trypanosoma gambiense* infection.

The Ugandan Ministry of Health, which took charge of the situation, and its well-trained technical staff as well as the NGOs coming from abroad were prepared to start control measures immediately. But the doctors and nurses in the North were much more difficult to convince, since they seldom met the disease in its late stage. (Patients were treated separately in the Sudan, not in the normal health institutions.) In addition, they were faced with a great

(continued)

[14] *Stich, A.,* Personal communication, Würzburg (1997).

number of acute health problems which they considered much more important than the sleeping sickness – diseases such as malaria, diarrhoea, worm infections, malnutrition, tuberculosis and many others.

Also the refugees had difficulty in understanding the necessity for the examination procedure. In the reception camps refugees were lined up and checked for clinical symptoms, especially for palpable lymphnodes of the neck. Serum was taken and a screening test – the so-called CATT-Test – was performed on each person, which had the disadvantage of 5 % false positive results. Those with positive results had to be transferred to the hospital for further examinations. Unless the parasite was found in the blood, the diagnosis was not certain and no treatment could be started. Even with concentration techniques (Buffycoat examination from centrifuged blood and Lanham column provided by WHO), *Trypanosoma gambiense* is difficult to detect. Therefore it was recommended by WHO and the Ugandan authorities to perform at least 7 different blood examinations on different days before sending people home.

The refugees who felt healthy often left the hospital before this run of examinations was complete. Of course this was understandable. They had been out of the country for many years and had to start rebuilding their houses and cultivating their fields again. The general population had quite different priorities from the medical authorities and the expatriates.

It became obvious that other control measures had to be tried additionally, like vector control.

Soldiers were instructed to spray passing cars at road blocs. At first they cooperated very well, as it made their boring job more interesting. However, after a short while, the spraying equipment disappeared and it was obvious that it had been sold.

In addition, cloth and sewing machines were bought and women were employed to produce tsetse fly traps.

Tsetse flies are attracted by dark moving spots and blue colours. When they approach a trap of black and blue cloth, sewn in the form of a pyramid which is then hung from the low branch of a tree and moves in the wind, they search for a hole in it and enter the trap. Once in the trap, they fly towards the light in order to escape. But their way is blocked by curtaining material at the top of the trap. When they are exhausted, they fall into a fold of the curtaining material under the cover of the trap and eventually they die. Impregnated with insecticides, these traps are an effective, complementary method of killing great numbers of vectors.

In Uganda these traps were placed in the bush, especially where people fetched water on the river bank. There the contact between flies and humans was most intense.
This programme, too, was not very successful at first. The traps were stolen because the people couldn't understand the sense of hanging such nice pieces of cloth in the bush, while some of their children had to go naked. Looking back, we should not have been surprised to see babies being baptised in beautiful blue-coloured dresses, the origin of which was only too obvious!
This attitude of the people could only be changed by posting one person next to each of the traps to guard it during the daytime, providing him with food-for-work. (As tsetse flies only fly during daylight, the traps could be collected in the evenings.)
But the population also helped to control the flies and the disease very effectively – though unintentionally! – by clearing the bush, burning the grass and cultivating the land. Because the area is so densely populated and because the whole population came back within a short time, the environment that was ideal for the multiplication of tsetse flies was quickly destroyed.
The cases of sleeping sickness were registered. Cases diagnosed in the late stage had to be treated in spite of toxic reactions. The risk of fatal side-effects had to be accepted, and in fact there were some deaths. However the outbreak of an epidemic was avoided.

Sadly, the story in *Southern Sudan* is a different one. Here the control programme, run by Belgians, had to be stopped because of the local political situation. Many people left the area to seek refuge elsewhere. Their fields were left abandoned and uncultivated. At the same time the health system broke down. Probably it will only be possible to assess the dimensions of the problem when the war finally comes to an end. The duration of wars in these countries is a most significant factor, since they cause the environment for the tsetse flies. Sleeping sickness is not the only disease that profits from wars and unrest. But it makes the connection between disaster and disease very clear.

To see what dimensions sleeping sickness can assume after a war of more than 20 years, we have only to look at *Angola* today. There the disease is so wide-spread and the late stages of the disease so common that the people don't need to be convinced that early diagnosis and treatment would be a good thing.[15] In spite of massive financial support from outside the country, the capacity of the health organisations is still inadequate. It is not even possible to provide treatment for every person displaying symptoms. They are far removed from the goal of actively looking for cases of the disease and slowing down its spread.

And since large areas of the country are still unsafe in 1997, control of the disease will be very difficult to achieve in the foreseeable future.

In this setting, it is time to give less priority to the well-being of the individual patient – as painful as this decision may be – and to consider how best to use the financial resources that are available or can be mobilised in order to stem the epidemic as a whole.

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[15] *Stich, A.,* Personal communications, Würzburg (1996).

3. Cholera

In 1996, when half-a-million refugees crossed the "petite barrière", the narrow boundary between Eastern Zaire and Rwanda, many of them were suffering from diarrhoea. Some had typical symptoms of cholera, such as rice-water diarrhoea with great loss of fluid and consequent dehydration (sunken eyes, decreased flexibility of the skin, an accelerated and weak pulse, and the tendency to collapse) as well as muscle cramps caused by electrolyte deficiencies. These symptoms were more than sufficient reason to conduct laboratory examinations. Twelve of these patients were found in fact to have cholera. (This could have been merely the tip of an iceberg. Were these cases the first of a new epidemic among the huge mass of humanity that had passed the main road into Rwanda within just a few days?) Some of the preconditions that had caused such an outbreak in 1994, when the same group of people had moved in the opposite direction to Zaire, were again present. The people were weakened by walking for so long bare-footed. They suffered from lack of water. The possibility that the limited water sources along the road were contaminated with cholera couldn't be ruled out. Sanitation had been non-existent on the Zairian side of the border as well as on the Rwandan side. However, the disaster which was feared did not occur. What were the circumstances that prevented it from happening?

Cholera is a disease that originated in Asia. Since 1970 there have been reports of epidemics in Africa, and since 1990 cholera is also on the increase in South America, having begun in Peru. Cholera infection is caused by the toxin of the Gram-negative, comma-shaped bacillus called *vibrio cholera* (with a number of subtypes), which causes a secretion of Na^+, Cl- and HCO_3 in the upper bowel, resulting in a massive efflux of water and preventing reabsorption. This is the reason for the characteristic cholera diarrhoea.

The disease is transmitted from one human being to another by the faecal-oral route. Not every one who comes into contact with the bacteria falls ill. The quantity of bacteria transmitted, the virulence of the bacterial subtype and the presence or absence of gastric acid determine whether the person becomes ill. Some people become chronic carriers of the disease. While some cases are characterised by massive diarrhoea, causing a condition that can end in death within a few hours, other patients only experience a mild gastro-enteritis. Therefore every occurrence of diarrhoea has to be considered as a potential symptom of cholera during an epidemic.[16] If a patient survives the first 24 hours, it usually means that he has overcome the critical peak in the course of the disease, and he then generally makes a quick recovery (usually within another 2-3 days). Crucial intervention in the course of the disease is the immediate replacement of the fluid (very large quantities) and electrolytes lost, the replacement quantities strictly corresponding to the losses. By giving the right antibiotics at once, the entire course of the disease can usually be limited to about 2 days.

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[16] *Ure, B.*, Diss. Univ. Cologne, 1988, reprinted 1994.

In infants, meningitis-like symptoms may occur, sometimes accompanied by convulsions. However, these may also be due to the mode of rehydration. Children excrete less sodium and more potassium into the intestine than adults suffering from the disease. Therefore oral rehydration must always be given priority – even though it requires enormous patience – and oral fluids usually have to be administered through gastric tubes. If intensive parenteral rehydration is unavoidable because the child is also vomiting, and if under the given circumstances different fluids are available, fluids with less sodium (such as Half Darrow's Solution) should be administered instead of just Ringer Lactate, which is recommended for rehydration in adults.

There is a vaccine available, which has to be injected twice in order to give individual protection within 1-4 weeks in up to 60 % of those immunised. However, it is of no use in epidemics as it does not prevent transmission. The WHO therefore does not recommend immunisation at present. But in Sweden and Switzerland a new oral vaccine has recently become available which may prove more effective.

Just as important as the medical treatment itself, is the *management* of the situation during – or before the outbreak of – an epidemic. If the epidemic can have catastrophic results, such as is the case with a cholera epidemic, the management of situation is even more important.

In Rwanda, in the autumn of 1996, a cholera epidemic was avoided because of preparedness and good management:

1. The humanitarian organisations were already present, well-organised and equipped when the refugees arrived at the border.
2. Co-operation with government officials and local authorities was possible.
3. The communication and co-operation between relief organisations of different types was already well-organised, and it intensified during the following days and weeks.
4. Sufficient supply of drinking water was provided along the road, with taps to prevent contamination.
5. In so-called "care stations", every 5 kilometres along the route, exhausted and sick refugees could be treated.
6. The transport of severely ill people to the nearest possible hospital was organised. The hospitals were adequately staffed and equipped.
7. The stream of refugees was not allowed to halt except at night, when small grouping was permitted with limited numbers of people along the roadside. Forcing the majority of the refugees to continue walking, which some observers simplistically considered cruel or likened to a kind of punishment, was the only way to achieve a rapid and safe repatriation. If this mass of humanity had come to a halt during the first few days, this would certainly have resulted in a chaotic situation and increased the risk of an epidemic outbreak of cholera. (It became possible within a few days to provide lorries for a more human and even more effective rapid repatriation.)
8. The most vulnerable groups were identified as such beforehand – e. g.

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unaccompanied children, the elderly, and disabled people – and organisations were appointed to take care of them.

9. Food was provided exclusively in the form of dry rations, protein biscuits providing all the nutritional requirements of the human organism. They were only distributed in the evening in order to avoid large, uncontrolled gatherings of people. Inevitably, the people would have come together in this way if other types of food had been distributed, which needed cooking or diluting and couldn't be consumed while moving.
10. Finally, there were special cholera units placed near hospitals, which were prepared and equipped to take care of small numbers of patients (10 to 15) in the early stage of a possible epidemic. This was merely a preventive measure, and fortunately it was never required.

There are different views on how to set up a cholera unit. In his thesis, *Ure*[17] gives an example of how such a situation in Somalia was effectively managed some years ago. His account provides very useful guidelines for similar situations.

For someone who might at some future date be confronted with an outbreak of cholera which he/she has to help manage, it is a most useful exercise to reflect on the special conditions within a given geographical and social environment where you have worked before. You should consider ways of setting up and managing a cholera unit under pressure of time and consequently, if possible, with resources that are already available locally.

Against this background, the following questions should be answered:

- How many patients must the unit provide for?
- How much space has to be available?
- How can isolation of the patients best be achieved?
- Is a suitable building (e. g. a school or church) available? Is it big enough? Does it have a stone floor?
- Where should the patients lie? (In beds or on simple mats? How many are required?)
- How can the excrement of patients be collected, measured and safely disposed of? (Number of buckets required, type and quantity of disinfectants?)
- Where will the disinfectants be stored and mixed (e. g. dissolved in water)? In what containers should they be kept?
- How can the intensive care and supervision of patients who are critically ill be organised?
- What would be the minimum number of trained staff required (nurses, doctors, interpreters, technicians etc.)? And the minimum number of untrained staff (e. g. water carriers, cleaners, guards, cooks etc.)?

[17] *Ure* (1988).

- How many blankets should be provided, and how can they be cleaned (or burned) after use?
- Who could show the staff their specific tasks and supervise them, and what information has to be provided and for whom? (E. g. what precautions do they have to take?)
- How much fresh drinking water (and water for cleaning) will be required, and how can it be organised? In what containers could it be stored? How should it be handled in order to avoid contamination?
- How could food in general (and possibly high calorie food supplements for children) be prepared and served? With what equipment and by whom?
- Where could medicine (infusions, oral rehydration salts (ORS), antibiotics, and other drugs and minimal medical equipment) be safely stored and locked up? What quantity will be needed, especially of ORS and infusions (if the water loss is more than 20 litres during the first day)?
- Where could latrines be constructed, and how? Who will be in charge of cleaning them and how is this to be done? (gloves, disinfectants, etc.)
- What is to be done with patients who die of cholera? (How can the bodies be safely buried or cremated in a manner that is also culturally acceptable?)
- How can disposal of waste be organised and where?
- How can people continue to receive treatment after they leave the unit? How can they be decontaminated?
- Where can the staff do the necessary administrative work, and with what equipment? Where can they relax? (Is there a roofed area? How many chairs?)
- What sources of light can be organised at night? (How many?)
- Do patients have to be transported to the "intensive" care unit, and how? Who will be driving, and how should the car be disinfected afterwards?

Cholera is often considered to be merely a medical problem, but the epidemic is of general concern and in no way can it be managed by the physician-in-charge alone. The above list of questions that have to be answered and decisions made has little in common with the curriculum that doctors follow in medical schools! It should be obvious that other professionals can also be involved – people who are used to clear thinking and decision-making, those with management skills and authority within the community.

Returning to our starting-point: it must be stressed that the conditions in which a cholera epidemic is likely to occur should, at best, be foreseen and eliminated before the actual epidemic breaks out. World-wide there is still a lot to do in this respect.

> In Freetown, Sierra Leone, a three-storied children's hospital, situated close to the harbour and – ironically – planned as a referral centre for cases of cholera, had all its toilets blocked or destroyed when it was visited in 1996. This is a disastrous situation, and it is sad that potential donor organisations know of such a situation and hesitate or find no way to intervene.

Of course intervention in such a situation earns much less public acclaim – and fewer public donations – than the management of a cholera epidemic, once it has started! This

is the situation and the frustration which a relief worker might be faced with, once he has understood the whole context of cholera.

4. Meningococcal Meningitis

Meningitis is an inflammatory infection of the meninges, causing symptoms of fever, headache, nausea, vomiting and neck-stiffness. In infants (under the age of 2 years) the neck-stiffness can be less pronounced or even missing. But the fontanelle is seen to be bulging in the fully-developed disease. Symptoms like drowsiness, confusion and even convulsions may occur.

Different sorts of infectious agents can cause these symptoms.

The most frequent in southern countries where living conditions are poor are probably:

1. in parasitic infections, the most common: malaria (cerebral malaria)
2. viral meningitis or viral meningo-encephalitis (mostly diagnosed after excluding the others)
3. bacterial meningitis:
   - *pneumococcal meningitis* (often after purulent infection of the ear)
   - meningitis caused by *haemophilus influenza* (mostly in small children under 5 years)
   - *meningococcal meningitis:* single infections and epidemics, mainly in the so-called meningitis belt of Africa (mainly Sahel)
   - *tuberculous meningitis:* onset is mostly more insidious than in meningitis caused by other infectious agents; the symptoms are less pronounced. Diagnosis often late, therefore, often fatal. (BCG-Vaccination cannot prevent TB infection, but mostly the outbreak of TB meningitis.)

     Apart from clinical symptoms, microscopic examination of the CSF (cerebral spinal fluid) is important for the diagnosis. The CSF in viral meningitis and in cerebral malaria is mostly clear (like water), even if the microscopic cell count is increased. In bacterial meningitis, the CSF is cloudy (except in TB meningitis!). (Malaria can be diagnosed in a thick film of peripheral blood; for differentiation of bacterial meningitis, special staining methods are available.)
4. cerebral toxic reaction: *neonatal tetanus* (after delivery in unhygienic conditions, 3-10 days after delivery when the cord care is inappropriate; when the mother is not immunised)

In 1981, at the end of the dry season in the region known as West Nile, in Northern Uganda, a sudden outbreak of purulent meningitis occurred in children and young adults. This region belongs to the south-eastern extension of the so-called "Meningitis belt of Africa". Therefore it was immediately suspected that these meningitis cases were the beginning of an epidemic.
The microscopic examination of the CSF sediment (staining with Methylene blue and Gram Stain) in the only functioning hospital of the district showed *diplococci* which were "Gram negative". Together with the clinical signs, the time of onset (during the dry season) and the geographical characteristics, the diagnosis was quite certain. Other diagnostic procedures, that may usually help to provide 100 % confirmation of the diagnosis in individual cases, were not available.
A spread of disease among patients and the relatives taking care of them had to be avoided. In addition, waiting for the patients to be brought to hospital would have involved carrying patients very long distances, delaying treatment (with the risk of more deaths and cerebral complications) and also risking new infections among contacts on the way.

Meningococci are transmitted by droplet infections. They may be present in the pharyngonasal cavity without producing symptoms. But from there they can also invade the blood stream and infect the membranes of the brain and the spinal cord. The incubation period (the time between infection and the appearance of symptoms) usually lasts between 1 day to 1 week. Two types of *meningococci* are usually responsible for epidemic outbreaks: Type A and C. Vaccines are normally available from centres in capital cities.

But in 1981, Uganda was involved in a civil war. Radio communication was not as wide-spread then as it is nowadays in southern countries, even in war zones. Consequently, action had to be taken which did not include vaccination.
At first those villages and compounds were registered, where meningitis cases had occurred. On a detailed map of the area, the centre of the epidemic could be identified. Then a small team of hospital personnel went there and met with the local authorities (chief, clergy, headmaster).
The team succeeded in informing and persuading the authorities that control measures had to be taken by the community. These included the closing of schools and the temporary prohibition of markets and other public assemblies in the affected region. General information was distributed to facilitate the early diagnosis of new cases within the community. The school and church compound were turned into a centre for the diagnosis and treatment of meningitis patients. Shortly after this meeting, two medical staff (a doctor and a nurse) were moved to the church compound where they were helped by the teachers of the neighbouring school. Within a short time, such a great number of patients were brought to them that a microscopic CSF examination of all suspected cases was impossible. Instead, all patients with clinical signs of the disease received a lumbar puncture.

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If the spinal fluid was clear (like water), the patient was transported to the hospital, but if it was cloudy, the patient was admitted to the emergency ward set up in the church and given intravenous antibiotic treatment (penicillin) immediately. (Of all the patients diagnosed in this way (about 400), only one diagnosis was false-negative for meningitis. And this false diagnosis was corrected the next day, when the lumbar puncture was repeated.)

The second dose of antibiotic treatment was then administered at the same time as the other patients received their treatment, 6-hourly (at 6 a. m., at 12 noon, at 6 p. m. and at midnight) for 5 days. In the case of vomiting, infusions were applied, the bottles being hung from wires stretched down both aisles of the church. A small truck brought a tank of clean drinking water every day for the patients and the relatives taking care of them. Each patient was permitted only one relative to stay. These people and the other direct contacts were given prophylactic antibiotic treatment daily.

Provided the patient's condition had improved and he returned to full consciousness, intravenous treatment was discontinued after 5 days and substituted with orally administered Choramphenicol (for children, a pleasant tasting syrup is available). At this point the patient was moved to the neighbouring school for another 5 days.

Parallel to these activities, the local authorities also organised an active search for further cases, visiting every family in the community.

It may be assumed that this swift and well-organised response to the occurrence of meningitis cases during a relatively early stage of the epidemic significantly limited the spread of the disease, saved the lives of many patients, and prevented complications with only a few exceptions. The number of cases decreased after just two weeks, and with the beginning of the rainy season, the epidemic ended within 3-4 weeks, and there were no further cases.

(Unfortunately, the meningitis epidemic was immediately followed by an outbreak of typhoid fever, which typically develops during the rains.)

In this particular case of an epidemic of meningococcal meningitis in Uganda, fortunately (petechial) bleedings in the skin and mucous membranes did not occur. These are due to capillary damage and caused by toxins occasionally elaborated by the micro-organism (*Waterhouse-Friderichsen* Syndrome, sometimes associated with shock – especially in small children and babies).

The preferred therapy in disaster areas nowadays is Chloramphenicol (in oil-suspension) administered intramusculary. It can be given once every 24-48 hours during large outbreaks and is very cost-effective.

Sometimes resistance develops, as with penicillin. Ampicillin, given 3-4 times daily, and cephalosporines are also effective but much more expensive.

The incidence of 20 meningococcal meningitis cases per week in a population of 100,000 is considered an epidemic. They occur mainly in the Sahel Zone, in northern India, Nepal and the slum areas of South American megatowns. The frequency of epidemic outbreaks in one specific area influences the average age of those afflicted in the area (the shorter the intervals between the epidemics, the younger the patients).

5. Tuberculosis

The civil war in Liberia caused large numbers of the rural population to seek refuge in the two major towns, Monrovia and Buchanan. Many of them were taken in by relatives. Others took shelter in public buildings that were still under construction. But when the fighting spread to Monrovia itself in April and May 1996 and the urban population and their homes were attacked, whole districts of the town became uninhabitable. Living space became even more cramped.
Not surprisingly under these conditions, tuberculosis spread rapidly. The tuberculosis control programme that had been operating in Liberia before the war had collapsed with the outbreak of hostilities. Thus, on a field trip to the war-torn region in the summer of 1996, an important question to be assessed was whether, despite the civil war, it would be reasonable to start a new tuberculosis control programme in Monrovia and/or Buchanan. In both cases the answer was yes.

The following preconditions must be fulfilled before a tuberculosis programme can be started:

1. All the *medicines* that are necessary for the treatment of tuberculosis must be available in sufficient quantities and over a long period of time. During a war, this usually means that foreign organisations have to support the programme continuously and not just sporadically. In case supplies are held up or interrupted, adequate quantities of medicine must be reserved for the patients who have already begun therapy before any new patients are accepted for treatment.
2. The programme must have sufficient, suitable *staff* and access to a suitable *laboratory*.
3. The *therapy regime* must be conducted under medical supervision – especially intensive in the first 2 months – in accordance with official international guidelines and the most recent medical knowledge.
4. The patients must live permanently (i. e. for at least 8 months) at a *short distance* from the medical centre. They will have to visit the centre regularly. In addition, the medical staff (or social workers) must be able to visit the patients at home. This has to be arranged before therapy begins, so that the circumstances of the patients' lives are known and the relatives, with whom the patients live, can be examined. Especially in the case of children living with the tuberculosis patient, chemoprophylaxis and early treatment has to start as soon as possible. Home visits may also be necessary during the course of therapy if the patient fails to appear at the centre.
5. Regional *authorities* should be informed about the importance of the programme and their support canvassed.
6. The patients' *compliance* must be assured. This requires time and skill, not only to explain the therapy to the patients, but also to guide them firmly during the whole therapy regime. This can prove difficult as soon as their condition improves and when possible side-effects of the drugs occur (which might need an immediate exchange of the drug, like with ethambutol, when eye problems occur). In addition, the

material well-being of the family must be assured in order to avoid them moving away from the area during the therapy.

Tuberculosis is caused by tubercular bacteria, which are mostly conveyed through droplet infection, by coughing, from one infected person to another (and occasionally through fresh milk from infected cattle). The infection usually disappears by itself. Only in a small percentage of cases, it causes a local infectious inflammatory reaction of the lymph nodes (primary complex), which again mostly passes unnoticed. The early haematogenic scattering can lead to miliary tuberculosis and tuberculous meningitis, mostly in children.

