CHAPTER 14

Cholera