The tubercular bacteria remain infectious in the lymph nodes but are encapsulated in granulomatous tissue. When the organism has been weakened as the result of other diseases (e. g., measles, HIV infection, diabetes mellitus), drugs (e. g., cortisone) or malnourishment, such sources of infection can be reactivated. (The disease develops in 15 % of infected persons.) Thus the tubercular bacteria reach the lungs – but also other organs, such as the kidneys, the spine, the meninges etc. – via the blood circulation and can cause an organic tuberculosis there. In the lungs it is often the apex that is infected. If the infectious reaction spreads into the branches of the bronchial tree and the inflamed tissue dissolves in the course of the infection, bacteria can be emitted from the body through the bronchial tubes, and other people in the vicinity of the diseased person can be infected. This is termed *open tuberculosis*.

Control programmes in countries where the disease is widespread aim at the fastest possible diagnosis and effective treatment of patients with open tuberculosis. However, such a programme involves considerable responsibility. When the therapy is disrupted – as is often the case in war zones – the TB germ develops resistances to the available medicines and poses a greater threat to human society world-wide.

There are many ways of preventing the disruption of therapy. Since tuberculosis is also a disease of the poor, it is not sufficient to hand out medicines; feeding must also be monitored. Small work programmes to accompany the therapy, or rewards for fulfilling part of the regime sometimes provide motivation. The importance of the therapy can be emphasised by signing a contract with the patient in the presence of an official witness before the regime starts.

It is a matter of controversy, whether patients should pay money for being treated. One often places more value on the things one has to pay for. But when patients find it difficult to pay fees, they may tend to delay appointments or discontinue the therapy altogether.

The patients often include teachers. Such people are often well-suited for training as assistant health workers (during the time that they are released from teaching). They can then spread information about tuberculosis control. TB sufferers in many countries are discriminated against; knowledge combats such discrimination. Education programmes can result in a rapid increase in the number of patients requesting diagnosis and treatment, thus increasing the effectiveness of the control programme.

The programme in Liberia fulfilled all the criteria listed above. Nevertheless, the work in Monrovia was disrupted after just a short while. It had been guaranteed exclusively by foreign workers, and they had to leave the country on account of the security situation. Before departing, they tried to ensure a continuation of the medical treatment during the first 2 months – the intensive phase of treatment. Happily, the programme in Buchanan, on the other hand, continues uninterrupted.
The example of Monrovia, however, shows how careful one must be when starting a tuberculosis control programme, especially under the unpredictable conditions of war.

A note on immunisation and tuberculin tests:

The *BCG immunisation* with weakened bacteria from a species of cattle, intradermally injected, does not prevent infection or the later reactivation of the bacteria. However, it does prevent the haematogenic development of miliary tuberculosis and tuberculous meningitis. Especially in developing countries, it should be given to all children as early as possible.

Immunised children living with an infectious person in the same household should be given 3 months' chemoprophylaxis, while non-immunised children should be given a course of 6 months. (Children with a failure to thrive, which cannot explained by another reason and successfully treated, should be considered as TB and treated with a combination of three different drugs.)

The *tuberculin test,* which consists of a special tuberculosis protein or a refined protein derivative, is injected intradermally. When positive, it causes a hypersensitive reaction in the form of a small area of hardened skin. This indicates that an infection has occurred (acute, symptomatic or asymptomatic), or that the subject has been immunised. However, when the immune system is defective – particularly in advanced HIV infection and severe malnutrition – the test is mostly negative, even when the subject is infected with tubercular bacteria.

6. Measles

The Luwero Triangle, about 70 km north-west of Kampala, was one of the most dangerous places to live in 1984, during the civil war. Nevertheless, a great number of the civil population had no alternative but to stay and try to survive, sometimes hiding in the bush, sometimes cultivating land as far as possible away from the roads in order to avoid being harassed by the soldiers.
To re-open a hospital in the middle of the Luwero Triangle in such a situation and after it had not operated for years was a risky enterprise. It was evident that people would come from all directions to the only place where they could expect to find medical care. Thus, contagious diseases could easily spread in a population that had already suffered so much, were not immu

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nised, and whose nutritional status was worse than simply insufficient. Some of them lived in camps, especially the descendants of Rwandan refugees from the south of Uganda, after losing their cattle.
The medical team from abroad was well aware of the potential risks of their work. They immediately started immunisation of children in the hospital, especially against measles. Every child that was brought for medical treatment, no matter what the complaint, was vaccinated against measles before the specific case was even examined.
In addition, the team organised mobile health services in order to make their services more readily available to the people in need, especially those living in camps.
But despite all these measures, the hospital still became a draw-factor for the sick. Instead of the maximum 120 in-patients, the number of admissions to the hospital more than doubled in a short time. In addition, many more were seen daily in the out-patients' department.
In spite of the immediate vaccination and the careful handling of the measles vaccine (which is extremely sensitive to gradual changes of temperature and short interruptions of the cold chain), an epidemic of measles occurred.
Why?
Looking back, one can ask if every one of the new patients was really vaccinated immediately after admission, or if perhaps a few of them escaped immediate vaccination when they came in the middle of other emergencies or late in the evening. The number of trained medical staff was of course limited, and obviously they could not be everywhere they were needed at the same time.
But these considerations alone cannot explain the dimensions of the measles epidemic that blew up.
It became a horror scenario for about 6 weeks and a very traumatic experience for all involved. 10 % of the children admitted to the hospital with measles died. On one single day, at the peak of the epidemic, which no one from the medical team will probably ever forget, ten children died – mostly after the onset of the disease, with severe laryngitis, creating a terrible sense of helplessness and even a feeling of responsibility and guilt.

"*Measles is an acute, highly contagious viral disease which is a scourge of children in all the developing countries*".[18] It is transmitted from person to person by droplet infection and usually starts with symptoms easily confused with a severe common cold: soryza, pyrexia, conjunctivitis, coughing and loss of appetite, and these symptoms are often accompanied by dehydration as the result of diarrhoea and vomiting.

On dark skin the common skin rash is more difficult to recognise before it causes desquamation at a late stage. But little white-grey spots with a reddish base, called "Koplik dots", appearing on the inside of the cheeks, make a firm diagnosis possible at an early stage. Common symptoms during a severe attack are also sores in the mouth (which

[18] *Hendrickse, R. G. / Barr, D. G. D. / Metthews, T. S.*, Paediatrics in the Tropics, Blackwell Scientific Publications, London.

can prevent breast-fed children from sucking), laryngitis, bronchopneumonia, extensive weight loss and bleeding of the nose and gums. Sometimes convulsions may occur during bouts of high fever and also the brain can be affected in small children. The most striking problem is that the children become very prone to bacterial infections, such as pneumonia, otitis media and tuberculosis. They often continue to lose weight after the acute measles infection and show signs of marasme or kwashiorkor, accompanied by iron and vitamin A deficiency.

As in most virus infections, only symptomatic treatment is available once the infection is acquired. Much emphasis has to be given to immediate rehydration and prophylactic treatment of the mouth (with gentian violet) as well as supplementary vitamin A (to avoid eye complications). Therapeutic feeding with a lot of patience is the most crucial response, as these children have no appetite at all. One person is required just to instruct the mothers and to insist on continuing breast-feeding right from the beginning, combining this with food supplementation as well as constant feeding of small amounts of an appropriate solid food mixture (in increasing concentration) to the weaned and older children as soon as the vomiting has stopped.

Secondary infections require early diagnosis and antibiotic treatment. If tuberculosis is suspected in these severely malnourished children after the acute measles infection, one should not wait for a positive tuberculin reaction (skin reaction after inocculation of toxins, produced by tuberculous bacilli or its purified protein derivatives). These children too often lack the capacity to give an appropriate skin immune reaction. A positive test is only possible later when the child's condition has improved.

Immediate active immunisation (with the measles vaccine, an attenuated living virus vaccine) usually prohibits the infection of contacts.

The most probable reason why immunisation was not effective in many children during the measles epidemic of war-torn Uganda in 1984 was their poor nutritional status at the time when they were exposed to the infection. This probably resulted in a very severe immune suppression, with little or no antibody production against the attenuated virus in the vaccine within the incubation period. Thus, passive immunisation (serum already containing antibodies of a person that had gone through the infection) would have been the only effective protection at that time. Unfortunately, in the given situation, it was not available.

The highest percentage of infections in Uganda happened to occur among children of the Rwandan refugee community. As they were mainly restricted to camps, their cattle taken by the Ugandan soldiers, the Rwandans were the most vulnerable group in the Luwero Triangle and further south of it at that time. But even this identification and the special emphasis put on their care from the side of the medical professionals didn't have the expected effect. Their political marginalisation, which was the root cause of their vulnerability, couldn't be changed. It is therefore not surprising that they helped *Museveni* to take over the country in the hope of improving their own situation in this way, with the ultimate goal of returning to their own country, Rwanda, as soon as possible.

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After the war, the immunisation programme was successfully intensified in Uganda (by the Ugandan Ministry of Health, supported by UNICEF). Today measles occurs extremely rarely in that country, and mortality as the result of measles no longer plays a role in the health statistics of Uganda.

IV. Other Diseases, Possibly Occurring in Disaster Situations, Their Mode of Infection, Treatment and Control

Disease	Mode of Infection	Treatment	Control
Scabies	skin to skin contact (mites)	repeated treatment of the patient and the contacts	water supply
Respiratory infections	droplet	virus: symptomatic bacterial: antibiotic	ventilation avoid overcrowding
Whooping cough	droplet	antibiotic	routine immunisation
Worms (e. g. ascaris, hookworms)	faecal-oral	anthelmintics	sanitation
Trachoma	eye-hand-hand-eye	antibiotic ointment	water supply
Hepatitis A	food contamination	symptomatic	water supply
Hepatitis B/ HIV infection	sexual intercourse blood, needle sharing mother-to-child	symptomatic	behaviour change STD-Control
Syphilis	as above	penicillin	STD-Control
Gonorrhea	sexual intercourse mother-to-child *(ophthalmia neonat.)*	antibiotic treatment antibiotic ointment	STD-Control routine silver nitrate prophylaxis
Typhoid Fever	food contamination	chemotherapy	environmental and personal hygiene
Amoebic Dysentery	faecal contamination of water	amoebicides	sanitation, personal hygiene
Bacillar Dysentery	faecal-oral	rehydration selective chemotherapy	hygiene, water supply
Dengue Fever	mosquito	symptomatic	vector control
Lassa Fever	mammals	antiviral	source control (mammals)
Tetanus	contaminated soil – wounds	symptomatic tetanushyperimmunglobulin, antibiotics	routine immunisation
Relapsing Fever	louse or tick-borne *(borrelliosis)*	doxycycline tetracycline	louse: delousing insecticides
Epidemic Typhus	louse-borne *(rickettsia)*	doxycycline	as above
Endemic Typhus	flea-borne	doxycycline	as above

V. Further Reading

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VI. Addresses

International Union Against Tuberculosis and Lung Disease	68 Boulevard Saint Michel 75006 Paris France
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D. Particularities of Health Care

The general aim of management and health care in emergencies is the prevention and effective treatment of diseases in a great number of individuals. Many principles of Western medical and surgical care are not useful in disasters. At medical universities or when physicians and nursing staff are working in a clinical setting, essential aspects are not learned. This counts in particular for specific conditions in developing countries, where most emergencies occur. In the following chapter, some of the particularities of medical and surgical work in emergencies will be pointed out, without regarding details of diagnostic procedures or treatments.

I. Medical Fields in Humanitarian Assistance

1. General Priorities

The control of infectious diseases, paediatrics, surgery including traumatology, gynaecology and obstetrics represent the common medical fields in emergencies and there is no preference. However, the great killers in developing countries are malnutrition, pneumonia and diarrhoeal diseases, but not surgically treated disorders. This also holds for emergencies, in particular for displaced people or refugee camps. *Moore*[19] reported from Somalia in 1992 a mortality of up to 32 deaths per 10,000 persons per day due to outbreaks of common infectious diseases which had devastating effects on a weakened and malnourished population. Therefore, on top of the list of priorities is the provision of safe water, nutrition, shelter, and sanitation. At the same time, medical health care is performed treating a very limited number of the most common diseases (see below) and using not more than 20 drugs. It may be easier to establish a field or makeshift hospital, but the hospital personnel may not be able to meet the immediate needs of the population. The institution will be overcrowded unless medical care is provided at a basic level. Therefore, only after this has been established, will the time come for a hospital including surgery and operative gynaecology or obstetrics.

Order of Priorities in Emergencies

→ safe water
→ nutrition
→ shelter
→ sanitation

→ basic health care at health centre level < 20 drugs
→ extended basic health care at dispensary level
→ health care at hospital level
→ surgery, operative gynaecology and obstetrics

Curative medicine in emergencies mainly deals with how to perform *appropriate* health care at a basic level with limited resources and manpower, initially without safe water and nutrition for patients, without electricity, laboratory, x-ray machines, or intensive care units. Under these conditions, standard surgery and paediatrics textbooks and textbooks in other fields of medicine may be somewhat helpful, but the philosophy and techniques of "primary medical care" such as "primary surgery" or "primary child care" are essential. These concepts are focused on the particularities of developing countries and include the restriction on very simple diagnostic procedures such as physical examination and a basic laboratory. Exclusively, essential drugs are used and priority is given to the treatment of the most common diseases.

It has to be noted, that the workload of health care personnel is limited. It depends on the caregivers' qualification and the field of medicine provided. From Papua New

[19] *Moore* (1993).

Guinea it has been estimated that a doctor can treat a maximum of 40 cases per day, a nurse 50. In emergencies these numbers may increase, but generally most manpower per patient is needed for surgery. One physician and two nurses or medical assistants could operate on three to five patients per day. The same team could perform more than 150 outpatient, and a considerable number of inpatient treatments. This has to be taken into account when taking decisions about concentrating manpower in specific medical fields.

2. Surgery

Surgery is mainly restricted to emergency procedures and techniques that are well-established in Western medicine are not advisable. In particular in developing countries traumatology means conservative treatment with skeletal traction or bivalved plaster casts. Due to a high rate of infections after implantation of osteosynthetic material such as plates or screws (internal fixation), these techniques are not recommended under "primary surgery" conditions.[20] Appropriate techniques such as external fixation using special fixateurs are preferred. It is generally accepted that elective or prophylactic operations (i. e. cholecystectomy, hernia repair, plastic reconstructions) should rarely be performed.

Example: Particularities of Surgery in Emergencies
- Limited surgery for the elderly patient
- No prophylactic surgery
- No diagnostic surgery without therapeutic consequences
- No plastic surgery (except skin grafting for burns)
- No internal fixation (osteosynthesis)
- Use of appropriate techniques (i. e. external fixation, skeletal traction)

Example: Typical Surgical Procedures in Emergencies
- Delayed primary wound closure
- Amputations
- Treatment of tetanus and gas gangrene
- Treatment of osteomyelitis
- Caesarean section
- Opening of abscesses

In Western medicine surgery is strictly subspecialised (i. e. traumatology, thoracic surgery, paediatric surgery, plastic and hand surgery, neurosurgery) and surgeons work exclusively in their field. In emergencies there is no place for such subspecialisation and one surgeon has to operate on all kinds of patients, on a baby, a mother or a severely injured patient. A neurosurgeon or plastic surgeon, for example, may be of little help in a surgical relief programme unless he is supported by a general surgeon.

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[20] *King* (1990).

II. Particularities of Health Care in Humanitarian Assistance

1. Health Care and the Emergency Phase

Spirgi[21] stated that "*within a few days, the most severely injured are either rescued and treated or dead*". Rescue teams with medical equipment providing life saving measures often reach patients or casualties not before 10 days after the *impact phase* during which the disaster strikes or there is war. It must be noted that the duration of the *emergency phase*, during which immediate life saving measures are taken, for earthquakes or after armed conflicts lasts several days to two weeks. Humanitarian assistance is often provided more than two weeks after the impact due to political or logistical constraints (i. e. Rwanda 1994, Liberia 1996, Zaire 1997). Health care is then provided in the *rehabilitation phase* and consists of routine medical care, in most instances for developing countries on a temporary basis.

2. Levels of Health Care

Due to differences in pre-existing health care levels (i. e. Bosnia versus Liberia), differences in the kind of disasters (i. e. famine in a refugee camp versus war in a capital city) and due to differences in ethnic backgrounds, a general recommendation concerning the level of appropriate care cannot be given. Since, transportable field hospitals with sophisticated facilities are available, theoretically, health care at the highest level can be provided nearly everywhere. However, it is well known from a study performed in East Africa that 225 mothers per 100,000 inhabitants need a Caesarean section, yet only 25 got one, 175 hernias would need repair but 25 were operated on per year. Thirty patients needed surgical treatment of a strangulated hernia which, unoperated, is nearly always fatal, but only 4 operations were performed. In numerous countries the level of health care is extremely low even before an emergency and this has to be considered when making decisions on the level of medical care in relief programmes.

Three levels of health care are defined:

I. Primary Level	♦ non-professional care from CHWs (community health workers)
	♦ health care station / home
II. Secondary Level	♦ professional care from nurses, medical assistants, physicians
	♦ dispensary / health centre
III. Tertiary Level	♦ professional care from specialised physicians
	♦ hospital (field, district or provincial level)

The type of health care provided by humanitarian assistance is balanced between the need of decentralisation which can reach a great number of people and the need of complex care on a hospital level. In emergencies when health care systems are not exis-

[21] *Spirgi* (1979).

tent, medical problems are preferably treated at the primary level in order to provide medicine for the greatest number of individuals. Referral of all patients to health professionals on the secondary or tertiary level may overcrowd dispensaries and hospitals. However, when infrastructure has broken down, the implementation of medical assistance on the primary level may be far more difficult. The skills of CHWs may be unacceptable and there may be a complete lack of control of the distribution and appropriate use of drugs.

When health care stations, dispensaries or hospitals are rehabilitated, the level of medical care provided within each facility should be adjusted to the level which existed before the emergency. Rarely it makes sense to establish specific laboratory tests, surgical facilities or x-ray machines on the secondary level. This may be useful on a very temporary basis in a refugee camp or remote area, but a high level of health care will not be sustainable after rehabilitation of the health care system in the afflicted country.

3. Aspects of Health Care

Health care is the interaction between a caregiver and a patient. By limited diagnostic means the caregiver decides which of limited resources he is providing for which individual and often there is a great difference between the demand of the patient, the preference of the caregiver and the real needs. In order to perform health care close to the real needs, the following aspects are taken into consideration.

a) The Caregiver

When making decisions on health care for a great number of individuals, skilled experts with experience in emergencies and humanitarian assistance are essential. These experts are often not available and medical care is provided by individuals who have never worked on their own and never made medical decisions for a great number of patients. In addition, health care professionals such as physicians, nurses, pharmacists, laboratory technicians have a strong orientation towards classic medical problems and concepts of Western medicine. It has to be noted that it is better to perform medicine by a small number of real experts together with local personnel than to provide medical care by a great number of untrained and inexperienced physicians and nurses.

Caregivers need to have

- Knowledge of appropriate health care for developing countries
- Competence / skills to identify the particular medical problems
- Competence / skills to treat the particular medical problems
- Competence to train and work with local health care personnel
- Ability to communicate through language
- Knowledge of the cultural background of the patients

In recent years an increasing number of skilled local physicians, medical assistants and nurses have been available in emergencies. Western experts were of limited use in numerous recently afflicted countries (i. e. Bosnia, Chechnya). In these situations the tasks of foreign experts are logistics, supervision and training rather than curative medicine.

Order of Preference for Selecting Health Personnel:

- Local residents / refugees
- Experienced nationals of the afflicted country
- Foreigners

Generally it has been agreed to offer contracts to foreign health care personnel for a period of at least 6-12 months. Shorter contracts lead to discontinuity of concepts and to a "burn out syndrome" of local personnel concerning the co-operation with caregivers.

b) The Afflicted Individual

Patients in emergencies are often malnourished, suffering from tuberculosis, AIDS or other infectious diseases and present with a superposed actual medical problem. For these patients, *appropriate* concepts of treatment are mandatory. Even minor surgery may be fatal. In particular, for these patients, it may be difficult to reach the caregiver. During the epidemic of typhoid in Rwanda in 1994 for example, mostly young men in good condition reached the caregivers at the hospitals and the mortality was calculated as being low. However, infected children, mothers and the elderly did not have access to caregivers and were not included in the statistics.

Specific Problems of Patients in Emergencies

- Reduced general condition due to malnutrition, tuberculosis, AIDS
- Problems approaching or reaching the caregiver
- Problems understanding treatment modalities
- Problems due to the cultural background (i. e. female circumcision)
- Specific psychological disorders and social problems (i. e. anxiety, depression)

It is a great concern that patients understand some basics of Western health care and specific teaching is mandatory from the beginning of any relief programme. Otherwise, prescribed medicine will remain useless. In addition, a caregiving team may not realise that patients or parents of children suffer from repression and violence. This can interfere with continuous health care in particular for children.

4. General Aspects of Standardisation

Standardisation of medical decision making and treatment in disasters is essential to ensure effective use of resources. The principles set out depend on the phase of the emer-

gency during which assistance is provided. There is always an interaction between the tools set out below and decisions in one direction have to be revised continuously.

Standardisation of Health Care Measures

- Triage by ranking health problems and actions in order of priority
- Standardisation of methods
- Mass medicine versus individual health care
- Training and involvement of local residents / refugees

a) Triage

In normal clinical practice, the patient with the most critical injury or disease is treated first, no matter how poor the prognosis. This concept is not practical in disasters where, as a general rule, the treatment has to be carried out under conditions of extreme scarcity of manpower, materials, and time. This holds for disasters with a high number of casualties, for refugee camps or epidemics where health facilities will not be able to meet the demand. In such conditions, the optimal use of resources is essential and calls for the employment of organisational structures for decision making.

aa) Definition of Triage

> Triage consists of classifying afflicted individuals rapidly on the basis of the benefit they can expect from a short-term therapeutic solution.

Triage is a French military term that means *"to sort or to separate"*.[22] The aim of triage is to insist on preferential treatment for those most in need, who at the same time potentially have the highest benefit. Patients are rapidly classified on the basis of the benefit they can expect and not according to the severity of the disease. There are two main methods of triage: 1. medical teams examine all patients, decide about initial treatment and carry out medical or surgical therapy; 2. a doctor or nurse performs rapid assessment of the severity of the disease and assigns the patients to treatment or non-treatment. The patients are then referred to a treatment area.

bb) Triage Categories

Several techniques of triage are proposed which categorise patients into three to five groups. The most simple classification has been applied by *Roy* and *Spirgi* distinguishing three categories.

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[22] *Spirgi* (1979).

Three Triage Categories: Patients are divided into those requiring

1. immediate treatment – available medical care can be expected to save life or function,
2. delayed treatment – little increased risk by delay in treatment,
3. expectant treatment – critically ill patients for whom only complicated and extensive treatment offers any hope for improving life expectancy.

Triage is carried out by the most experienced clinician which means that a senior physician or medical officer should fulfil this function. There is no rigid application of the described methods of triage. Triage is a continuous process and each patient or activity may require repeated assessment during the process.

cc) "Direct" and "Indirect" Triage

It is suggested that it should be distinguished between "direct" and "indirect" triage.

Direct triage categorises patients. For example during the outbreak of a cholera epidemic in Somalia in 1985 patients with an extremely high mortality despite extensive treatment (i. e. children under 2 years of age or pregnant women with excitation) were categorised group III. and treatment was expectant.

On the contrary, *indirect triage* refers to decisions concerning activities which are not directly related to the medical treatment of patients. The aim of indirect triage is to prevent the attraction of a great number of individuals to an unprepared and unsuited area creating secondary health problems. As an example, on arriving, a rescue team could perform immediate individual treatment by setting up a treatment unit, but this may not be advisable. By indirect triage, priority is given to establish specific structures and a safe area (i. e. safe water, nutrition, demining, basic sanitation, removal of dead bodies) before mass medicine or individual treatment is provided. These activities may take from several hours to several days during which limited workload can be assigned to individual patients.

Direct triage:	Categorisation of afflicted individuals
Indirect triage:	Categorisation of activities of a rescue team versus individual approach

Indirect triage is common, but caregivers are rarely confronted with direct triage.

b) Standardisation of Methods

Various methods of standardisation of establishing a diagnosis and performing appropriate treatment have been proposed. Symptoms such as dehydration, skin rash, tachypnea or fever and specific clinical findings on examination are attributed to diseases and therapeutic standards by using flowcharts or algorithms. In addition, a standardisation of

treatment is achieved by using exclusively "Essential Drug Lists" established by the WHO or the national ministry of health.

Standardisation of Methods in Emergencies[23]

- Standardisation of diagnostic procedures – i. e. flowcharts, algorithms
- Standardisation of treatments – guidelines for treatment according to level I-III of care
- Standardisation of drugs – use of essential drug lists
- Standardisation of responsibilities – definition of tasks for health care personnel
- Standardisation of records and reporting – individual record charts / community reporting
- Standardisation of transfer procedures – between different health care levels

In chaotic situations, the clear definition of tasks for health care professionals is essential in order to prevent chaos (i. e. definition of who is responsible for assuring treatment according to guidelines, for sanitation in the treatment area, for keeping records and reporting). The standardisation and organisation of patient transfer between different levels (i. e. dispensary to hospital) is essential to ensure health care of severely ill patients and to prevent frustration in caregivers who may not be able to treat a patient at their level.

c) Mass Medicine versus Individual Approach

In mass medicine, sophisticated diagnostic procedures or treatments do not exist. A defined number of the most common diseases (i. e. diarrhoea, malaria, pneumonia, typhoid, xerophtalmia, meningococcal meningitis) are treated. This imposes ethical problems. Patients with diseases not included in the guidelines, such as a mother with diabetes or a child with a tumour, would require a more complex approach. The concentration of resources on a smaller number of patients by a caregiver who prefers an individual approach may be ethically questionable, but the decision has to be made on a case-by-case basis. Numerous relief organisations solved this problem by simply not providing "extraordinary" drugs or equipment. It has to be noted that this may lead to extreme frustration in caregivers.

[23] *Perrin* (1996).

12 Most Common Diseases Treated in Refugee Camps (UNHCR)

- Diarrhoeal diseases
- Measles
- Respiratory diseases
- Malaria
- Meningococcal meningitis
- Tuberculosis
- Typhoid and cholera
- Worms, esp. hookworms
- Scabies (skin disease caused by burrowing mites)
- Xerophtalmia (child blindness)
- Anaemia
- Tetanus

d) Involvement and Training of Local Residents / Refugees

There are several reasons for immediately involving and training local personnel. When health care is provided “with” rather than “for” the population, local individuals will take responsibility and provide ongoing health care. As the workload of experts is limited it has to be focused on essential activities. Numerous medical tasks can be performed by non-professionals, in particular during epidemics. As an example, in a field hospital for treatment of an epidemic disease, a very limited number of experts in needed. More than 70 % of the personnel in a cholera hospital described by *Ure*[24] was non-medical. In numerous recent emergencies, foreign personnel of relief agencies had to leave the project, mostly due to security problems. Over long periods of time, health care was exclusively performed by local personnel. This needs preparation and training.

[24] *Ure* (1988/1994).

CHAPTER 3
ORGANISATION OF MEDICINE IN HUMANITARIAN ASSISTANCE

A. Hospital Health Care

Emergency hospitals are established in chaotic situations. Activities have to be co-ordinated and only essential facilities are established. Various types of emergency hospitals have been described. Due to very specific demands (i. e. treatment of a high number of injured individuals or cholera patients) and due to differences in socio-economic levels of afflicted countries, there is no general plan for initial or long-term management. However, some general decisions have to be made during the implementation process and may have a long-term impact on the success of the programme.

One of the central questions is whether to rehabilitate a pre-existing health service, or to work with an autonomous unit implemented by a relief organisation (i. e. field hospital). There is a general tendency towards using existing facilities due to following reasons:

Some Reasons for Preferring Pre-existing Services Compared to Autonomous Units

- Level of care more appropriate
- Local personnel available
- Minimal economic approach
- Equipment can be used appropriately after the emergency
- Governments will take responsibility for the service after the emergency

It is easier to perform *appropriate* health care in a pre-existing facility compared to a new unit with all equipment and tents imported and with specific difficulties in logistics. In pre-existing hospitals local health personnel are mostly available some days after the impact phase. However, due to high salaries paid by relief organisations, personnel prefer to work in field hospitals. As a consequence, health care in a marginally functioning local hospital may collapse completely. The use of autonomous units may be essential during an epidemic or wartime, but it is noted, that these hospitals represent a “foreign body” in

the local health system. Governments or local authorities will rarely take responsibility for the service after the emergency.

I. Establishing a Hospital

During armed conflicts, hospital facilities are often used by military and therefore, the buildings may have been looted, damaged, and there might be mines and dead bodies in the area. These difficulties may represent an obstacle for immediate use of pre-existing facilities and "indirect triage" may be mandatory. As a general rule, logistics and some basic structures are to be established *before* commencing the treatment of a large number of patients. Otherwise there will be a sanitary disaster some days after starting the programme. Some general steps for establishing a makeshift or field hospital are set out below:

Priorities *before* Providing Health Care in an Emergency Hospital

- Agreements with local authorities
- Co-ordination with activities of other relief organisations present in the region
- Preparation of a safe area / demining / security personnel
- Provision of save water for personnel and patients/relatives
- Provision of nutrition for personnel and patients/relatives
- Sanitation (latrines, waste disposal, mortuary)
- Safe store for equipment and supplies
- Facilities for medical treatment / wards

Basic Units to be Established in an Emergency Hospital in Ranked Order

- Outpatient unit
- Water supply unit / kitchen
- Wards for medical and postoperative care
- Pharmacy/store
- Operation theatre / sterilisation
- Power unit / generator
- Basic laboratory
- Maintenance department
- X-ray
- Blood bank

From the start of a programme, a leader with a wide range of experience in emergencies has to be identified and tasks for each member of a team should be defined. A *basic leadership team* will carry the responsibility of establishing and running the facility. This team consists of a senior doctor, senior nurse and a logistician/administrator.

The modality of payment of local personnel is of great concern. Regular salaries provided by an organisation lead to an improvement in motivation and often are essential for personnel survival. However, once commenced, a regular payment cannot be stopped without problems for the relief organisation concerned. Payment is introduced for a small number of personnel during an emergency. After some weeks, hundreds of employees of a hospital may receive economic resources. It has to be considered that in numerous countries the employing agency is obliged to pay pensions for individuals who have a contract. In recent years, some relief agencies had more qualified personnel due to higher salaries in their project compared to others. Therefore, an agreement between relief organisations and local authorities on the level of salaries is mandatory.

Payment Modalities for Local Personnel

- Payment by a local authority/government
- Payment by a relief organisation
- Food for work
- Irregular incentives

II. Makeshift Hospitals

The particularities of hospital management are beyond the scope of this chapter. The literature on hospital management in developing countries,[25] on surgical programmes during wartime[26] and on field hospitals during epidemics[27] should be referred to. Generally, four types of makeshift hospitals can be distinguished:

The rehabilitation of *hospitals for general health care in pre-existing facilities* (i. e. regional or provincial hospitals) is commenced when medical care in a region has collapsed and there is no specific medical problem calling for mass treatment. Such facilities represent the most frequent form of hospital care in emergencies;

field hospitals for general health care are established when pre-existing facilities cannot be used or rehabilitated (i. e. isolated refugee camp).

When there is a short term need for the mass treatment of injured individuals and existing hospitals cannot meet these demands *field hospitals for surgery* are established. These “foreign bodies” to the local health plan are exclusively focused on surgical care on a temporary basis.

Regular hospitals are not suitable for the treatment of highly contagious diseases during epidemics. *Field hospitals during epidemics* meet the specific demands (i. e. cholera treatment according to the severity of the disease, isolation, specific sanitation) and are also established on a very temporary basis.

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25 *Pearson* (1990).
26 *Perrin* (1996).
27 *Ure* (1988/1994).

III. Example: Gisenyi Hospital / Rwanda 1994

An example for initial management and implementation of a general emergency hospital is presented. The hospital was established in a pre-existing facility (Gisenyi Hospital, Rwanda, August 1994) after an armed conflict by a team of the *German Committee Emergency Doctors / Cap Anamur*. Initial fact finding was not possible due to security problems, but it was known that neither the hospital nor any infrastructure were functioning. Equipment and drugs for hospital care for 200 patients / 3 months which consisted of 40 tonnes were transported to the capital Kigali as soon as the US Army started to clear the airport. The team consisted of 1 general surgeon, 1 orthopaedic surgeon, 1 anaesthetist, 1 general practitioner, 2 nurses and 1 technician/logistician.

The time schedule of the programme presented below shows several important aspects. There was an agreement with local political representatives *before* starting the programme. All members of the team except one had worked in several emergencies. Four members of the team arrived at the hospital on the same day the transport started from Germany. Local fact finding, agreements with military representatives, co-ordination with other relief agencies and logistics (transport/storing, water supply) took three days. Despite the necessity of demining and removal of dead bodies from the hospital ground, it was decided to rehabilitate the pre-existing facilities instead of establishing a field hospital.

Outpatient and inpatient treatment was commenced on day four. By that time the kitchen or latrines were not fully established, the dead bodies were not removed from all hospital buildings and the demining of the area was not completed. By “indirect triage” these activities took until the third day after opening of the hospital and during this period of time not all patients could be treated appropriately. By then, 60 patients were already admitted. The first operation was performed not earlier than five days after opening the facilities. Initially, the local personnel consisted of 12 individuals, two of them doctors. After four weeks there were 60 and after 16 months nearly 100 local hospital employees. The assisting programme of the *German Committee Emergency Doctors* stopped after more than 16 months when the condition within the hospital and the country was stabilised.

Example: Rehabilitation of a Hospital for General Health Care in a Pre-existing Facility (District Hospital Gisenyi / Rwanda 1994)

Preparation

- Agreement with representatives of the Rwanda Patriotic Front to the programme
- Experienced team consisting of 4 physicians, 2 nurses, 1 technician/ logistician
- Equipment for a field hospital / 200 patients (surgery, cholera treatment, general health care)
- Transport by assistance of German Ministry of Foreign Affairs
- Small team in Kigali for preparation of logistics

(continued)

Initial Activities before Treatment of Patients

Day 1
- Arrival of team and equipment in Kigali
- Transport of 4 members of the team to Gisenyi

Day 2
- Local fact finding
- Negotiations with local military authorities / relief agencies
- Establishing a store / arrival of transport part I / storing

Day 3
- Agreements with local military authorities
- Preparation of hospital water supply
- Arrival of transport part II / storing

Activities During Opening of the Hospital and Treatment of Patients

Day 4
- Establishing water supply (tank/logistics)
- Clearing of a part of the hospital
- 50 outpatients / 20 inpatients
- Arrival of transport part III / storing

Day 5
- Establishing a kitchen
- 12 local personnel (1 doctor, 2 nurses)
- Demining of the area by local army
- Removal of dead bodies from the hospital area
- 100 outpatients / 40 inpatients / first delivery

Day 6
- Establishing latrines
- Establishing 2 wards (male/female and children)
- Systematic paediatrics / intravenous rehydration
- 150 outpatients / 80 inpatients
- Systematic rounds and documentation

Day 7
- Pharmacy
- Establishing 3 wards (male/female/children)
- 90 inpatients

Day 8
- First operation / operation theatre
- Begin of “normal hospital function”

Following 4 Weeks
- Regular operations
- 4 wards / 120 beds / outpatient department
- 60 local personnel
- Repairing of the x-ray machine
- Basic laboratory / blood bank

B. Planning

Successful performance of health care programmes needs a rational approach. In particular in emergencies the absence of a plan will result in chaos and unproper use of resources. On one hand complex situations require professional assessment and planning, on the other, many relief operations of recent years had to be performed without sufficient information on the number of afflicted individuals or on specific needs. The assessment of essential data is often not possible (i. e. limited time during the outbreak of a cholera epidemic, limited security during armed conflicts) and the situation changes rapidly necessitating immediate changes in planning. In this chapter, some of the basic tools outlined by *Perrin*[28] in his "Handbook on War and Public Health" are included and may help in outlining a plan on health care in emergencies, with or without sufficient data.

Some reasons for planning:

- Economic reasons (i. e. high needs versus limited resources)
- Political / socio-political reasons (i. e. fair distribution of appropriate health care)
- Technical reasons (i. e. need of reorganisation of a complex local "health market")

I. Definition of Planning

Planning means to identify the most relevant problems and specific needs, to define aims and appropriate means and to outline strategies with a schedule for implementation. *Reinke* formulated:

> *"Planning [...] is the analysis of alternative means of moving toward identified [...] goals in the light of specified priorities and existing constraints".*

The planning process consists of

- Initial assessment,
- Identification of health problems,
- Definition of priorities,
- Outline of a strategy,
- Mobilisation of resources,
- Concepts of surveillance and analysis.

II. Initial Assessment

Four aspects concerning initially assessed data can be distinguished. There are data on the *status and needs of victims* on one hand and on the *state of existing health services* on the

[28] *Perrin* (1996).

other. In addition, information on the *status of health care before the emergency* and on planned or actual *activities of other relief organisations* are essential.

Data obtained by observations, examinations or screening are most reliable compared to all other types of data presented below. Numerous lists, questionnaires and methods for collecting data on health care in a population are available and cannot be presented in detail. But often there is no time or personnel available to perform systematic assessment. In such instances, data may be obtained by communication with individuals or families, for example on the number of children under five years of age who died within a recent period of time. In particular, the data obtained from local authorities or governments have to be considered carefully as they may be influenced by specific interests. However, the interpretation of data remains subjective and should generally be performed by experts.

Sources of Data for Planning Medical Relief Programmes

- Data obtained by observation/examination/screening
  i. e. on water supply, food distribution
  i. e. on the prevalence of specific diseases
  i. e. on malnutrition in children
- Data obtained by communication with afflicted individuals
  i. e. on access to health services for a specific group of a population
  i. e. on recent mortality in children under 5 years
- Data given by local officials / national ministry of health
- Data given by relief organisations / UN
- Literature on pre-existing health care in the area

III. Identification of Medical Problems

Health problems may be classified into three categories. Diseases such as diarrhoea, osteomyelitis or sexually transmitted diseases are *universal health problems* and a certain incidence may be expected in emergencies and under normal conditions. In a specific situation the incidence of some universal health problems may be extremely high (i. e. infectious diseases in a refugee population) and may lead to high mortality. Such *specific health problems* are attributed to a certain population or region. In addition *extraordinary health problems,* which are not common in a normal situation, represent an immediate and particular problem (i. e. local outbreak of a cholera or meningitis epidemic, mass casualties during an armed conflict).

Classification of Medical Problems

- Universal health problems in a defined population
  i. e. cardiovascular or sexually transmitted diseases
  i. e. pneumonia, otitis media
- Specific health problems in a defined population or region
  i. e. malnutrition in a refugee population
  i. e. endemic malaria in a region
- Extraordinary health problems
  i. e. local outbreak of a cholera epidemic
  i. e. mass casualties due to an armed conflict

The mobility of victims and lack of access to health services represent another major problem which may interfere with proper planning and health care.

IV. Definition of Priorities

Priorities are defined according to the highest needs in a specific situation. This means that out of a multitude of problems, one or several are selected. The selection process is considerably influenced by the constraints in setting up the programme (see below) and the anticipated impact of the intervention. Local political and national health authorities and other relief organisations which are involved in the region should participate in the process of defining priorities.

Priority may be defined for a

- Specific health problem
  i. e. typhoid, measles, malaria, malnutrition
  i. e. injured individuals
- Specific aim
  i. e. reduction of the transmission of a disease
  i. e. reduction of the mortality of a disease
- Specific intervention
  i. e. establishing a field hospital
  i. e. reorganisation of primary health care in a region
  i. e. vaccination campaign
- Specific population
  i. e. group of refugees
  i. e. children < 5 years of age

V. Outlining a Strategy

A general rule for outlining strategies cannot be presented. However, it is essential to outline a schedule for different steps of the implementation and the duration of the pro-

gramme. In particular, logistic procedures concerning the transport, custom clearance and storing of material and drugs have to be outlined before implementation.

Outlining a Strategy may Concern

- Agreements with national officials / ministries
- Schedule for implementation
- Personnel
  i. e. number of physicians, nurses or technicians and their tasks
  i. e. recruitment and payment of local personnel
- Individuals who benefit from the programme
  i. e. meet specific demands
  i. e. safe access to the provided service
- Logistics / custom clearance
- Purchasing material and drugs
- Financial support

There are general assumptions concerning the number and size of health care facilities for a defined population in normal situations. A health station where care is performed by CHWs serves 500-3,000 people, a dispensary or local clinic 5,000-10,000 and a district hospital 100,000-200,000 people. These numbers do not hold for emergencies with specific demands, but besides the particularities of any disaster, general health problems have to be considered in curative health care programmes.

VI. Problems of Planning

No plan of health care in emergencies can be considered without problems. The most common constraints are presented below. In recent years the lack of security for caregivers and the lack of skilled foreign health care personnel, in particular physicians, have become most relevant.

Problems in Planning Health Care

- Rapid change of the situation and needs
- Lack of relevant data
  - i. e. on functioning health care facilities
  - i. e. on number of afflicted individuals
  - i. e. on specific or extraordinary health problems
- Lack of foreign experts
- Technical problems
  - i. e. logistical constraints
  - i. e. communication problems
- Institutional and political problems
  - i. e. customs formalities
  - i. e. interfering interests of local authorities
  - i. e. interfering interests of local health care personnel
- Lack of security for relief teams
- Economic restraints
  - i. e. insufficient fund raising / budget restrictions
  - i. e. problems in transfer of financial resources

VII. Concepts of Surveillance and Analysis

Health care programmes in humanitarian assistance are generally considered to be successful, but rarely is a systematic assessment of the feasibility and impact performed. The central aspect in surveillance and assessment of health care is the determination of appropriate use of resources and services and the determination of the impact of the programme from various points of view.

Perrin[29] suggested distinguishing qualitative and quantitative analyses concerning resources used (input) and services provided (output). Another relevant aspect is the impact on the victim's health status (outcome). The *qualitative analysis of resources* is concerned with whether medicines and materials meet the real needs of a population. *The quantitative analysis of resources* deals with the quantities used and their placement. On the other hand, a *qualitative analysis of services* determines whether there is correspondence with the norms defined in the objectives or in local technical standards. This ends with the determination of the quality of medical care. The *quantitative analysis of services* determines whether the number of items used or distributed (i. e. vaccines, courses of TB treatment) correspond to the quantity of items sent.

In addition, techniques of medical technology assessment as defined by *Mosteller, Jannett* or *Troidl*[30] can be helpful in the analysis of health care programmes. Six aspects are defined by *Ure.* By analysing each aspect, the success or failure of the programme may be determined from very different points of view. *Feasibility,* for example, deteriorated and lead to failure of a multitude of relief operations (i. e. lack of transport of relief

[29] *Perrin* (1996).

[30] *Mosteller* (1985); *Jannett* (1986); *Troidl* (1996).

goods in Bosnia in 1995, security problems in Zaire and Rwanda in 1997). The *impact on victims* may be positive in terms of survival, improvement in morbidity or psychosocial care. However, relief operations may have a negative impact on patients. As an example, a tuberculosis programme implemented for a mobile population may result in multi-resistancy of bacteria to tuberculostatic drugs due to inconstant treatment. Future treatment would be more difficult and more expensive. In addition, the *impact on the caregiver* can be determined. Today, often the negative aspects outweigh positive ones. *Economical aspects* are calculated by specific methods of economical analysis (see annex on economic analysis). The analysis of *political and ethical aspects* deals with the broad impact of a programme not related to health care itself, such as the support of a totalitarian regime, the support of one of two conflict parties or the acceptance of the fact that a national authority delegates responsibilities to a relief organisation.

Assessment of Success or Failure of a Health Care Programme: 6 Aspects

- *Feasibility*
  i. e. logistics, availability of experts, security of caregivers, agreements with local authorities, acceptance of the programme by the population
- *Impact on Victims*
  positive i. e. improvement in mortality, morbidity, quality of life
  negative i. e. inappropriate medical care, attraction of individuals to an unsuited area
- *Impact on Caregivers*
  positive i. e. gain of experience, satisfaction
  negative i. e. financial restriction, injury as a result of an armed attack
- *Economical Aspects*
  i. e. cost analysis
  i. e. cost-effectiveness analysis
- *Political Aspects*
  positive i. e. initiation of rehabilitation of a region, improvement of bilateral correlation
  negative i. e. support of one party in a conflict
- *Ethical Aspects*
  i. e. support of a totalitarian government, short-term relief versus long-term demand

CHAPTER 4
BASIC CONCEPTS OF OBSERVATIONAL EPIDEMIOLOGY

A. Introduction

Epidemiology, the study of the occurrence and distribution of diseases and other health-related conditions in populations, is used for many purposes. One use is to determine the magnitude and impact of diseases or other conditions in populations or in selected subgroups of populations so that this information can be used in setting priorities for investigation and for control, in deciding which preventive efforts should be focused on, in evaluating the efficacy of therapeutic procedures, and in determining what type of treatment facilities are needed. However, most epidemiological studies are undertaken to identify causes of a disease.

Learning about causes of a disease through epidemiological studies is generally a gradual process that requires different types of study designs, depending upon the nature of the diseases and possible aetiologic agents being considered, as well as upon the current state of knowledge of the aetiology of the disease. Epidemiological studies are classified into descriptive studies, which are usually undertaken when little is known of the epidemiology of a disease, and analytic studies, which are carried out when clues about the aetiology are already available. Although considerable overlap exists between these two categories of studies, the distinction between them is nevertheless often useful.

We can define a cause of a disease as an event, condition, or characteristic that plays an essential role in producing an occurrence of the disease.[31] Causality is a relative concept that can be understood only with conceivable alternatives. Smoking one pack of cigarettes daily for 10 years may be thought of as a cause of lung cancer, since that amount of smoking may play an essential role in the occurrence of some cases of lung cancer. But this construction postulates some lesser degree of smoking, such as non-smoking, as the alternative. On the other hand, smoking only one pack of cigarettes daily for 10 years is a preventive of lung cancer if the alternative is to smoke two packs daily over the same period, because some cases of lung cancer that would have occurred due to smoking two packs daily will not occur. Thus, causation and prevention are relative terms that should be viewed as two sides of the same coin.

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[31] *Rothman* (1986).

But how does the causal inference in epidemiology work? What is the empirical content – in the sense of *Popper* – of epidemiological propositions? Consider the proposition that cigarette smoking causes lung cancer. Clearly, not all cigarette smokers will get lung cancer, it is equally clear that some non-smokers will develop lung cancer. Therefore, the proposition cannot prevent lung cancer among non-smokers, nor its absence among smokers. The proposition could be taken to mean that cigarette smokers, on average, will more often develop lung cancer than non-smokers.

In epidemiological investigations a high association between smoking and the occurrence of lung cancer could be found. But this high association is still no proof for the causality of lung cancer due to smoking. With the suggestions of *Hill [Rothman]* it is possible to distinguish causal from non-causal associations: considering (1) strength, (2) consistency, (3) temporality, (4) biologic gradient, (5) plausibility or coherence, (6) experimental evidence, and (7) analogy.

1. Strength. *Hill* argues that strong associations are more likely to be causal than weak associations. Weak associations might have been obtained just by chance or due to systematic errors.
2. Consistency refers to the repeated observation of an association in different populations under different circumstances. Lack of consistency does not rule out a causal association because some effects are produced by their causes only under unusual circumstances. Furthermore, studies can be expected to differ in their results because of the use of different methods.
3. Temporality refers to the necessity that the cause precedes the effect in time.
4. Biologic gradient refers to the presence of a dose-response curve.
5. Plausibility or coherence refers to the biologic plausibility of the hypothesis, an important concern but one that may be difficult to judge. It also implies that a cause and an effect interpretation for an association does not conflict with what is known of the natural history and biology of the disease.
6. Experimental evidence. Such evidence is seldom available for human populations.
7. Analogy. The insight derived from analogy seems to be handicapped by the imagination of scientists who can find analogies everywhere. Nevertheless, a simple analogy can enhance the credibility that an association is causal.

These criteria can not be used as a check list for the causal inference of an association. The causal inference may exist without the proof of all these criteria, for example the biologic gradient.

B. Design Strategies

The basic design strategies used in epidemiological research can be broadly categorised according to whether such investigations focus on describing the distributions of diseases or on elucidating their determinants. Descriptive epidemiology is concerned with the distribution of a disease, including considerations of what populations or subgroups do or do not develop the disease, in what geographic locations it is most or least common,

and how the frequency of occurrence varies over time. Analytic epidemiology focuses on the determinants of a disease by testing a hypothesis formulated from descriptive studies, with the ultimate goal of judging whether a particular exposure causes or prevents the disease.

I. Descriptive Studies

As the name implies, descriptive epidemiology is concerned with describing the general characteristics of the distribution of a disease, particularly in relation to person, place, and time. Indices of person include basic demographic factors, such as age, sex, race, marital status, or occupation, as well as lifestyle variables such as the consumption of various foods or medication use. Descriptive studies can be done fairly quickly and easily, because of the availability of information on many characteristics of person, place, and time.

> For example, *Robertson* and co-workers[32] conducted a survey of the nutrition and immunisation status among Bosnian women and children during 1993. Therefore, they chose 120 randomly selected "clusters" of households in the Bosnian regions of Sarajevo, Tuzla, Zenica and Bihaæ:30 smaller administrative units or local communities in each region. In each of the "clusters", all children from 6 to 59 months and their mothers were selected and their nutritional status was examined. Children aged 13 to 25 months and infants under 16 weeks were also assessed for their immunisation status and infant feeding practices respectively. Altogether the information about 2,529 children and 2,181 mothers were collected.

II. Analytic Studies

There are a number of specific analytic study design options that can be employed. These can be divided into two broad design strategies: observational and by intervention. The major difference between the two lies in the role played by the investigator. In observational studies, the investigator simply observes the natural course of events, noting who is exposed or non-exposed and who has or has not developed the outcome of interest. In intervention studies, the investigators themselves allocate the exposure and then follow the subjects for the subsequent development of disease.

There are two basic types of observational analytic investigation: the case-control and the cohort study. Each design offers certain unique advantages and disadvantages. In general, the decision to use a particular design strategy is based on features of the exposure and disease and on logistic considerations such as available time and resources.

Since both cohort and case-control studies are used to quantify exposure-disease relationships, it is critical to define clearly what is meant by "exposure" and by "disease".

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[32] *Robertson* (1995).

In situations where the exposure is a relatively discrete event, defining the exposure status is conceptually straightforward, (e. g. defining who was or who was not in contact with a toxic agent). In other situations, exposure status must be defined by setting a cut-off point, for example defining the status of malnutrition in children by less than 70 per cent of the mean weight for height. Establishing a case definition is equally important. The case definition is a standard set of criteria for deciding whether an individual should be classified as having the health condition of interest. A case definition includes clinical criteria that should be simple and objective (for example fever, neck stiffness for defining a potential meningitis). Whatever the criteria, they must be applied consistently and without prejudice to all persons under investigation.

In a case-control study, a case group of patients who have a disease of interest and a control, or comparison group of individuals without the disease are selected for investigation, and the proportions of those with the exposure of interest in each group are compared.

> For example, *Henry* and co-workers[33] studied the risk factors for clinical marasmus in Bangladeshi Children. The study was carried out in Matlab, a rural area located about 45 km south-east of Bangladesh's capital, Dhaka. Every month the community health workers measured the mid-upper arm circumference (MUAC) of all children between the ages of 6 and 59 months. Of the 12,000 children screened each month, about 200 had a MUAC of less than 110 mm and were diagnosed by this criteria as marasmatic. Cases were randomly selected from the list of marasmatic children and interviews of their mothers were conducted within a month of initial identification. For each case, one child with a MUAC of more than 120 mm was selected as a control. To select the controls, a bari (a cluster of 12 houses) was randomly selected from the same block as the case. Interviews of case-control pairs were done within a few days of each other.

In contrast, in a cohort study, subjects are classified on the basis of the presence or absence of exposure to a particular factor and then followed for a specified period of time to determine the development of disease in each exposure group. This approach permits a direct assessment of the degree of increased risk associated with the disease.

> In a prospective cohort study 1529 children under 5 years of age were observed over one month for the occurrence of shigellosis.[34] 1036 children lived with their family in a house with no latrine, while 493 children lived in a house with a latrine. All these children were under the risk of getting the disease because of the exposure to an index case of shigella dysentery. After one month, 131 children in the group living in a house with no latrine developed shigellosis, compared to 88 in the group of latrine users.

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33 *Henry et al.* (1993).

34 *Ahmed et al.* (1994).

The terms prospective and retrospective refer to the temporal relationship between the initiation of the study by the investigator and the occurrence of disease being studied. For all cohort studies, the subjects are selected according to whether they are exposed or nonexposed to the factor under investigation, and their subsequent disease status is determined. The difference between a prospective and a retrospective cohort study is simply whether the outcome of interest has occurred at the time the investigator initiates the study. At the beginning of a prospective cohort study, the groups of exposed and nonexposed subjects have been assembled, but the disease has not yet occurred, so that the investigator must conduct a follow-up to determine the outcome of interest. In contrast, in a retrospective cohort study, the investigation is initiated at a point in time after both the exposure and disease have already occurred.

The relative advantages and disadvantages of the cohort approach compensate the advantages and disadvantages of the case-control approach. One important advantage of the cohort design is that the disease frequency can be directly measured. Only a cohort study can answer the question of what is the risk of getting the disease if the person is exposed. The case-control study, which starts with the disease status and retrospectively assesses the exposure, permits the calculation of disease risk for a given exposure group only under great restrictions. Cohort studies are better suited than case-control studies in examining health effects following a relatively rare exposure. With the cohort approach, all persons with the exposure can be enrolled and followed, as well as a sample of comparable persons who were not exposed. On the other hand, it is difficult to examine multiple exposures that may be associated with the disease, because the starting point in cohort studies is the exposure status. In contrast, as the disease status is the starting point in case-control studies, it is possible to question participants retrospectively about a variety of potential exposures. The main disadvantage of a prospective cohort study is its cost and the logistic complexity of following exposed and unexposed persons over time. This problem is heightened if the disease outcome of interest is rare. In this situation, large numbers of exposed and unexposed persons would be required to permit meaningful statistical comparisons.

Intervention studies may be viewed as prospective cohort studies, because the participants are identified on the basis of their exposure status and followed in order to study whether they develop the disease. The main feature of an intervention study is that the exposure status of each participant is assigned by the investigator.

Haelterman and co-workers[35] investigated the impact of a mass vaccination campaign against a meningitis epidemic in a refugee camp. A serogroup A meningococcus epidemic occurred in two refugee populations in Zaire in August 1994. The refugee camps Kibumba and Katale were formed after the massive influx of displaced persons from Rwanda into the Goma region, north-eastern Zaire, in mid-July. Both camps were extremely overcrowded and the health conditions were comparable and poor. Population figures at the end of July were 180,000 in Kibumba and 80,000 in Katale. From early September, some of the refugees were progressively moved from Kibumba to a new setting. In Katale, the population increased after a late arrival of refugees, giving a new estimate of 110,000 on 21 August. In Kibumba the first case was detected on 28 July, in Katale on 1 August. Two weeks later, the epidemic was declared in both camps. In Kibumba, a mass vaccination was started immediately as an intervention to minimise the outbreak of the epidemic, meanwhile in Katale the resources were preferably allocated to other priorities on account of vaccine shortage. Nine weeks after the first case onset the epidemic ended. One hundred and sixty-two meningitis cases were observed between 28 July and 25 September in Kibumba and 137 between 1 August and 25 September in Katale.

Intervention studies are often considered as providing the most reliable evidence from epidemiological research. This is due to the strength of randomisation (the division of the study population into two or more groups at random) as a means of determining exposure status in a trial. In the above-mentioned study, it was not possible to randomise the study population into two groups. Therefore, the authors compared the demographic data of the populations in the two refugee camps, and argued that there was no difference in the distribution of the sex, age, nutrition status and health status between these two groups. Thus, they concluded that all known factors, which could influence the morbidity and the mortality of meningitis, were similar in both study populations. Randomisation divides the study population into two groups, so that all known and all unknown factors related to the disease are equally distributed in both groups.

C. Measures of Disease Frequency and Risk Association

I. Incidence and Prevalence

Reflecting on the causation of a disease, it is necessary to study the occurrence of the disease in the whole population as well as in sub-populations which are defined by the existence or the non-existence of a special exposure to a certain hypothetical agent. The occurrence of the disease is expressed in terms of disease frequencies. There are three basic measures of disease frequency: The incidence rate is a measure of the instantaneous force of disease occurrence. The cumulative incidence measures the proportion of people

[35] *Haelterman et al.*(1996).

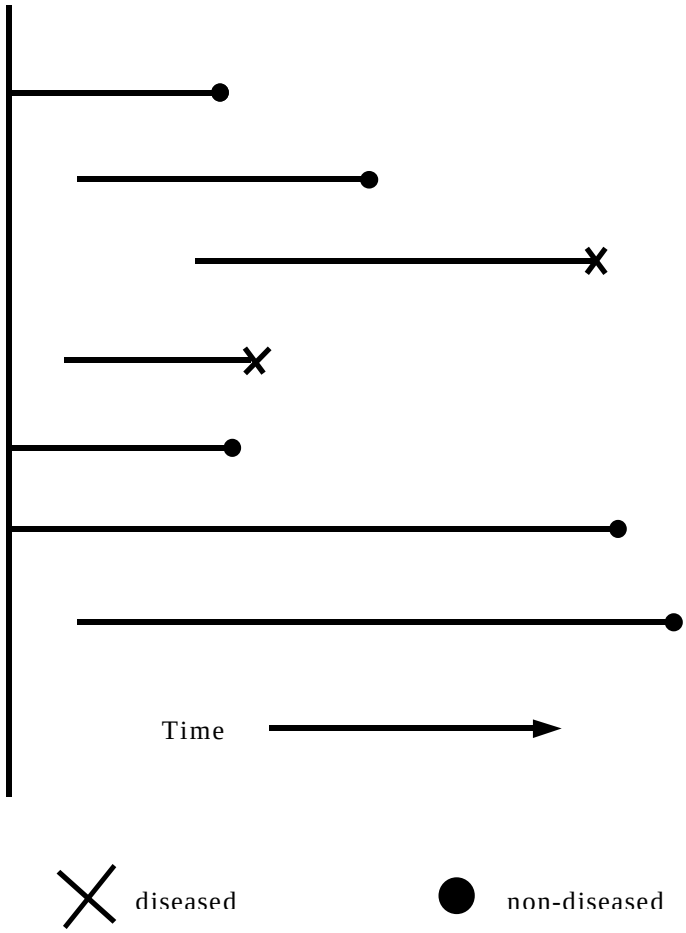
who convert, during a specified period of time, from non-diseased to diseased. The prevalence measures the proportion of people who have the disease at a specific point in time. Thus, the prevalence is a measure of the status of the disease in the underlying population. In contrast, the incidence density and the cumulative incidence measure the development of the disease during a given time frame.

In an ideal situation, the underlying population is stable during a given time period: the population cannot grow by births or immigration and it cannot decrease by emigration or deaths from causes other than the disease. In this stable population, the incidence can be measured by the number of newly diseased persons divided by the number of all persons who were healthy at the beginning of the time period and were under risk of getting the disease. If the population is not stable, the incidence measure must take into account the number of individuals in a population that become ill and the time periods experienced by members of the population during which these events occur. *Incidence density* (id) is therefore defined as the number of disease onsets in the population divided by the sum of the time periods of observation for all individuals in the population:

$$\mathbf{id} = \frac{\textbf{no. disease onsets}}{\boldsymbol{\Sigma}\ \textbf{time periods}}$$

where Σ indicates the sum of time periods for all individuals. The denominator of the incidence rate is often referred to as a measure of “person-time” distinguishing the time summation from ordinary clock time. Comprised in the measure of person-time is the implication that a given amount, say 100 person-years, can be derived from observing a variety of populations from a variety of settings, e. g. the observation of 100 persons for 1 year, 50 persons for 2 years, 200 persons for 6 months or 1 person for 100 years. One unit of person-time is assumed to be equivalent to and independent of another unit of person-time. This concept means that the whole population in the study is always at the same risk of getting the disease.

Figure 4. The concept of person-years



In the department of paediatrics at the Lok Nayak Jai Prakash Narain Hospital in New Delhi, a study was conducted during the yearly "diarrhoea season" in 1988. The study investigated the association between the probability of surviving diarrhoea and the nutrition status of children. 357 children were included in the study, 37 of them died and 320 left the hospital in satisfactory condition. Supposing altogether the 357 children stayed 3946 days in the hospital, then the incidence density is

$$\text{id} = \frac{\text{no. of deaths}}{\sum \text{time periods}} = \frac{37}{3946} = 0.0094.$$

Or, in 10000 hospital days 94 deaths from diarrhoea are expected.

Despite the interpretation that can be given to the incidence density, it is occasionally more convenient to use a more easily interpretable measure of disease occurrence. Such

a measure is the *cumulative incidence,* which may be defined as the proportion of a fixed population that becomes diseased in a stated period of time.

$$\text{cumulative incidence} = \frac{\text{no. disease onsets}}{\text{no. persons at risk}}$$

If *risk* is defined as the probability of an individual developing the disease in a specified time interval, then cumulative incidence is a measure of average risk. It is not interpretable without specification of the time period to which it applies. A cumulative incidence of death of 5 per cent may be low if it refers to a 30-year period, whereas it would be high if it applies to a 30-day period.

> In the prospective study on the occurrence of shigellosis,[36] 1529 children were observed for one month. After that time period, 219 children suffered from the disease. So the cumulative incidence for shigellosis in this one-month-period is 219 / 1529 = 0.143. That means that 14.3 per cent of all observed children acquired the disease during one month.

Unlike the incidence measures, which focus on events, *prevalence* focuses on the disease status. Prevalence may be defined as the proportion in a population that is affected by the disease at a given point in time. The term point prevalence is sometimes used to denote the same thing. The sub-population of people suffering from the disease is called the prevalence pool. Its relative size with respect to the whole population is the *prevalence rate:*

$$\textbf{prevalence rate} = \frac{\textbf{no. diseased}}{\textbf{no. population}}$$

The size of the prevalence pool depends on the fatality rate; an individual that dies from an illness is thereby removed from the group that constitutes the numerator of the prevalence. Diseases with large incidence rates may have low prevalences if they are soon fatal. People may also exit the prevalence pool by recovering from the disease.

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[36] *Ahmed et al.* (1994).

Rate	Type	Numerator	Denominator
Morbidity rate	Incidence	New cases of non-fatal disease	Total population at risk
Mortality rate	Incidence	Number of deaths from a disease (or all causes)	Total population
Case-fatality rate	Incidence	Number of deaths from a disease	Number of cases of that disease
Attack rate	Incidence	Number of cases of a disease	Total population at risk, for limited period of observation
Disease rate at autopsy	Prevalence	Number of cases of a disease	Number of persons autopsied
Birth defect rate	Prevalence	Number of babies with a given abnormality	Number of live births
Period prevalence	Prevalence	Number of existing cases plus new cases diagnosed during a given time period	Total population

Table 10. Special types of incidence and prevalence measures[37]

In both kinds of disease frequencies – incidence and prevalence – either the numerator or the denominator can be altered to yield special types of measures suitable for use in particular circumstances. An overview can be found in table 10. The two most commonly used incidence measure types are the morbidity and the mortality rate. The morbidity rate is the proportion of new diagnosed non-fatal cases in the total population under risk during a given time period. In the special situation of an epidemic, the morbidity rate is often called attack rate. The mortality rate is the proportion of fatal cases in the complete population during a given time period. Similarly, the case-fatality rate is the mortality rate in the diseased population.

	Disease: yes	Disease: no	
Exposure: yes	*a*	*b*	n_1
Exposure: no	*c*	*d*	n_2
			n

Table 11. Contingency table

II. Measures of Risk Association

In epidemiological research the calculation of measures of disease frequency is the basis for the comparison of populations and, therefore, the identification of disease determinants. In the case of the comparison of two populations, the most efficient and informa-

[37] *Hennekens et al.* (1987).

tive way is to combine the two disease frequencies in one single parameter. This parameter can be the ratio of the two disease frequencies or the difference. The first parameter indicates how much more likely one group develops the disease than the other one. The second parameter indicates the absolute amount of how much higher the disease frequency is in one group than in the other one. These measures of association, the relative risk and the attributable risk, are the most frequently used in epidemiology.

For a more simple calculation of the association measures, epidemiological data are often presented in the form of a two-by-two-contingency table, also called a fourfold table. The two-by-two-contingency table derives its name from the fact that it contains two rows and two columns, each representing the presence or absence of the exposure or the disease. This creates four cells, e. g. labelled *a*, *b*, *c*, and *d* (see table 11).

As an illustration of the construction of a fourfold table, table 12 shows the data of the case-control study conducted by *Henry* and co-workers. 164 cases were identified by the mid-upper arm circumference (MUAC) of less than 110 mm, and 164 controls with a MUAC of more than 120 mm were included in the study population. The exposure of interest was breast feeding.

Similarly, table 13 shows the data of the cohort study by *Ahmed*. In this prospective study, data was collected from 1529 children regarding the occurrence of shigellosis. In the group of children living in a house with no latrine, 131 suffered from shigellosis in comparison to 88 in the group of children living in a house with a latrine.

	cases: MUAC < 110 mm	controls: MUAC > 120 mm	
still breast feeding	39	18	57
not breast feeding	125	146	271
	164	164	328

Table 12. Case-control study:[38] association between breast feeding and mid-upper arm circumference (MUAC)

	shigellosis	no shigellosis	
no latrine use	131	905	1036
latrine use	88	405	493
	219	1310	1529

Table 13. Cohort study:[39] association between the occurrence of shigellosis and the use of latrines

[38] *Henry et al.* (1993).
[39] *Ahmed et al.* (1994).

In this form of presentation it is possible to calculate the incidence rates if the data is derived from a cohort study. So, in this example the cumulative incidence ci_1 for shigellosis in the group of the latrine users is $ci_1 = 88 / 493 = 0.178$, the cumulative incidence ci_0 for shigellosis in the group of non-latrine users is $ci_0 = 131 / 1036 = 0.126$.

1. Relative Risk

The relative risk estimates the magnitude of an association between exposure and disease. It is defined as the ratio of the incidence rate of the exposed group divided by the incidence rate of the unexposed group. Depending on the data, this can be the ratio of the cumulative incidences or of the incidence densities:

$$\mathbf{RR} = \frac{\mathbf{ci_1}}{\mathbf{ci_0}} \text{ or } \mathbf{RR} = \frac{\mathbf{id_1}}{\mathbf{id_0}}$$

where ci_1 (or id_1) is the cumulative incidence (or incidence density) in the exposed group and accordingly ci_0 (or id_0) is the cumulative incidence (or incidence density) in the non-exposed group. A relative risk of 1.0 indicates that the incidence rates in the two groups are identical, or that there is no observed association between the exposure and the disease. A relative risk larger (smaller) than 1 indicates a positive (negative) association between the exposure and the increase in the incidence rate.

For example, in the cohort study of shigellosis and latrine use, the relative risk would be calculated as follows:

$$\mathbf{RR} = \frac{\mathbf{ci_1}}{\mathbf{ci_0}} = \frac{\mathbf{88/493}}{\mathbf{131/1036}} = \frac{\mathbf{0.178}}{\mathbf{0.126}} = \mathbf{1.4}\ .$$

This value means that in this study, children using a latrine had a 1.4 times higher risk of suffering from shigellosis compared with children not using latrines.

2. Odds Ratio

In a case-control study it is not possible to calculate incidence rates or a prevalence, because the study populations are collected according to their disease status. So, a relative risk cannot be calculated for expressing the association between the exposure and the disease frequency. The alternative is to look at the odds for the exposure in the diseased and in the non-diseased group. The odds of exposure in the diseased group can be expressed by the term a:c, and the odds of exposure in the non-diseased group by the term b:d. The ratio of these two odds is called odds ratio (see table 11):

$$\text{OR} = \frac{\mathbf{a/c}}{\mathbf{b/d}} = \frac{\mathbf{ad}}{\mathbf{bc}}\ .$$

The odds ratio is a good estimator for the relative risk if the underlying disease is rare. For example, in the case-control study of *Henry* and co-workers, the odds for “still breast

feeding" in the case group is 39:125 = 0.312, and the odds in the control group are 18:146 = 0.123. The odds ratio is

$$\text{OR} = \frac{\mathbf{ad}}{\mathbf{bc}} = \frac{\mathbf{39 \cdot 146}}{\mathbf{18 \cdot 125}} = \mathbf{2.5},$$

so that the risk of a MUAC of less than 110 mm in the group of "still breast feeding" is 2.5 fold increased (or increased by 150 percent). Because of the fact that the investigators found only 200 children with a mid-upper arm circumference of less than 110 mm during the screening of 12 000 children, the disease marasmus is quite rare in this population, and the calculated odds ratio is a good estimator for the relative risk.

3. Attributable risk

Whereas the relative risk represents the likelihood of a disease in a exposed group relative to a non-exposed group, the attributable risk is a measure of the absolute effect of the exposure or the excess risk of the disease in those exposed compared with those non-exposed. Depending on the data, the attributable risk can be estimated using the incidence densities or the cumulative densities:

$$\mathbf{AR} = \frac{\mathbf{ci_1 - ci_0}}{\mathbf{ci_1}} \text{ or } \mathbf{AR} = \frac{\mathbf{id_1 - id_0}}{\mathbf{id_1}}$$

It estimates the proportion of the disease among the exposed group that is attributable to the exposure. Often the attributable risk is interpreted as the proportion in the disease group which could be prevented by eliminating the exposure. But this interpretation implies the causal inference between the exposure and the disease.

For example, in *Haelterman* and co-workers' intervention study, the cumulative incidence of meningitis in the camp where the mass vaccination was conducted was ci_0 = 162 / 180 000. In the camp without a vaccination campaign the cumulative incidence was ci_1 = 137 / 80 000. Therefore, the attributable risk for the effect of the mass vaccination is:

$$\mathbf{AR} = \frac{\mathbf{137/80000 - 162/180000}}{\mathbf{137/80000}} = \mathbf{0.474}.$$

So, if in the second camp a mass vaccination campaign was started earlier, 47 percent of the observed meningitis cases would have been avoided. But especially in this example, the attributable risk must be interpreted with caution: due to the movement of the refugees from the camp with the mass vaccination campaign into another camp and due to the late arrivals of refugees in the second camp, as mentioned earlier, the cumulative incidences are underestimated in the first case and overestimated in the second case. That would mean that the calculated attributable risk is overestimated and the true impact of the mass vaccination campaign is smaller.

D. Presentation and Summary of Data

For any study, the collection of information on many variables for a large number of individuals is necessary, so that presentation of all the original, or raw, data can be cumbersome. Descriptive statistics are used to summarise data in a form that permits the clearest presentation of most of the information and useful comparisons between study groups.

The presentation and summary of data first requires an understanding of the types of variables that are encountered in epidemiological research. Any variable can generally be considered as one of two basic types: discrete or continuous. Discrete variables are those having values that can fall into only a limited number of separate categories. In the simplest case of so-called dichotomous variables, they can take on only two values, such as *yes/no, female/male, alive/dead* or *exposed / not exposed.* When more than two alternative categories are possible, the variables are termed multichotomous. Such variables include marital status *(single, married, divorced, widowed)* or race *(white, black, oriental, Hispanic, other).* There is no order associated with the individual categories in these examples. Consequently, such variables represent what is called a nominal scale. When discrete variables include a natural order in their values, they are termed ordinal.

In contrast, continuous variables are those that can assume all possible values along a continuum within a specified range. Many clinical parameters are continuous, including e. g. height, weight and blood pressure. Continuous variables can be easily transformed into discrete or so called categorical variables by summing them into different categories. For example, the continuous variable, age of children, could be classified into categories “less than 5 months”, “6 to 11 months”, “12 to 17 months”, etc.

The classification of variables as discrete or continuous provides different concepts of presentation and analysis of data. With discrete variables, the basic analysis is the comparison of the proportions of different categories between different sub-populations. With continuous variables, groups are often compared in terms of average values or the shape of the distribution of the variables.

I. Frequencies

1. Frequency Distributions

A frequency distribution lists for each value of a discrete variable the absolute or relative frequency for each category. An example is listed in table 14. In a survey of 120 selected households in the Bosnian regions of Sarajevo, Tuzla, Zenica, and Bihaæ the infant feeding practices of 288 mothers with children under 16 weeks were obtained. Only five per cent or – in numbers – 14 of the Bosnian mothers were exclusively breast-feeding their babies. One quarter (25 %) of Bosnian mothers with babies under 16 weeks old were not producing any breast milk.

	absolute frequency (n)	relative frequency (%)
Breast milk only	14	5
Breast milk / sweetened tea / water	121	42
Breast milk formula / flour / cow's milk	81	28
No breast milk	72	25

Table 14. Frequency distribution of infant feeding practices in babies under 16 weeks in 1993 in Bosnia[40]

While frequency distributions can be used to present discrete data, they also provide the most complete and convenient way to summarise quantitative continuous variables. Because of the number of values a continuous variable can theoretically assume, it is often necessary to define classes of values and record the number of observations that fall within each category. For example, Table 15 shows the frequency distribution of the children's age (in months) for a group of 2783 children obtained in a study about the explanation of hygiene behaviour in Burkina Faso. The relative distribution varies between 15 and 27 per cent in each category.

2. Histograms

A frequency distribution can be displayed graphically as a bar chart, with the values on the horizontal axis and the frequencies of observations for each value on the vertical axis. When displaying a continuous variable by its categorisation, the blocks can differ in the ranges of the underlying variable. This can be misleading in the interpretation of the graph, when the areas of the bars are not proportional to their height. So a corrected graph, termed a histogram, would consider the width of each bar. For example, in figure 5 the frequency distribution of the children's age (in months) for the study of hygiene behaviour in Burkina Faso (see table 15) is presented as a bar chart and as a histogram. The relative frequency of the oldest age group leads to misinterpretation in the bar chart: all age groups seem to have nearly the same proportion in the study group. In the histogram the relative frequency is proportional to the area of each bar. Here, the impression of a gaussian curve is quite clear.

[40] *Robertson et al.* (1995).

	absolute frequency (n)	relative frequency (%)
0-5 months	490	17.6
6-11 months	743	26.7
12-17 months	571	20.5
18-23 months	406	14.6
24-36 months	573	20.6

Table 15. Frequency distribution of children's age[41]

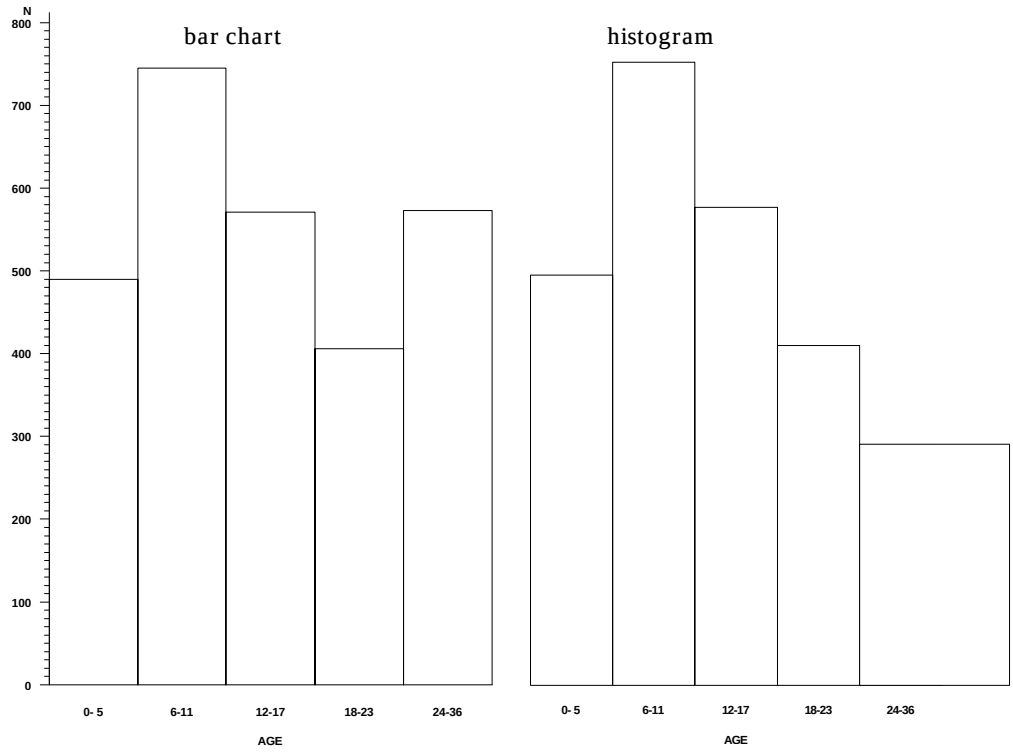


Figure 5. Frequency graph and histogram of children's age (in months)[42]

II. Summary Statistics

While tables are a convenient way to present specific information about individual values of a variable and graphs can provide a general picture of the pattern of the observations, it is often useful to provide additionally a numerical summary of the important characteristics of the distribution of the variable. Such summary statistics are also necessary for

41 *Curtis et al.* (1995).
42 *Curtis et al.* (1995).

precise and efficient comparisons of different sets of data. For discrete variables, the most informative summary measure is simply the proportion of individuals falling into each category. Continuous variables generally require the use of at least two parameters for describing the shape of their distribution. The first is a measure of the central tendency of location of the observations, and the second is a measure of their variability or spread.

1. Measures of Location

There are three measures of the location that are frequently used in the literature: the mean, the median, and the mode. Each of them has advantages and disadvantages in describing the "typical" value of a given continuous variable for a specific population.

The most commonly used measure of location is the *mean* or *arithmetic average*. It is calculated simply by adding up all the observed values x_1, ..., x_n and dividing this by the total sample size n of the group:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

age (in months)	frequency	cumulative frequency
0	72	72
1	75	147
2	86	233
3	84	317
4	92	409
5	81	490
6	107	597
7	131	728
8	115	843
9	126	969
10	134	1103
11	130	1233
12	104	1337
13	115	1452
14	86	1538
15	78	1616
16	89	1705
17	99	1804
18	71	1875
19	75	1950
20	82	2032
21	70	2102
22	52	2154
23	56	2210
24	70	2280
25	60	2340
26	67	2407
27	63	2470
28	57	2527
29	44	2571
30	46	2617
31	37	2654
32	30	2684
33	27	2711
34	24	2735
35	21	2756
36	27	2783

Table 16. Data list of child's age (in months)[43]

[43] *Curtis et al.* (1995), modified by the author.

age group j	n_j	m_j	$n_j m_j$
1 (0-5 months)	490	2.5	1225
2 (6-11 months)	743	8.5	6315.5
3 (12-17 months)	571	14.5	8279.5
4 (18-23 months)	406	20.5	8323
5 (24-36 months)	573	30	17190
$\sum_{j=1}^{k} \dots$	2785		41333
$\frac{1}{n}\sum_{j=1}^{k} \dots$			14.84

Table 17. Grouped data of the children's age[44]

Example: For the data of *Curtis* about the hygiene behaviour in Burkina Faso the mean can be calculated as follows:

$$\begin{aligned}\bar{x} &= \frac{1}{2783}(0+0+0+\ldots+36) \\ &= \frac{1}{2783}(0\cdot 72+1\cdot 75+2\cdot 86+\ldots+34\cdot 24+35\cdot 21+36\cdot 27) \\ &= 14.56\end{aligned}$$

If the data are only available as categorical data, the formula for the mean changes:

$$\bar{x} = \frac{1}{n}\sum_{j=1}^{k} n_j m_j$$

where m_j means the mid-point of class interval j and n_j the number of observations in class interval j. For the example of the *Curtis* data, the calculation for the grouped data can be done directly in the table (see table 17).

The mean has a number of desirable theoretical properties that allow it to be used as a basis for a large number of statistical tests. As a sole descriptive measure the mean has the potentially serious disadvantage of being very sensitive to extreme values, or "outliers".

The *median* describes the literal "middle" of the data. It is defined as the value above which or below which half the observations fall. For calculating the median it is

[44] *Curtis et al.* (1995).

necessary to transform the original data x_1, ..., x_n into the ordered observations $x_{(1)}$, ..., $x_{(n)}$. Then the median is defined as:

$$\mathbf{x}_{0.5} = \begin{cases} \mathbf{x}_{((n+1)/2)} & \text{, if n odd} \\ \frac{1}{2}\left(\mathbf{x}_{(n/2)} + \mathbf{x}_{(n/2+1)} \right) & \text{, if n even} \end{cases}$$

For the *Curtis* data the median can easily be calculated by using the cumulative frequencies of table 16:

$$\mathbf{x}_{0.5} = \mathbf{x}_{((n+1)/2)} = \mathbf{x}_{(1392)} = \mathbf{13}$$

The advantage of the median as a measure of location is that it is unaffected by extreme values. The comparison of the mean and the median for the same data set gives an impression as to where the main weight of the observations is obtained and what kind of asymmetry exists in the distribution. The disadvantage of the median is that since its value is determined solely by its rank, it provides no information about any of the other values within the distribution.

The *mode* of a distribution is the value that is observed most frequently in a given data set. The mode is rarely used as the only descriptive measure of location, since with a small number of observations it is likely that each value will occur only once, and thus there may be no mode.

The choice of a measure of location will depend in large part on the nature of the distribution of the observations. For continuous variables with a single-peaked and symmetrical distribution – a distribution with equal weights on both sides of their peak – the mean, median and mode will be identical. With a distribution that is skewed, the median may be a more informative descriptive measure than the mean. For statistical analyses and tests of significance, the mean is preferable whenever possible, since it includes the information from all observations. If the data is considerably skewed and there is no function that will transform the observations into a form that is more symmetrical, specialised methods of statistical analysis based on the median need to be considered.

2. Measures of Variability

In addition to a measure of location, for describing a distribution it is important to provide information concerning the relative position of other data points in the sample, that is, a measure of variability.

One simple descriptive measure of variability is the *range*, calculated as the difference of the minimum and the maximum of the sample:

$$\mathbf{R} = \left(\mathbf{x}_{(n)} - \mathbf{x}_{(1)} \right)$$

For example, the range for the *Curtis* data is $\mathbf{R} = \left(\mathbf{x}_{(2783)} - \mathbf{x}_{(1)} \right) = \mathbf{36} - \mathbf{0} = \mathbf{36}$. Although the range is both simple to calculate and easy to understand, it is far from being optimal as a measure of variability. First, the range is not a stable estimate, because as the sample size

increases, the range also tends to increase. Second, it is not a basis of statistical procedures and testing. Finally, since the range is derived from only the most extreme values, a sample may have a large range even when the majority of the observations are fairly close to the mean. Thus, a preferable measure of variability would include the distribution of all observed values, not just those at the extremes. A compromise is the difference between the upper and the lower quartiles. This measure of variability includes information on 50 per cent of all observed values. It is defined as:

$$\mathbf{Q} = \left(\mathbf{x}_{0.75} - \mathbf{x}_{0.25}\right)$$

where $x_{0.75}$ is the upper and $x_{0.25}$ is the lower quartile of the data. The quartiles are special forms of quantiles: the α-quantile being defined as:

$$\mathbf{x}_{\alpha} = \mathbf{x}_{(\|\mathbf{n}\cdot\alpha\|)}$$

where $\|\mathbf{y}\|$ stands for the smallest integer greater than y. The meaning of the α-quartile is, that at least 100 * α per cent of the data are smaller than this value.

We can calculate the difference of the quartiles for the *Curtis* data:

$$\begin{aligned}\mathbf{Q} &= \left(\mathbf{x}_{(\|0.75\cdot 2783\|)} - \mathbf{x}_{(\|0.25\cdot 2783\|)}\right)\\ &= \left(\mathbf{x}_{(2088)} - \mathbf{x}_{(696)}\right)\\ &= \mathbf{21 - 7 = 14}\end{aligned}$$

The most informative and frequently employed measures of variability are the *variance* and its related function, the *standard deviation*. Both parameters provide a summary of the dispersion of individual observations around the mean. The variance of a sample is calculated by adding up the squared differences of each observation to the mean and dividing this sum by the sample size minus one:

$$\mathbf{S}^2 = \frac{\mathbf{1}}{\mathbf{n-1}}\sum_{\mathbf{i=1}}^{\mathbf{n}}\left(\mathbf{x}_i - \bar{\mathbf{x}}\right)^2$$

For our example we obtain:

$$\begin{aligned}\mathbf{S}^2 &= \frac{\mathbf{1}}{\mathbf{2783-1}}\left(\mathbf{72}\cdot\left(\mathbf{0-14.56}\right)^2 + \mathbf{75}\cdot\left(\mathbf{1-14.56}\right)^2 + \ldots + \mathbf{21}\cdot\left(\mathbf{35-14.56}\right)^2 + \mathbf{27}\cdot\left(\mathbf{36-14.54}\right)^2\right)\\ &= \frac{\mathbf{1}}{\mathbf{2782}}\left(\mathbf{236699.8}\right) = \mathbf{85.08}\end{aligned}$$

The standard deviation is the square root of the variance. It is expressed in the same units as the original data. For distributions which are approximately normal – that is, with a single-peak and roughly symmetrical – the standard deviation and the mean together provide sufficient information to describe the whole distribution. A very useful property of the normal distribution is that 68 percent of the individual observations will lie within one standard deviation around the mean, that 95 percent will lie within two

standard deviations around the mean and that 99 percent of all the individual observations will lie within the range of three standard deviations around the mean.

3. Box-and-Whiskers-Plots

The box-and-whiskers-plots are one possibility to summarise the measures of location and the measures of variability in a graph. It summarises the minimum, maximum, the upper and lower quartile, the median and the arithmetic mean. The "box" is formed by the quartiles and the median is marked as a line in the box, the mean as a point. The "whiskers" are formed by the extension from the quartiles to the extreme values.

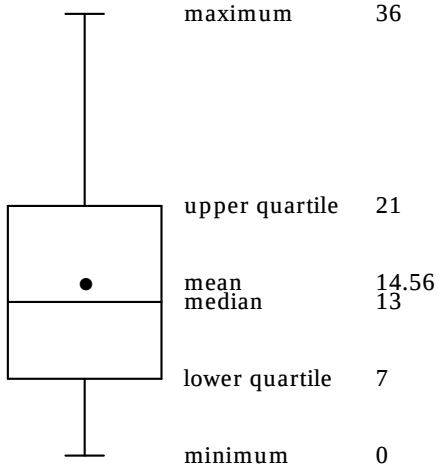


Figure 6. Box-and-Whiskers-Plot of child's age (in months)[45]

[45] *Curtis et al.* (1995).

CHAPTER 5
ANNEXES

A. Annex 1: Community Health Techniques

I. Introduction

The previous chapters have explained the importance of preventing diseases in the whole population by using appropriate health services. We have stressed the need to understand people, their total number and distribution, their environment, the disease patterns they suffer from, and how the services are organised to deal with them. This information is needed in order to practise community health from the health centre.

It is often referred to as making a *community diagnosis*.

When you want to diagnose a health problem in a patient, you make tests or examinations. For example, you listen to a patient's chest, or you look at a blood smear. These tests help you to decide what is wrong with the patient. When you want to diagnose the health problems of a community, there are certain community health techniques, such as surveys, that you use to make a community diagnosis. You use surveys to find out about a population in the same way as you use tests and examinations to find out about an individual outpatient.

Basically you first need to find out if the health services are effective in:

- their coverage of the population
- reducing the number of new cases of diseases
- reducing the morbidity and mortality of the new cases.

This chapter explains some of the techniques needed to get this information and also how to carry out community health programmes.

1. To the Health Centre

The medical staff who have been there the longest often know about the services and the local community. Ask the medical assistans and the drivers.

Health centre records and registers for outpatients, inpatients, and clinics provide statistical data. The health assistant will know about the local environment and progress with environmental programmes in the area.

Reports to the district medical officer (DMO), and the hand-over reports and summaries should be in the files; these will explain what has been done in the past.

2. To the District

The other principal officer is the person concerned with finance, staff and development plans for the district who can supply further information. There may also be others concerned with the administration of the health centre. Do they have any information or reports to read?

The other principal officer is the DDD; he is concerned with finance, staff, and development plans for the district and can supply further information. As the work of the health centre is only one part of the development occurring in the area, it is important to talk with the other district executive officers.

3. To Other Sources:

The Ministry of Health may be approached through the DMO for information, particularly about special diseases such as malaria, trypanosomiasis, leprosy, and tuberculosis, and for information about special services such as maternal and child health, nutrition, health education, and environmental health. Registers of different problems or diseases are often kept by specialised clinics or laboratories. Some parastatal, voluntary, or private organisations, such as family planning or occupational health services, keep their own records and can supply additional data.

4. Surveys

When the necessary information is not available it can sometimes be obtained by organising small surveys. These surveys can be very helpful in finding out, for example, the number of people in an area, some of their beliefs and customs, or the prevalence of a particular disease.

II. Measuring Diseases

1. Incidence and Prevalence

There are many uses of incidence (new cases in a certain length of time) and prevalence (all cases at a certain time). The ones relevant here are as follows. Incidence is the best measure of what changes are taking place – whether the number of new cases is increasing or decreasing – but prevalence is often used instead because it measures the size of

the problem that the health services have to deal with. Prevalence figures are also more often available.

The prevalence of a disease is affected by many factors. If the incidence of disease changes, so will the prevalence change. But prevalence can also change due to patients being cured or dying, or to cases migrating into or out of the health centre population. Also the health services may lose track of some of the cases. These factors do not affect incidence. Whether you use incidence or prevalence measures, it is important to be clear about what you are counting. With diseases like malaria or diarrhoea, a person may have several separate attacks in a year and perhaps attend for treatment 2 or 3 times each attack. A tuberculosis or leprosy patient might attend 12 times a year for a disease which started a year or more ago. At the antenatal clinic each patient may attend 5 or 6 times during a pregnancy.

What shall we count? People, total attendances, or new attenders? This depends on what we want to measure. If we want to estimate the proportion of the population sick with a chronic disease (prevalence) then we need to know the number of names (people) in the register for that disease. If we want to see how a control programme is working, then we want to know the number of new cases occurring (incidence). This is easy for diseases with separate registers, like tuberculosis, leprosy, or the antenatal clinic – we can easily find out how many new cases were registered in a month or a year. But it is hard to find out from the usual outpatient records the incidence of diarrhoea or malaria. Total attendances might be 500. Going through all the names might show that 200 people made up these 500 attendances. But unless we went through each person's case notes we could not find out the true number of new episodes of malaria.

What do we learn from this? That we should be clear in our minds what figures we can get from usual records and what they mean; also, that if we want to know something special, like new cases of malaria, we shall have to make special arrangements in advance to record the information we want.

2. Reliability of Diagnosis

What is a "case"? Before counting a disease in any way it is important to decide quite clearly how a "case" is to be defined. Confusion and misunderstanding may easily arise if this is not done. In a malarious area, people with fever, headache, and body pains may be called malaria cases, but to count all these as malaria would not be satisfactory. Indeed, the DMO or Ministry of Health would probably only accept these symptoms as malaria if confirmed by a positive blood slide. Rabies is another good example. Many "cases" of this always fatal disease are reported although hardly any die. What is really being reported is a "patient who needed anti-rabies vaccine" and only those who died may have actually had rabies. Clear definition of what is a "case" is very important. If in doubt, check with the DMO.

3. Measuring Disease by Rates

When it is necessary to *make comparisons* between two different areas, or between what is happening in the district now compared with 10 years ago, we cannot simply compare the total number of cases. If district A reports that there are 100 patients registered with leprosy (a prevalence measure) and district B reports 150, in which population is leprosy more common? Before we can give a proper answer, we need to know the total number of people in each district, i. e. the population at risk. If there are 20,000 in A and 60,000 in B, we can find how many cases there would be *per 1,000 population* in each, and compare the two rates.

$$\text{A}: \quad \frac{100}{20{,}000} \times 1{,}000 = 5 \text{ per } 1{,}000 \text{ population}$$

$$\text{B}: \quad \frac{150}{60{,}000} \times 1{,}000 = 2.5 \text{ per } 1{,}000 \text{ population}$$

This use of rates shows us that leprosy is in fact twice as common in district A, even though it reports fewer cases. (We could also, if we wanted to, calculate how many cases of leprosy there would be among a full "health centre population" of 50,000 people in each district – 5 x 50 = 250 in district A, and 125 in B.)

Important rates to work out for your district are the rate at which children die within their first year of life (the infant mortality rate) and the rate children die between one year and five years of age (the child mortality rate).

The infant mortality rate (IMR) measures all the deaths from all the serious illnesses, e. g. malaria, gastroenteritis, pneumonia, measles, that young children get before they are one year old. The IMR is still high in Tanzania – about 160 deaths per 1,000 live births. In some countries this figure has fallen to around 50 per 1,000, and in a few countries the figure has gone down to less than 20 per 1,000. The following formula gives the IMR, which is usually given as the number of deaths in one year:

$$\frac{\text{number of deaths of infants in one year}}{\text{number of live births in one year}} \times 1{,}000.$$

The child mortality rate (CMR) is also important because it measures deaths at the age when malnutrition, as well as the other diseases, is common. The CMR is more difficult to calculate than the IMR, because detailed child population figures are required. It is also very high in Tanzania.

4. Measuring by Case Fatality

A measure of the seriousness of a disease can be obtained by seeing what proportion of those who get the disease die from it. Virtually no one dies from the common cold, and only a few from influenza, but many die from measles, and everyone who gets human rabies dies. This measure of seriousness is called the case fatality rate and it is usually ex-

pressed per 100 (percentage) not per 1,000 as in the IMR. (Remember that 5 per 100 (5 per cent), 50 per 1,000, or 500 per 10,000 are all the same rates. It is only a matter of custom and convenience which one is generally used.)

Case fatality rate =

$$\frac{\text{number of cases who die fom a particular disease}}{\text{total number of cases diagnosed with particular disease}} \times 100$$

e. g. if a health centres sees 140 measles cases in one year and 7 die,

$$\frac{\text{number of deaths from measles in one year}}{\text{total number of cases of measles in one year}} \times 100 \Leftrightarrow \frac{7}{140} \times 100$$

therefore case fatality rate for measles = 5 per cent.

If 2 people out of 25 bitten by dogs in a year actually develop rabies and die,

$$\frac{\text{number of deaths from rabies in one year}}{\text{total number of cases of clinical rabies in one year}} \times 100 \Leftrightarrow \frac{2}{2} \times 100$$

therefore case fatality rate for rabies = 100 per cent.

III. Describing Situations

When we have detailed knowledge about diseases we can predict which people are most *at risk* of getting them. This helps us to prevent them. The method of studying the distribution and frequency of diseases is called epidemiology and it is based on these questions:

- *What* is the disease frequency?
- *Who* is ill? – people
- *Where* did they become ill? – place
- *When* did they become ill? – time

When presented with a problem concerning the general population, or the use they make of the health services, describing the situation by answering these questions helps to make things clearer.

1. Who?

People can be grouped in many different ways. Some of the important ways of grouping them are by:

- age

- sex
- occupation
- income
- culture and religion
- family size
- nutritional state
- immune status

Other groupings can be used, such as clinic attenders and non-attenders, those with latrines and those without, or normal and low-weight infants.

2. Where?

The place where people are living or working may partly determine which diseases they could suffer from and what use they would make of the medical services. This place could be:

- a town, village, or isolated dwelling
- at high or low altitude
- near or far from ponds, wild animals, or toxic substances
- near or far from a dispensary, or health centre.

3. When?

When a disease starts, or when someone visits the medical services is useful information. In describing the incidence of cases or events, they can be grouped according to the number occurring in a day, a week, a month, or a year. For instance, new cases of tuberculosis in one year, new maternal and child care clinic attenders registered in one month, new cases of measles in one week, or new cases of cholera in one day.

IV. How Well Are the Health Services Working?

The effect of clinical services on an individual patient is frequently checked. For instance, when looking after an inpatient we regularly record his temperature and pulse and watch his condition. In the same way it is necessary to check the effect of community health services by watching and recording the health of the population. This is difficult to do comprehensively, but there are a number of simple ways in which some estimates may be made. This process of maintaining a watch on how effective the community health services are is called *evaluation*.

The following are examples of simple evaluation:

- Keeping weekly or monthly charts of the number of new cases of malaria, gastroenteritis, measles, and tuberculosis – and any other locally important diseases – seen at

the health centre; graphing of the number of new and repeat visits made each week to outpatient and MCH clinics

1. Comparing how many new infants or mothers are registered at MCH clinics compared with the total number of infants or mothers in the population
2. Seeing what proportion of the total population is living within 10 km of a dispensary or the health centre

- Graphs of the number of new latrines built in different villages
- A map showing the sites of the wells that have been built

A useful method of evaluation is to make comparisons. Two of the comparisons for evaluating health services are:

1. to see what happened *before* and *after* a change was made – for instance, before and after a new clinic was established or a new person was appointed;
2. to see what differences exist between an area when a new improved service has been introduced and one where it has not – for instance, areas with and without a new dispensary or MCH clinic.

Many evaluations are better made by good judgements than by trying to count something and give a figure. A good judgement is worth much more than bad counting.

Some examples of evaluations that could well be based on judgements are:

- How much local community involvement is there in the health services?
- What does the community think of the service?
- How well have all the jobs been distributed amongst the staff?
- Are all the staff thorough and conscientious?

Just as judgements are often used in clinical medicine and a record of them made in the patient's notes, so judgements should be made in community health and recorded in reports and placed on the appropriate files.

V. Surveys

If the required information about the community is not available in reports or from routine records, a survey should be organised. Before a survey is undertaken, careful thought should be given to what can be done when the information has been obtained. If we collect information just out of curiosity and do nothing with it the community will be disappointed and will not be so willing to co-operate with the health service the next time they are asked to help. Make it a rule not to do a survey without providing some service. If, for example, you do a survey to find out the coverage of immunisation, it is a good plan to offer immunisation to those found in the survey who have been missed previously; do this immediately after the survey is finished. This will help any long-term plans for health education or for improving the immunisation service.

Surveys are carried out for three main reasons:

1. to find people with important diseases, e. g. tuberculosis or leprosy, who either do not know that they have them, or who do know but have not yet been to the dispensary or health centre. This type of survey is often called *screening* for a disease;
2. to find out what beliefs, customs, and behaviour people have before organising a community programme, e. g. for nutrition, family planning, or environmental sanitation;
3. to find out how people are using the health services, in order to get ideas about how to improve them, e. g. when, where, and how often mothers would like to have the MCH clinic held.

When planning a survey, it is important to remember:

1. the questions and tests should be simple and reliable;
2. the questions should be acceptable to the people included in the survey, otherwise they may refuse to co-operate;
3. the medical staff should be prepared to treat or refer any sick person found during the survey;
4. a survey should not screen for disease if there is no effective treatment for the cases found;
5. surveys are not usually useful for rare diseases or rare events.

Sometimes it can be very difficult to know what questions to ask and what tests to use. It is wise to discuss your problem with the district medical officer first and then plan the survey with his advice. When you have decided what you want to do, you should pre-test the programme in the field before undertaking the survey.

1. Cross-sectional and Longitudinal Surveys

There are two main kinds of surveys designed to collect information. One involves questioning and examining a sample of the population at *one point in time*. This gives prevalence information and is called a prevalence or cross-sectional survey. The one point in time may be a day or several days, and examples might be the collection of blood smears taken in one day for malaria parasite examination or the screening of school children for possible leprosy.

The prevalence rate =

$$\frac{\text{number of cases found at a point in time}}{\text{total population}} \times 100$$

(You can also multiply by 1.000 instead of 100 and express the rate “per thousand”.)

The second kind of survey collects information about all the new cases of a disease or events *over a period or interval of time*, like one month or a year. Such surveys give incidence data and are usually called longitudinal surveys. Examples might be the recording

of all new cases of measles or tuberculosis, or all new pregnant mothers attending the antenatal clinic for the first time during one year.

The incidence rate =

$$\frac{\text{number of new cases detected in a defined period or interval of time}}{\text{total population at risk}} \times 100 \,(\text{or} \times 1000)$$

It is important to be clear which kind of information is needed – prevalence or incidence – and how it is going to be used. Then it will become clearer how the population to be studied should be defined. This is a very important step before going on to sampling.

2. Sampling

In a survey there may not be the time or the resources to survey all the people in the population or all the people attending the health centre or clinic. In these situations it is best to choose a smaller group of people, a sample, to include in your survey. It is important to select a sample in such a way that it will give roughly the same answer as if the whole population had been surveyed. This type of sample is called an "unbiased" sample. A sample which gives a different answer from the one which you would get from surveying the whole population is called a "biased" sample.

3. Biased Samples Can Give Wrong Answers

If the question you are asking is "what is the prevalence of scabies in the health centre population?", you would be wrong to select a sample from people living close to the health centre. These people close to the health centre might have a better supply of water and more knowledge about hygiene, or have been treated, and therefore have a much lower prevalence of scabies than people living far away. This would be a biased sample. If you tried to estimate the prevalence of scabies in the population by examining people in the clinics you would also have a biased sample because these people would probably have a higher prevalence than people in the general population.

When you have thought about influences like these which might bias your sample and decided where to do your survey, you still need to pick an unbiased sample so that everyone in the area population has an equal chance of being in the survey. A very convenient way of doing this is by using the Ten-cell system. An unbiased sample could be chosen from the list of Ten-cell leaders by selecting, for example, every seventh leader on the list and then examining *every family in the cell* to find out the proportion of the children showing signs of scabies. There are many ways of doing this depending on how many people are wanted in the sample and how big the whole population is.

When using this kind of sampling, it is important to use different Ten-cell leaders when another survey is organised. Be careful that you do not only go to helpful and co-operative Ten-cell leaders as this might also give biased results. Sampling is a complicated subject and you should ask for help in selecting an appropriate sample if you are in

any doubt. The important thing to remember is that a badly planned survey will produce useless results. Do not attempt it without good advice. If you are involved in a survey planned by an expert, be very careful to follow his directions about selecting the sample exactly, so that you end up with an unbiased sample which will yield useful results.

4. Response Rate

There is another way in which surveys can give wrong answers, even when the sample has been well chosen. This is when only a few of the people selected for the sample are seen. It is important to know what percentage of the people in the sample were actually seen. This is called the *response rate*. In surveys for leprosy, for instance, people who think they have leprosy may hide from the survey team. The medical staff might then send in a report that there was very little leprosy in the area. It is important to remember that the people who do not turn up, or are not seen by the survey, may have something to hide or some reason for not coming.

As a general rule it is necessary to see at least 75 per cent of the sample selected.

VI. Accuracy of Measurements

We must always try to measure things as accurately as possible.

Most errors are made by the people making the measurements and not by the instruments used or by the patients. This type of inaccuracy or error is called “observer error”. Different observers very often report different measurements on the same patient – this is called between-observer or inter-observer error. Also the same observer may get different results from the same patient or specimen at different times – this is called within-observer or intra-observer error. For example, blood pressure or body temperature readings are often not accurate, but this is not because of the sphygmomanometer or thermometer!

There may also be problems with some instruments such as weighing scales, particularly if the zero has not been checked for some time. Other errors may occur while writing down the figures on the record card. Take great care to be accurate both in routine work and surveys.

The two most important ways by which medical staff can reduce the amount of inaccuracy are:

1. for all staff to follow an agreed *standard method*, such as how long the thermometer should be left in the mouth, which blood pressure sounds to listen for, and how to ask the questions in the questionnaire;
2. for all the staff to be *thoroughly* trained, and every now and again *checked* to see that they are doing things correctly.

The staff of a health centre will only do good and accurate work if the medical assistant takes trouble to discuss and agree on the methods to be used and then trains the staff in

these methods and periodically checks their work and the instruments they use. This applies both to clinical work in the centre and also to community health work outside.

Check staff by observing them doing their tasks and looking at their results straight away. Check instruments like the weighing machine by seeing if it always reads the same on different occasions when a standard like a 5 kg weight is put on it. If it does not give the same reading it is faulty and it should be checked more fully.

From time to time divide a faeces or sputum specimen into two halves and let the laboratory assistant report on both halves without knowing they are from the same patient. If his work is accurate, his reports on the two halves should usually agree.

It also helps to get all staff to sign their initials against any case history, physical examination, or laboratory tests that are done so that it is clear who did them. This is also helpful when checking records for missing information.

VII. Keeping Good Records

Good records can help the individual patient and also those organising the health services. Bad records or records that cannot be found when they are wanted are of no use to anyone.

If too many records are kept, or too much information is required on a record form, all health workers get bored and fill them in carelessly or leave blanks.

The purposes of routine record keeping are:

1. Individual patient management
   For this we keep the individual patient record. This must have sufficient information to identify the patient – name, age, sex and the name of the Ten-cell leader (usually the best method of locating a patient). There must also be a number for filing if the cards are kept at the health centre. Patients may also keep their record cards themselves. This is often the best way of making sure that the record card is available at any clinic a patient attends. Mothers look after their children's Road-to-Health cards at least as well as records clerks.
   The health worker should record the date of attendance, patient's condition, and treatment given and initial the card, so that he can be identified if something is missing or the patient needs to see the same person on his next visit.
2. Information about disease patterns
   For this we keep a daily register. Records kept at clinics can provide information about the pattern of disease seen in people living around the clinic. If we analyse records kept over a period of time and present them properly, we can see how diseases patterns are changing and perhaps detect an epidemic in its early stages.

3. Information for evaluation
   The above records, together with monthly, annual and survey reports help to answer the questions:
   - What was done?
   - Who was it done for?
   - How effective was it?

B. Annex 2: Water and Sanitation in Emergencies

I. Introduction

The complex emergencies of the last years were all accompanied by an almost complete breakdown of infrastructures, especially in the health sector.

In nearly all the camps of refugees and displaced people, a completely new system of potable water supply, food supply, and basic health care had to be installed from point zero.

In all disaster response there is a *hierarchy of needs* – priority tasks that need to be set.

For mere physiological reasons, the availability of sufficient quantities of safe drinking water is the first and most urgent problem to resolve.

> *The health status of the victim population in emergencies depends directly on water supply!*

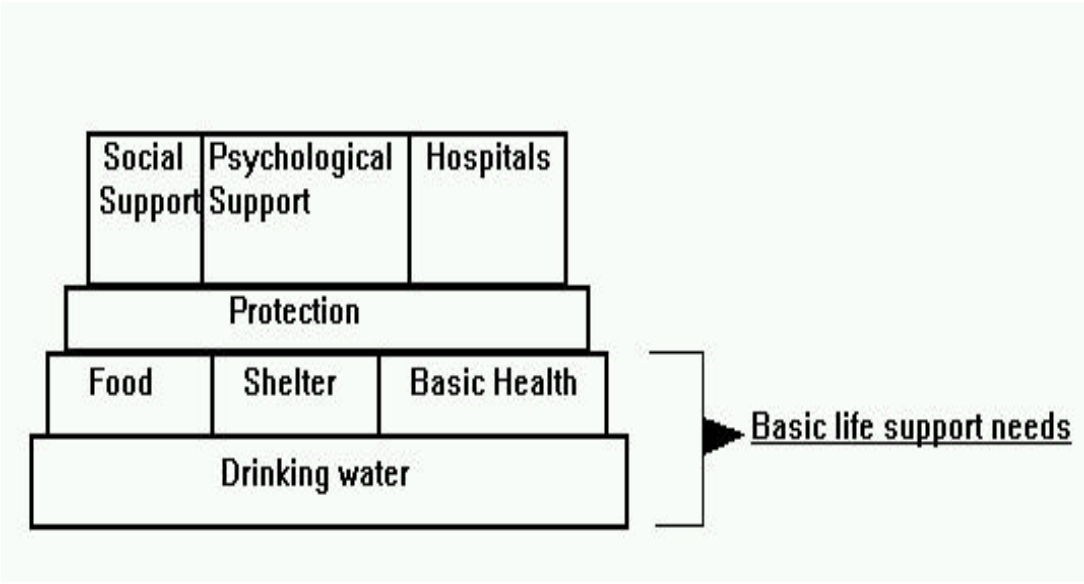


Figure 7. The Hierarchy of Needs

The need for potable water starts at day one, and water supply has to be considered the first priority in complex emergencies. For this reason, the water teams are often the first responders in the relief operations of aid-agencies, and they work under an enormous time-pressure.

While food and medical facilities can be brought in the camps from outside, water supply is absolutely dependent on the sources found at the site. Water cannot be produced by agencies, it can only be delivered and treated if necessary, but it must be available in the camp area.

The use and distribution of water is almost impossible to strictly control in cases of shortage. If people need it and if there is no alternative, they will drink any kind of water they can get.

To establish a sufficient supply of potable water, protection of available water-resources has to start immediately. Sanitation is therefore an integral and indispensable part of water supply.

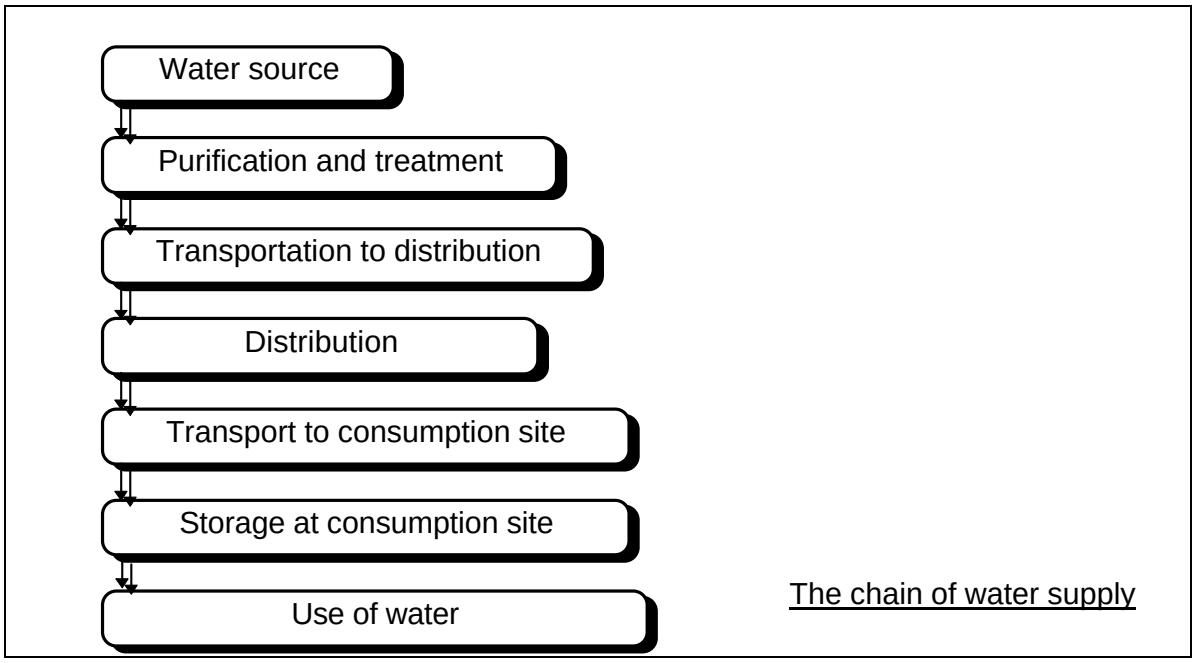
In camps with a large concentration of people and no functioning infrastructure, this is not only a technical problem. The real outcome of all the technical possibilities depends absolutely on the proper handling and use of potable water and sanitation devices by the victim population.

The effect on the health status of the population will therefore depend mostly on *basic health education* of and *participation* by the people. Both components have to be included in the relief programmes from the very beginning.

In most of the emergencies, the need for sufficient quantities of potable water will be the first and most urgent priority and the first operational contact between relief agencies and the victim population. On this occasion, the victims' the participation and collaboration will be determined for the complete further operation. The technical facilities of the relief-agencies in being able to treat and transport a sufficient quantity of water must be matched with the habits, traditions and beliefs of the people to achieve a positive effect on the health status.

Humanitarian assistance among the victims themselves has always started long before the first agency arrives on the field. Relief agencies should try to use these first structures and to give the people a real chance to participate in the decision-making process.

Water supply means a complete and complex system with the target of assuring the *consumption* of sufficient quantities of safe drinking water. This requires treatment, transport, distribution and storage in a well organised and supervised chain. All along this chain, the water has to be protected from contamination. Even if one link in this chain is broken or weak, people will not receive enough safe water and their health will suffer.



The chain of water supply

II. Priority of Quantity

Less water for the people will directly affect their health.

Their basic water requirements depend on work-load, climate and other environmental factors.

In emergency situations, each individual needs at least *5 to 7 litres* of drinking water a day just to survive. Another 15 to 20 litres are needed for cooking, hygiene, washing, etc.

absolute *minimum*	*5-7 litres/person/day*	only *provisionally*
target	*20-25 litres/person/day*	only *for consumption* *consumption, cooking hygiene*
feeding-centres	30 litres/person/day	
health-centres	50 litres/person/day	
hospitals	200 litres/person/day	

Table 18. Water needs

The quantity of water available will be determined by the site of the camp or the place where the emergency occurred.

There are three different types of water sources that can be used:

1. Surface water (rivers, lakes, etc.)
   - ♦ instantly available
   - ♦ good quantity estimation
   - ♦ relatively easy access
   - ♦ sometimes seasonal variations
   - ♦ enormous danger of contamination
   - ♦ difficult to protect
   - ♦ polluted; needs treatment
2. Ground water (boreholes, deep wells, etc.)
   - ♦ the deeper the better (quality)
   - ♦ no bacteriological treatment needed
   - ♦ easy to protect
   - ♦ in deep bore-holes no seasonal variations
   - ♦ rarely available in sufficient quantity
   - ♦ digging or drilling is time consuming
   - ♦ capacities are difficult to predict
3. Rainwater
   - ♦ relatively clean
   - ♦ normally no treatment needed
   - ♦ quantities unstable

Following a disaster, all available sources of water, including springs, wells, bore-holes and deep wells, rivers, lakes and ponds, must be thoroughly assessed for the quantity and the quality of their water. Seasonal variations have to be taken in account.

Immediate protection of all water sources is necessary to avoid pollution by human excreta.

It is generally preferable to use ground water, because it generally needs no treatment.

In the emergency situation, there is often no choice between the different kinds of water sources and relief agencies have to normally start with the surface water available, which needs complex treatment and protection.

The restriction on the consumption of water in cases of severe shortage is practically impossible. During the first few days, we always have to expect a shortage in safe potable water with the need to assure that treated water will be used exclusively for drinking, while water of minor quality should only be used supplementarily (cooking, hygiene etc.).

> *In emergencies, quantity is more important than quality!*

The lack of water that will ensure a minimum standard of hygiene is more problematic than the consumption of relatively poor water quality.[46]

> *Water borne diseases coming from drinking unclean water are usually less serious than those resulting from a lack of water. Therefore, a large amount of reasonably safe water is preferable to a small amount of pure water!*

[46] MSF, Public Health Engineering (1994).

The above-mentioned figures (table 18) represent the quantity for consumption, not for treatment. A certain loss must always be taken in account.

Distribution and storage need good supervision and organisation.

If there is no chance of reaching a continuous supply of 20 litres/person/day, it should be considered moving the camp.

III. Quality

The quality of water can, in practice, be defined by the absence of health risks through consumption.

The major health risks in emergencies, when the breakdown of infrastructures occurs, are epidemics due to water which has been contaminated by pathogenic organisms.

Turbidity of water is, by itself, no criteria for the absence or presence of pathogenic organisms, but it is important for the acceptance of the consumers to eliminate it by filtration or flocculation.

Chemical analysis is rarely necessary.

Bacteriological Analysis:

In practice, it is impossible to detect all the pathogenic organisms which could be present in the water source. As an *indicator* for a possible *faecal contamination*, the detection of *Escherichia coli* is normally used. This indicates pollution by human faeces or faeces of warm-blooded animals, with the possible presence of other dangerous pathogenic organisms.

With the number of *E. coli* per 100ml, the degree of contamination can be estimated.

Following the WHO directives, there should be no faecal coliforms in drinking water.

In practice and in the emergency situation in the field, a certain degree of contamination must be tolerated, giving priority to the necessary water quantity (section II).

In areas with a high population density and the danger of faecal contamination, the protection of the water sources is one of the keys to a safe water supply.

Practical guidelines[47]

Less than 10 faecal coliforms/100 ml:
In emergencies, water can be consumed as it is

10 to 100 faecal coliforms/100 ml:
Water should be treated if possible, but in emergencies it may possibly be consumed as it is.

More than 100 faecal coliforms/100 ml:
Water must be treated!

If there is a threat of cholera, typhoid or shigella dysentery epidemics, all contaminated water, or in any case water with more than 10 faecal coliforms/100ml should be rejected or treated.

Bacteriological analysis should always be combined with a sanitary inspection (defecation areas, protection, transport, etc.).

Each analysis only describes the present situation. It should be repeated regularly for a constant monitoring and detection of possible sources of contamination.

It is never sufficient to analyse only the water quality of the water source or of the treated water. Once a distribution system is established, the quality of the water at the tapstands of the distribution points has to be monitored regularly in order to trace eventual contamination during storage or transport.

In camps with a large population density it is nearly impossible to assure a sufficient water supply of perfect quality from the beginning. The target must therefore be, to provide a sufficient quantity of water as first priority and to improve or maintain the water quality as fast as possible.

IV. Treatment

The most serious threat to the safety of water supply is the contamination by human faeces.

The aim of treatment is the *elimination of pathogenic organisms.*

This needs time, money and trained staff.

Treatment always has to be combined with the tracing and elimination of possible contamination sources.

In emergency situations, individual treatment by the population (cooking water, filtration, etc.) can never realistically be expected.

[47] MSF, Public Health Engineering (1994).

Measures

1. Storage and sedimentation
   The purification through storage occurs by sedimentation.
   Turbid water can not effectively be disinfected. If disinfection is needed, flocculation or sedimentation must first be carried out.
   Storage and sedimentation alone is not a very effective measure. It takes a lot of time and requires large storage facilities.
   To avoid too much loss of time, flocculation will very often be necessary.
2. Filtration
   This means the elimination of a proportion of pathogenic organisms by passing the water through a permeable layer (membranes, sand, etc.). This retains most of the larger particles like eggs, cysts and also some pathogenic bacteria and viruses.
   Slow sand filtration is the cheapest and most effective method, but time consuming and therefore not very practicable at the very beginning of an operation.
3. Disinfection with chlorine
   Chlorine is a very effective and powerful disinfectant.
   It is not toxic.
   Given properly, it can eliminate all bacterial and viral pathogenic organisms in the water.
   In practice, chlorine generating products are used, which release chlorine when dissolved in water (i. e. calcium hypochloride, chloride of lime, etc.).
   The reaction starts immediately. Reaction time is about half an hour.
   The amount of chlorine needed can be determined by the measurement of free residual chlorine, this means, the surplus of remaining chlorine that has not been consumed in the disinfection process.
   Chlorination is ineffective against protozoan cysts and helminth eggs or larvae. There is also no effect on pathogenic organisms within suspended particles.
   To eliminate this contamination, preliminary filtration is necessary.
   Chlorination sometimes produces a strange smell in the treated water, which may cause problems in the acceptance by the victim population. This may sometimes even lead to the suspicion of being poisoned. Participation of the population and basic health education by well-trained local teams is essential.
   In emergency situations, chlorination is the fastest and most effective way to treat contaminated water.
   It needs good equipment, trained staff, continuous maintenance and control and a lot of money.
   (Details of chlorination see sub-annex 1)

V. Logistics

The treatment of contaminated water by itself can not assure the consumption and proper use of potable water.

Transport, storage and distribution are possible sources of recontamination.

Thinking with the aim of 20 litres/person and day, it has to be taken in account that an average family has to transport more than 100 litres/day to their settlement.

Number and site of distribution points have to assure that the distance allows the victims to transport the water they need.

If distances are too far, people will not fetch enough water for limiting diseases or they collect it from closer, possibly contaminated sources.

For the transport of the water from the distribution points, each family should have containers with a minimum total capacity of 40 litres. They should have small openings with caps to diminish the risk of contamination.

The single container should not contain more than 20 litres, so that it can be carried by all family members when full.

1. Distribution Points

In practice, bladder tanks with a volume of 15,000 or 20,000 litres are mostly used at the distribution points, which can assure the water supply for about 200 families. The bladder tank has to be based on a solid platform at a height of about 1.5 metres to distribute the water by passive flow.

The distribution point should be established at a certain distance from the tank and protected by an efficient drainage system. About 10 taps are recommended for a tank of 15,000 or 20,000 litres.

The establishment of distribution points requires a lot of personnel and can only be done with the collaboration of the victim population. The participation of the beneficiaries in the site selection and the construction can be the base for effective health education as well as for the maintenance of the system.

2. Transport

Transport of treated water to the distribution points is often the most critical part of the water supply system. Numerous heavy trucks are sometimes needed, and transport without contamination must be assured. The construction of pipelines takes up too much time at the beginning of the operation and their protection is difficult.

Sometimes, local tanker trucks are available. They normally carry fuel, so if hired for hauling water, they must be cleaned very thoroughly before use.

Water distribution requires a lot of staff and very good planning of sites and transport schedules. These decisions are essential for the acceptance of the system by the population, and real participation of the beneficiaries is needed.

VI. Protection of Water Sources – Sanitation

1. Excreta

The treatment of contaminated water is just the first step towards a safe water supply system. Overcrowding and the absence of sanitation systems pose enormous dangers of recontamination, either of the water sources or of the already treated water during the transport or in the dwellings before consumption.

Many infectious diseases that may lead to fatal epidemics are transmitted by human excreta (i. e. cholera, shigella).

The safe disposal of human faeces and urine is easy, but time consuming and requires man power. Despite this, action has to be taken immediately, especially in situations with large population concentration.

In emergencies, there will rarely be a perfect system available from day one, but defecation and possible contamination starts from the first moment.

The effect of all sanitation measures is dependent on the collaboration and awareness of the victim population. This have to be discussed with the local leaders and adjusted according to the habits and traditions of the people. Local health information teams should be set up to inform the victims about the measures agreed upon.

The aims of all excreta disposal measures are:

- concentrate excreta in one place
- avoid contact with insects
- avoid pollution of water

Preconditions for a proper use:

- access (distance)
- privacy
- respecting habits and traditions

In most cases, the first decision will be the determination of a defecation area taking into account the location of the water sources and the distance to the dwellings.

Large trench latrines can sometimes be an alternative if collective defecation is traditionally acceptable and large digging machines are available.

Family latrines, like simple pit-latrines, are the preferable system in most cases. They are the most socially acceptable and maintenance is assured. If sufficient tools are available, they are easy to construct and can be adapted to the conditions in terms of material. Construction can be done by the families themselves. Privacy is sufficient.

But even the construction of pit latrines takes time, and it has to be made sure that in the mean time, the safest possible excreta disposal is well organised by temporary measures. (Pit latrine details in sub-annex 2)

2. Waste

Particularly in camps with a high population density, the normal household waste is also a threat to public health through the breeding of flies and the attraction of rodents. Flies play a major part in many infectious diseases that are transmitted by the faeco-oral route.

The quantity of household waste differs enormously and depends mainly on sociocultural factors, season and habits, but also on the packaging of food rations.

For rough calculation, a value between 0.5 and 1 litre per day can be taken as a base and adjusted to the special circumstances.

In most cases, metal drums are used for the household waste. They should have a cover to avoid contact with flies. The bottom should be pierced in order to prevent retaining liquid.

A collection system should be established as soon as possible in close collaboration with the population. Regular supervision and evaluation is also essential.

In emergencies, household waste should be disposed of in pits and covered with soil or ashes immediately after disposal to avoid contact with flies.

Medical waste has to be disposed of separately. Burial is essential because of the high risk of contamination.

VII. Health Education and Collaboration

Each relief operation has to start with the immediate installation of a safe water and sanitation system to avoid fatal epidemics. While the relief agencies can offer technical devices and technical experience, it is up to the victim population to adapt these offers to their habits and beliefs. The success of water and sanitation measures is absolutely dependent on the acceptance and awareness of the people.

Participation in water and sanitation programmes therefore, means much more than giving the refugees shovels to dig pits. It means including the local leaders in all decisions that have to be taken to assure a safe water supply and to avoid pollution.

Preformed solutions from the expatriate relief workers will be an obstacle for such an operation as well as the absolute adherence to habits by the beneficiaries.

While the technical abilities and experiences of the relief teams have to be adjusted to the situation and the people, the victims also have to adapt their behaviour.

The manner in which the whole operation is conducted is very often influenced by the atmosphere and collaboration that can be achieved in solving the problem of foremost importance: safe water.

Collaboration needs awareness and motivation of the people, with the aim of making them an active part of all the primary health care programmes. The formation of local health information teams (HIT) has to start immediately and priorities have to be fixed according to the situation.

In most cases, hygiene will be the most important starting point. This is not because people are not familiar with hygiene, but because the situation in the emergency requires special measures that have to be understood by the people.

The key is collaboration, which means a programme, that is designed, installed and supervised by both the victims and the relief agencies.

VIII. Water Borne Diseases

The main threats to the health status in emergencies are epidemics of diarrhoeal diseases (e. g. cholera, dysentery) transmitted by contaminated water or food.

In unprepared communities with a lack of health structures, case-fatality rates in cholera epidemics can be as high as 50 %.

Control of epidemics has to start as a preventive measure by installation of a safe water supply and basic health education in the field of personal hygiene and food preparation.

1. Cholera

Cholera is an acute intestinal infection caused by *Vibrio cholerae*.

The incubation period is short (less than 1 to 5 days).

It produces an enterotoxin.

Symptoms:

- Painless, watery diarrhoea which can quickly lead to severe dehydration and death.

Most infections remain without or with only mild symptoms (> 90 %). The bacterium remains in the faeces of these patients for about 2 weeks.

These asymptomatic carriers are the main reason that epidemics spread rapidly.

Contaminated water and food are the normal transmission route.

Treatment is easy and very effective if started in time, but it requires participation of the population and medical infrastructures. 80-90 % of the diarrhoea patients can be successfully treated by oral rehydration. Only about 10 % need i. v. fluids.

An effective antibiotic can reduce the duration and volume of diarrhoea as well as the period of *vibrio* excretion. Normally, tetracycline is used. Increasing resistances are reported.

Epidemic control measures, whether preventive or after an outbreak, are based on supply and consumption of safe drinking water, adequate disposal of human faeces and food hygiene.

Cholera vaccination gives only partial protection (50 % or less) for a limited period of time (max. 3 to 6 months). It is not recommended as a measure for the prevention of control of outbreaks.

The mass treatment of a community with antibiotics also shows no effect on the spread of the disease.

2. Dysentery

Dysentery is defined as diarrhoea containing blood. It can be caused by different types of pathogenic organisms. Shigella are the most important in emergencies and type Sd1 is the only cause of epidemics.

Symptoms:
- Abdominal cramps, fever, rectal pain.

Complications:
- Sepsis, seizures, renal failure, haemolytic uraemic syndrome.

The case-fatality rate is between 5 and 15 %.

The transmission occurs mainly by person-to-person contact and by contaminated water and food. People of all ages are affected. Case-fatality rate is highest among children.

Treatment can be achieved with antibiotics. Sensitivity has to be tested. Sd1 can rapidly develop resistances, even during the course of an epidemic.

All dysentery patients should be treated with a sensitive antibiotic and dehydration should be managed with oral rehydration solution if there is no need for i. v. fluids.

If there is drug shortage, high risk groups for complications and death have to be defined (e. g. children less than 5 years, malnutrition, etc.).

Additionally to the appropriate management of patients, continuous health education should improve safety of drinking water as well as personal hygiene, disposal of faeces and adequate preparation of food.

IX. Sub-Annexes

1. Sub-Annex 1: Chlorination

Measuring of chlorine demand

- Preparation of 1 % chlorine solution
- Preparation of some none metallic containers of known volume of water (e. g. 10 litres)
- Give different amounts of the 1 % solution to the water containers with a syringe (e. g. 0.5ml, 1 ml, 1.5ml ...)
- Wait at least half an hour
- Measure free residual chlorine in each container
- Find out the container with the free residual chlorine level at about 0.5 mg/l
- Calculate the amount of 1 % solution you need for the quantity of water to be treated

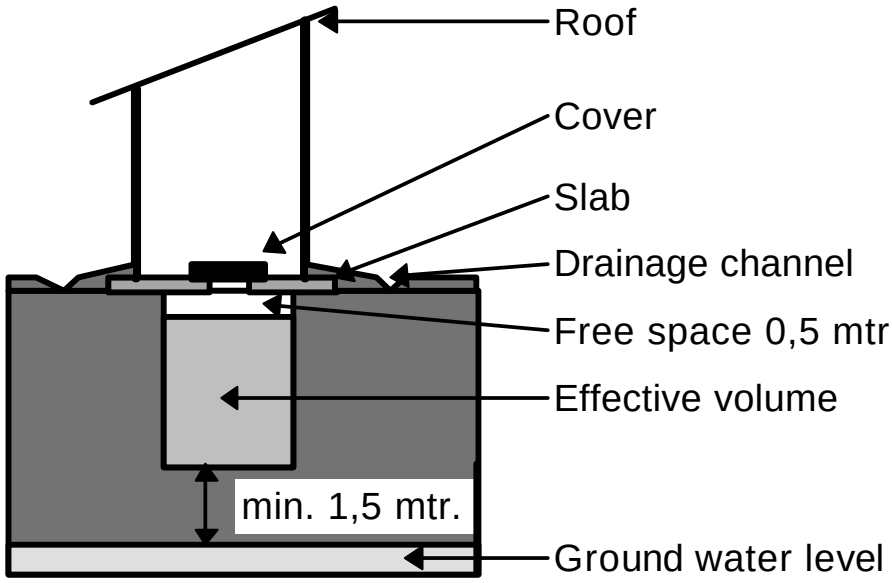
Turbid water must be filtrated or sedimentated before the measurement of the chlorine demand, to assure that the chlorine can react with all the pathogenic organisms.

Metallic containers can not be used, because they consume chlorine.

There is no relation between the taste of chlorinated water and the free residual chlorine.

The constant supply of chlorine must be assured. Concentrated chlorine is dangerous and can produce a very toxic gas when in contact with air. Storage facilities have to be dry, cool and safe.

2. Sub-Annex 2: Pit Latrine



Calculation of the effective volume:

For dry pits, the solids accumulation rate can be calculated at about 0.05 m³ per person per year.

This figure has to be multiplied by the number of users and the expected lifetime of the latrine in years. An additional free space of 0.5 metres depth has to be added.

The figure has to be increased if voluminous anal cleansing material is used (e. g. maize, cobs, etc.)

The distance to water points should be at least 30 metres and downhill.

The distance from the dwellings should be between 5 and 50 metres.

Assure that the cover always remains closed and that the slab and the surroundings are cleaned daily.

The superstructure can be constructed by any available and suitable material according to the possibilities and habits.

The simple pit latrine can be improved by a ventilation pipe (VIP-latrine = ventilated improved pit latrine).

C. Annex 3: Economic Analysis of Health Care Programmes

Answers to questions such as whether a health programme is worth doing compared with other things or whether resources should be spent in this way rather than some other way need a systematic approach. The basic tasks of any economic analysis are to identify, measure, value and compare the costs and consequences of alternatives being considered. The basic forms of economic evaluation of health care programmes set out in this chapter have been established by *Drummond*[48] for normal situations. Until today, only some of these techniques were used for analysing health care programmes in emergencies. However, due to increasing restriction in economic resources, complex economic analyses will become mandatory in the future.

I. Components of Economic Analyses

The components of economic analyses are costs on one side and health improvement as a consequence of health care and programmes on the other. Costs represent resources consumed, consequences are changes in physical, social and emotional functioning. Several types of costs and consequences are subdivided in the following chapters.

1. Types of Costs

a) Direct Costs

Direct costs are attributed to organising and operating within the health sector. Overheads and other costs not directly attributed to medical treatment (i. e. costs of transport, cars, tents, buildings, generators, tools) are to be distinguished from costs attributed to medical treatment (i. e. drugs, surgical instruments).

[48] *Drummond et al.* (1986).

Example: Direct Costs of a Field Hospital

Costs not directly attributed to medical treatment

- Transport (i. e. equipment, teams, cars)
- Tents / maintenance of buildings
- Non-medical equipment (i. e. tools, generator, kitchen)
- Non-medical personnel (i. e. logisticians, cleaners)
- Running costs (i. e. water, heating, electricity, waste disposal)

Costs attributed to medical treatment

- Drugs
- Medical material (i. e. bandages, dressings)
- Medical equipment (i. e. surgical instruments, laboratory equipment, x-ray machine)
- Medical personnel (i. e. physicians, nurses)

Direct costs may also be attributed to patients or their families (i. e. out-of-pocket expenses or input into the treatment).

b) Indirect Costs

Indirect costs are not directly attributed to health care such as costs due to time lost from work (production losses).

c) External Costs

External costs arise outside the health sector, patients or their families. These costs include costs for preparation of a health care programme (i. e. fact finding missions, negotiations with authorities, agreements, costs of offices in Europe).

2. Categories of Consequences

Consequences deal with results of a programme or health care. Three categories of consequences are presented.

a) Effects

Effects are therapeutic outcomes of alternatives in question. Normally these effects are changes in physical, social, or emotional functioning of individuals (i. e. cure of malaria, improvement of a general condition due to tuberculostatic treatment). These changes can be assessed or measured objectively and refer to the individual's ability to function.

b) Benefits

The therapeutic effects of a programme may result in changes in resource use (benefits). Within the health sector, less resources may be required for treatment of a condition than otherwise. As an example, effective screening for malnutrition averts the future cost of caring for a high rate of infectious diseases in children. Another example is the prophylactic application of vitamin A in a refugee camp which reduces the cost of treatment of xerophtalmia (child blindness) and the socio-economic consequences of the disease.

c) Utilities

The effects of health care give rise to another important category of consequences: the changes in quality of life of patients and their families. The concept of measuring quality of life in patients or families by validated questionnaires has not been used in analyses of emergency programmes. However, it represents a promising technique which allows us to distinguish the quality of life produced from the effects themselves by the significance or value that patients attach to these effects.

II. Types of Cost Analyses

Regarding the costs and consequences mentioned above, it is unrealistic to expect all relevant items to be measured and analysed. The amount of effort it takes to assess, measure and value specific effects may be unacceptable for emergency programmes. Simple techniques of economic analyses are often mandatory. Therefore, only some types of the analyses presented below have already been applied to emergency health programmes.

1. Cost Analysis

The calculation of costs without regarding comparison of two alternatives represents the simplest form of economic evaluation. A detailed cost analysis of an emergency health programme is relatively easy to perform. It may be extremely helpful in identifying components with a high impact on the total costs.

Two examples of cost analyses calculated by *Ure* are presented below. The total cost of establishing and running a cholera hospital for 5 months was calculated (Somalia, 1100 patients treated). The highest costs were identified for equipment and transport. The cost of one car was similar to the cost of all drugs and medical equipment used. For comparison, a cost analysis of a District Hospital (Rwanda) is presented. The hospital was supported for 16 months, approximately 11,600 patients were admitted, 53,600 underwent outpatient treatment. In contrast to the cholera hospital, the highest costs were due to drugs, medical equipment and transport. It has to be noted, that approximately 90 % of the expenses for both relief programmes were spent in Germany, 10 % were spent in Somalia or Rwanda.

Example of two Cost Analyses: Field Hospital for Cholera Patients (150 Beds, 5 Months) versus District Hospital for General Health Care (200 Beds, 16 Months)

	Cholera Hospital (DM Thousand)		District Hospital (DM Thousand)	
Drugs / medical equipment	64.6	(13.3 %)	566.3	(30.3 %)
Surgical equipment	-		90.4	(4.8 %)
Non medical equipment	161.2	(28.2 %)	69.4	(3.7 %)
Transport	138.0	(24.2 %)	424.0	(22.7 %)
Cars	59.6	(10.4 %)	163.2	(8.7 %)
Cost of the German team	59.5	(10.4 %)	299.3	(16.0 %)
Hospital overhead costs	33.6	(5.9 %)	59.4	(3.2 %)
Salaries of local personnel	45.2	(7.9 %)	172.4	(9.1 %)
Office costs in Germany	8.3	(1.4 %)	26.4	(1.4 %)
Total costs	570.0		1,870.8	

2. Cost-Minimisation Analysis

Two programmes or health care activities may lead to identical results (i. e. hospital admission or day surgery programme for operation of inguinal hernia, oral versus intravenous rehydration for mild dehydration). The efficiency evaluation then is a search for the cheapest alternative. This evaluation normally is made on the basis of cost per medical procedure. If we identified the common outcome of interest, operations successfully completed, it could be achieved to the same degree in a field hospital, which was totally established by a relief organisation, or in an existing facility which was rehabilitated, though presumably at different costs.

3. Cost-Effectiveness Analysis

This form of economic analysis investigates both the costs and consequences of a programme. Costs are related to a single common effect which may differ in magnitude between the alternative programmes. The result may be stated in cost per unit of effect or in terms of effects per unit of cost. As an example, the mortality of untreated cholera is approximately 50 %. It can be reduced to 2 % by running a cholera hospital. A cost-effectiveness analysis considers the mortality with and without treatment and the cost of the hospital for a given period of time and number of patients. The cost per effect would be the cost per surviving patient, which was calculated by *Ure* at 591 DM for a cholera hospital in Somalia.

Furthermore, cost-effectiveness analyses can be performed on any alternatives which have a common effect. Thus, an immunisation programme for meningitis could be compared to a programme for prevention of malaria. The common effect of interest then would be lives saved or disability days avoided.

4. Cost-Benefit Analysis

Consequences of health care or programmes are often not identical. The need for a common denominator then becomes apparent. One measure of value is money, and the consequences of a programme can be expressed in terms of its dollar benefits in order to facilitate comparison. This implies translating effects, such as life years gained, number of lives saved, or complications avoided, into their dollar benefit. This complex form of economic analysis is difficult to perform on emergency programmes due to the lack of precise data. However, it represents a promising technique.

5. Cost-Utility Analysis

Another measure of value is utility, which is more difficult to obtain. Utility refers to the value or a worth of a specific level or improvement in health status and is measured by preferences of individuals or the society for a particular set of health outcomes. The results are expressed in terms of cost per healthy day or cost per quality-adjusted life-years gained by undertaking one programme instead of another. The details of the techniques of cost-utility analysis are beyond the scope of this chapter and the specific literature should be referred to.

D. Annex 4: Expanded Programme on Immunisation[49]

PART 1

The twelfth meeting of the Global Advisory Group (GAG) of the Expanded Programme on Immunisation (EPI) took place in Tokyo, Japan, from 16 to 20 October 1989. The following are extracts from the conclusions and recommendations that are of particular importance to national programme managers.

Overall programme status

The EPI is achieving remarkable success as the decade of the 1980s draws to a close. For the first time in history, immunisation coverage for the world has reached the two-thirds mark (67 %) for a third dose of polio vaccine for children by 1 year of age (Table 19). In developing countries alone, coverage stands at 66 % for a third dose of polio or DPT vaccines, 72 % for BCG and 59 % for measles vaccines. Substantial progress is being seen in all regions, despite many special social and economic problems. These accomplishments provide optimism that at least 80 % coverage with these antigens can be reached by the end of 1990. Tetanus toxoid coverage of pregnant women continues to be the least satisfactory: in developing countries only 29 % are reported as having received 2 or more doses.

[49] From: WHO Wkly Epidemiol Rec, part I, n° 2, 1990, pp. 5-11; part II, n° 3, 1990, pp. 15-16.

Developing countries ranked by surviving infants	Infants surviving to 1 year of age	Cumulative percentage of infants	Immunisation coverage (percentage)				
			Children less than 1 year of age				Pregnant women
			BCG	DPT3	Polio 3	Measles	Tetanus
1. India (8)	22.57	20	72	74	63	45	61
2. China (9s)	20.25	38	98	95	96	95	-
3. Indonesia (8&9)	5.16	43	81	71	73	64	29
4. Pakistan (8)	4.90	47	77	64	64	55	22
5. Nigeria (8s)	4.75	51	53	42	42	42	16
6. Bangladesh (8)	4.23	55	26	16	16	13	12
7. Brazil (8)	4.16	59	67	54	89	60	62
8. Mexico (7&8)	2.55	61	72	60	95	70	42
9. Iran (8)	2.10	63	89	89	89	83	54
10. Viet Nam (7)	2.07	65	68	61	60	60	-
11. Philippines (8)	2.01	66	83	69	68	67	37
12. Egypt (8)	1.98	68	80	87	87	84	49
13. Ethiopia (7)	1.76	70	28	16	16	13	7
14. Thailand (8)	1.46	71	55	47	47	36	35
15. Turkey (9s)	1.44	72	64	77	77	65	-
16. Zaire (7&8)	1.36	73	57	38	38	41	29
17. Myanmar (8)	1.31	75	37	28	22	25	22
18. Kenya (7s)	1.19	76	86	75	75	60	37
19. Tanzania (7s)	1.11	77	95	82	80	78	58
20. South Africa	1.09	78	-	-	-	-	-
21. Sudan (8)	0.94	78	54	41	41	35	19
22. Algeria (7)	0.92	79	95	73	73	72	-
23. Morocco (8)	0.92	80	75	60	60	56	33
24. Colombia (7&8)	0.90	81	99	74	94	74	6
25. Rep. Korea (7)	0.89	82	95	85	93	95	-
26. Argentina (8)	0.71	82	74	61	70	68	-
Total 26 countries	92.71	82	74	69	69	60	30
Other developing countries	20.01	18	65	54	54	53	27
Total developing countries	112.72	100	72	66	66	59	29
Industrialised countries excluding Australia and United States of America[b]	14.02		76	88	88	76	-
Total industrialised countries	18.10		59	68	68	76	-
Global total	130.82		71	67	67	61	25

Table 19. Estimated immunisation coverage with BCG, DPT, poliomyelitis, measles, and tetanus vaccines, based on data available as of July 1989

[a] Up to 5 years of age

[b] Australia and the United States of America are among the most populous industrialised countries that do not report immunisation coverage data for children under 1 year of age, except for measles vaccine

(7) 1987 reported data

(8) 1988 reported data

(9) 1989 reported data

(s) Survey data

\- No information available

At current coverage levels, it is estimated that the EPI is preventing some 2.2 million deaths each year from measles, neonatal tetanus and whooping cough, as well as some

355 000 cases of poliomyelitis (Table 20). The urgency for raising immunisation coverage levels further is underlined by the continuing occurrence each year of some 2.8 million preventable deaths from measles, neonatal tetanus and whooping cough and over 200 000 cases of poliomyelitis (Table 21).

	(a) New-borns (000's)	(b) Surviving infants (000's)	(c) Neonatal tetanus deaths prevented (000's)	(d) Pertussis cases prevented (000's)	(e) Pertussis deaths prevented (000's)	(f) Measles cases prevented (000's)	(g) Measles deaths pre-vented (000's)	(h) Polio-myelitis cases prevented (000's)
26 largest developing countries	100,124	92,707	300	43,758	361	53,066	1,051	304
Other developing countries	21,968	20,008	56	7,452	85	10,075	302	51
Total developing countries	122,092	112,715	356	51,209	446	63,141	1,353	355

Table 20. Estimated annual number of deaths from neonatal tetanus prevented; cases and deaths from pertussis and measles prevented; and cases of poliomyelitis prevented in developing countries, based on data available as of July 1989

(a) New-borns: based on 1988 estimated population and crute birth rates
(b) Surviving infants: based on estimated number of new-borns and infant mortality rate
(c) Based on mortality estimations from surveys or reports, a vaccine efficacy of 95 % and immunisation coverage reported as of July 1989. Countries without available data were arbitrarily categorised into 1 of 3 levels of neonatal tetanus mortality: 5,10 or 15 per 1000 live births
(d) Based on an incidence estimation of 80 % of new-borns in absence of an immunisation programme, a vaccine efficacy of 80 % for 3 doses, and immunisation coverage reported as of July 1989.
(e) Based on mortality estimations of one-third of measles deaths, a vaccine efficacy of 80 % for 3 doses, and immunisation coverage reported as of July 1989.
(f) Based on an incidence estimation of 100 % surviving infants in absence of an immunisation programme, a vaccine efficacy of 95 % and immunisation coverage reported as of July 1989.
(g) Based on arbitrary case-fatality rates ranging from 2 % to 4 %, a vaccine efficacy of 95 % and immunisation coverage as of July 1989.
(h) Based on an incidence estimation of 5 per 1000 new-borns in absence of an immunisation programme, a vaccine efficacy of 95 % and immunisation coverage reported as of July 1989.

	Neonatal tetanus deaths (1) (000's)	Measles deaths (2) (000's)	Pertussis deaths (3) (000's)	Total deaths (000's)	Cumulative percentage of total deaths	Polio-myelitis cases (4) (000's)	Cumulative percentage of cases
26 largest developing countries	623	1217	395	2236	79	160	77
Other developing countries	163	298	115	577	21	49	23
Total developing countries	787	1516	510	2812	100	208	100

Table 21. Estimated annual number of deaths from neonatal tetanus, measles, and pertussis and estimated annual number of cases of poliomyelitis in developing countries, based on data available as of July 1989

The annual number of deaths from neonatal tetanus, measles and pertussis, and the annual number of cases of poliomyelitis in developing countries were estimated, using the immunisation coverage data in Table 19 and the following assumptions:

1. Neonatal tetanus: based on survey data or in absence of survey, neonatal tetanus deaths are estimated from countries with similar socio-economic conditions.
2. Measles: it is assumed that the vaccine efficacy is 95 % and that all of unimmunised children will acquire measles. Coverage is assumed to be zero in countries from which date are not available.
3. Pertussis: it is assumed that the vaccine efficacy is 80 % and that 80 % of unimmunised children will acquire pertussis. Coverage is assumed to be zero in countries from which date are not available.
4. In view of narrow limits of variation of results of poliomyelitis surveys, and in the absence of an immunisation programme, a fixed incidence rate of 5 cases per 1000 new-borns is used. A vaccine efficacy of 95 % is used. Coverage is assumed to be zero in countries from which date are not available.

Remarkable and unprecedented co-operation in support of the EPI has developed at global and regional levels among a wide spectrum of organisations, including WHO, UNICEF, the World Bank, UNDP, Rotary International and other service organisations, bilateral development agencies and nongovernmental organisations. Especially in the Americas, this type of co-operation has extended to country level and provides a model for WHO to promote and for all countries to examine and encourage.

However, the future of the EPI is by no means assured. Social and economic problems are likely to constrain the further development of health services in developing countries, and application of existing technology is still far from complete. Unless continued specific priority is accorded to the programme, its gains to date could be jeopardised.

Support from outside sources will be required for the foreseeable future to achieve and sustain high coverage. In the least developed countries, this will need to include recurrent costs. For new or improved vaccines to be added to developing country programmes, substantially increased support will be required.

National programme managers are urged to develop detailed fiscal plans as part of their overall plans for the EPI, clearly identifying the resources required and specifying whether they will be provided by the government or by outside agencies. Governments

and collaborating agencies should formally approve these plans, with all parties committing themselves to providing the financial support indicated.

Community demand for immunisation services can be developed through social mobilisation and activities aiming to change health behaviours. This is an important step in assuring national support. A second step is changing professional norms so that immunisation and other preventive health care services become accepted responsibilities of staff engaged in curative care by ensuring that health professional schools include specific curricular topics on the application of immunisation and other preventive and promotive elements of primary health care. Ministries of health are encouraged to actively seek collaboration from private and voluntary groups and from communities themselves in accomplishing both of these steps.

Basic health service needs for raising and sustaining immunisation coverage include:

- *improving the management of the health services,* decentralising responsibilities and providing training/supportive supervision to the health workers who provide immunisations;
- *making primary health care services more accessible;* and
- *informing and motivating the public,* specifically recognising that fathers, as well as mothers, have important health roles to play.

Priority actions specific to immunisation include:

- *Immunising at every opportunity.* All health facilities seeing women and children should provide immunisation services as frequently as feasible, with appropriate immunisation schedules. False contraindications should be avoided so that immunisations are not withheld unnecessarily. Any immunisations needed by the mother should be offered at the time of immunisation of the child.
- *Reducing drop-out rates.* Courteous services should be provided at times and places convenient for the users. Parents should be informed of the importance of immunisation, the need to return to complete the immunisation schedule and the time and place of the next appointment. Defaulters should be identified and actively followed-up, using individual names and addresses whenever feasible.
- *Using special immunisation activities where routine coverage remains low and/or disease transmission has not been interrupted.* These special activities include national or local immunisation days, weeks or months. Such events may include the provision of additional immunisation services or may be limited to providing increased publicity to encourage the use of the existing services. Special activities should always be planned to give maximum support for strengthening the permanent health infrastructure.

Studies of “missed opportunities” for immunisation should continue to be promoted to document this problem within national programmes and to secure the support of health workers and national decision-makers to take remedial action. These studies should include opportunities being missed for maternal and child health services in addition to immunisation.

The concept of missed opportunities may also be extended. For example, failure to include nongovernmental organisations and private providers as active partners in national immunisation programmes or to include all EPI antigens in national or subnational immunisation days should be considered missed opportunities.

Periodic national programme reviews continue to be a highly productive means of sharing information and improving management. Yet more needs to be done to assure that their recommendations are implemented. Funds should be specifically allocated to permit visits from central level to each state/province to discuss the recommendations in detail and to permit at least one of the international members of the review team to re-visit the country within 6 months to follow-up on the recommendations.

National immunisation policies are frequently not being followed at health centre level. National managers should strengthen programme monitoring, emphasising in particular the degree to which national recommendations concerning sterilisation of syringes and needles, immunisation schedules, contraindications to immunisation and health education are implemented.

As national immunisation programmes mature, it becomes increasingly appropriate to consider the introduction of additional vaccines of public health importance. In the past, the Group has called attention to the importance of introducing yellow fever vaccines in endemic countries of Africa (1988) and routine infant immunisation with hepatitis B vaccine in countries in which adult carrier rates for this virus exceed 2 % (1987). With respect to hepatitis B immunisation, the October 1989 recommendations of the EPI Research and Development Group were endorsed as follows:

> *"The scientific basis for the integration of hepatitis B vaccine within the EPI has been clearly established. There are no significant technical impediments to its use. Nonetheless, many countries are unable to use the vaccine while its price remains high. WHO is therefore urged to find ways to reduce the purchase price of hepatitis B vaccine to levels permitting its widespread use in developing countries.*
>
> *High-risk sub-groups exist in many countries with low overall carrier rates. To date, it has proved difficult to achieve high coverage in such groups through policies of selective immunisation. Re-evaluation of these selective immunisation policies is encouraged with specific consideration being given to introducing routine hepatitis B immunisation of infants even in countries in which the problem is largely confined within sub-groups."*

Research and development activities are yielding valuable results, and these efforts should continue to be vigorously pursued.

Disease control

Disease control is the central EPI priority. The control of measles, the elimination of neonatal tetanus and the eradication of poliomyelitis, the 3 diseases which have been identified for initial emphasis at the global level, depend on achieving high and sustained immunisation coverage of the target groups. Neonatal tetanus can also be prevented by assuring clean delivery and post delivery care. Such initiatives require strengthening of the primary health care infrastructure. The eradication of poliomyelitis requires that certain more specialised actions be undertaken, actions which can also strengthen health services management. These include improving surveillance and laboratory services, and enhancing public awareness.

These disease control initiatives should be seen as a way of consolidating the EPI progress which has been achieved and of assuring that the programme resources now in place are being directed for the maximal benefit of those they are designed to serve.

Measles control

The severity of measles in developing countries is well recognised. This disease is also an important cause of morbidity in industrialised countries. Unfortunately, in some of the latter countries, health workers and the general public persist in the belief that natural measles disease is preferable to immunisation. Such beliefs should be dispelled, and the importance of measles immunisation in all countries reinforced.

Measles before the age of 9 months continues to be a major cause of morbidity and mortality in a number of developing countries. At the same time, measles immunisation has altered the epidemiological patterns of disease so that an increasing proportion of cases occurs in older age groups. The introduction of measles vaccine strains which are effective before the age of 9 months offers a means to address the first problem. A variety of control measures will be helpful in addressing the second, among them the identification and immunisation of susceptible populations.

Measles immunisation before 9 months of age

Sufficient data are now available to recommend that "high titre" Edmonston-Zagreb (EZ) measles vaccine be administered at 6 months of age or as soon as possible thereafter in countries in which measles before the age of 9 months is a significant cause of death. "High titre" is defined as 5.0 $\log_{10}$ infectious units when the titre has been measured in parallel with the WHO International Reference Reagent for measles vaccine and corrected appropriately. It is anticipated that increasing supplies of this vaccine will become available for use in developing countries over the next 1 to 2 years, in part through UNICEF. High titre EZ vaccine should preferentially be offered to those countries with the most severe measles problems in young infants.

Before EZ strains produced elsewhere are accepted for use at 6 months of age, they should be shown to be comparable in this age group with respect to reactogenicity and immunogenicity to the strain produced by the Institute of Immunology in Zagreb. Most studies have involved countries in Africa and the Americas. Further studies are encouraged in other areas of the world.

In countries where high titre EZ vaccine will be used, HIV-infected infants (symptomatic as well as asymptomatic) should also receive it.

Evaluation of the impact on overall measles incidence and mortality following the introduction of high titre EZ vaccine should receive high priority. Programmes should be prepared to investigate apparent vaccine failures and adverse events in recipients of this vaccine.

In countries where measles before the age of 9 months is not a significant problem or high titre EZ vaccine is not available, currently recommended schedules of immunisation should be retained using any strain of measles vaccine meeting WHO Requirements. These vaccines should have a minimum potency of 4.0 $\log_{10}$ infectious units. This rec-

ommendation does not preclude further research on immunisation schedules to improve measles control using currently available vaccines.

Measles control in older children

Some countries with moderately high coverage levels have reported outbreaks in older children or even young adults. This is an expected consequence of immunisation programmes whose target age group has been children under 2 years of age (under 1 year of age in most developing countries) in which 100 % uptake has not been reached. Another expected result of high coverage levels is an increase in the proportion of cases which occur among children previously immunised (vaccine failures). Neither occurrence necessarily indicates programme failure. Even in countries currently reporting increased numbers of cases in older children, the present immunisation programme has succeeded in reducing overall incidence and mortality rates.

The occurrence of measles in older children should not divert attention or resources from the need to increase coverage in young children. Countries are urged to immunise children as soon as they become eligible and to improve health information systems so that groups with low coverage can be identified and immunised.

In many countries, immunisation programmes have reduced measles incidence to such an extent that health workers and the public expect measles outbreaks not to occur, and outbreaks thus generate strong political and social pressure for response that cannot be ignored. Countries which have reached moderately high coverage levels should be aware that future outbreaks in older children may occur. These should be notified promptly. Plans for their control should be developed which do not jeopardise routine immunisation of younger children.

Neonatal tetanus elimination

In May 1989, the World Health Assembly adopted a resolution to eliminate neonatal tetanus (NNT) from the world by 1995 (WHA 42.32). The goal of elimination of neonatal tetanus will be pursued in ways which strengthen EPI as a whole, fostering the development of maternal and child health programmes and primary health care.

The Group endorses the revised Plan of Action for Global Elimination of Neonatal Tetanus by the Year 1995.

Recognising the 784 000 infant deaths due to neonatal tetanus still occurring in 1989 and the need to rapidly increase tetanus toxoid immunisation coverage and the proportion of deliveries respecting the “3 cleans” (clean hands, clean delivery surface and clean cutting and care of the umbilical cord), the Group recommends the following additional actions:

- organising integrated training/planning workshops at national and district level;
- adopting a “risk approach” to designate high priority geographical or socio-economic areas for elimination activities;
- administering a protective course of tetanus toxoid to all women of childbearing age as early as possible and ideally before school-leaving and the first pregnancy;
- reducing/eliminating the number of “missed opportunities” by offering tetanus toxoid to mothers when children are immunised;

- providing a life-long immunisation card (record) for all tetanus toxoid recipients;
- reporting of neonatal tetanus cases by month and by district jointly with other EPI target diseases;
- making greater use of all antenatal visits, including those during the first trimester of pregnancy, to:
  - administer tetanus toxoid,
  - identify women at risk for complications from delivery,
  - deliver a cord care kit to those women who will not deliver at a health facility;
- simplifying recommendations concerning the tetanus toxoid immunisation schedule and indicators for monitoring progress, including those relating to the coverage among target groups and the proportion of births protected from tetanus;
- encouraging the use by maternal and child health programmes of tetanus toxoid coverage of pregnant women as an indicator of adequacy of service; and,
- encouraging the adoption of the neonatal tetanus incidence rate as a health indicator supplemental to the infant and maternal mortality rates.

Despite the persisting shortage of resources, rapid progress is being achieved. The Group commends the outstanding achievements in the Americas, noting the value of this experience for eradication efforts in other regions.

WHO should capitalise on the progress already being achieved and pursue strategies which produce and extend polio-free geographical zones, reducing poliomyelitis-endemic zones to a decreasing number of well-defined areas. When the interruption of the transmission of wild poliovirus is being attempted, trivalent oral polio vaccine (TOPV) must be intensively applied. Few areas which remain poliomyelitis-endemic will be able to accomplish this through routine services alone, and the use of immunisation days with all antigens should be considered as a supplemental strategy. Outbreak containment may require house-to-house TOPV immunisation without the use of other antigens.

The recommendations of the second Consultation on Poliomyelitis Eradication, held in Geneva in September 1989, are endorsed. The following recommendations are brought to the particular attention of national programme managers:

- As defined in the 1988 World Health Assembly resolution WHA 41.28, poliomyelitis eradication should be pursued in ways which strengthen the development of the EPI as a whole, fostering its contribution, in turn, to the development of the health infrastructure and of primary health care...
- Countries at all stages of poliomyelitis eradication should establish and strengthen appropriate surveillance activities. At a minimum, these activities should include regular reporting of cases from those health institutions most likely to see patients suffering from flaccid paralysis. Each district should be asked to report regularly, at least monthly and, as the incidence of cases declines to low levels, on a weekly basis...
- Present WHO recommended policies advocating TOPV as the vaccine of choice in EPI are reconfirmed. In endemic countries, doses of TOPV are recommended at or shortly after birth and at 6, 10 and 14 weeks of age (or as soon after as possible).

- In countries in which effective surveillance is identifying less than 50 cases of paralytic poliomyelitis a year, detection of suspect poliomyelitis cases should be followed by an appropriate immediate response, involving immunisation with a dose of TOPV given to all children in the age group at risk living in the epidemiological at-risk zone, delivered in a mass campaign or on a house-to-house basis.
- Where difficulties are being experienced in interrupting the transmission of wild polioviruses, possibly in spite of high immunisation coverage levels, it is essential to conduct competent investigations to identify the factors responsible and to correct these before making decisions on changing immunisation strategies prematurely, or on changing from oral to inactivated vaccine...
- *Serology is no longer recommended for routine use in the diagnosis of poliomyelitis,* although it may have a place in the identification of susceptibility or in waning immunity or in the future, when better and more specific serological tests have been developed.
- There is a need for substantial additional resources to be targeted at supporting research into the production of better polio vaccines, notably with greater antigenicity, improved thermostability and decreased neurovirulence. Production of such vaccines will facilitate global poliomyelitis eradication. In addition, high priority should be given to research on the use of combined OPV and IPV schedules.

As a part of regional and global monitoring of the poliomyelitis eradication initiative, consideration should be given to documenting the number of countries in which surveillance data are being analysed at central level and fed back to the health workers who have originated it.

Vaccine quality

Whether or not a national control authority exists in the receiving country, national managers should assure that the vaccine derives from a manufacturer whose products are known to meet WHO Requirements, should be assured of its potency on arrival and should assure it is stored and transported properly throughout the period it remains in use. Monitoring of adverse events associated with immunisation is an activity which will become more important as vaccine coverage increases and surveillance is improved. WHO should develop protocols for dealing with vaccine-associated adverse events and for problems related to loss of vaccine potency.

- Urban immunisation services and vitamin A and iodine supplementation were among the other items discussed. They will be reviewed later in a separate issue of the WER.

CHAPTER 6
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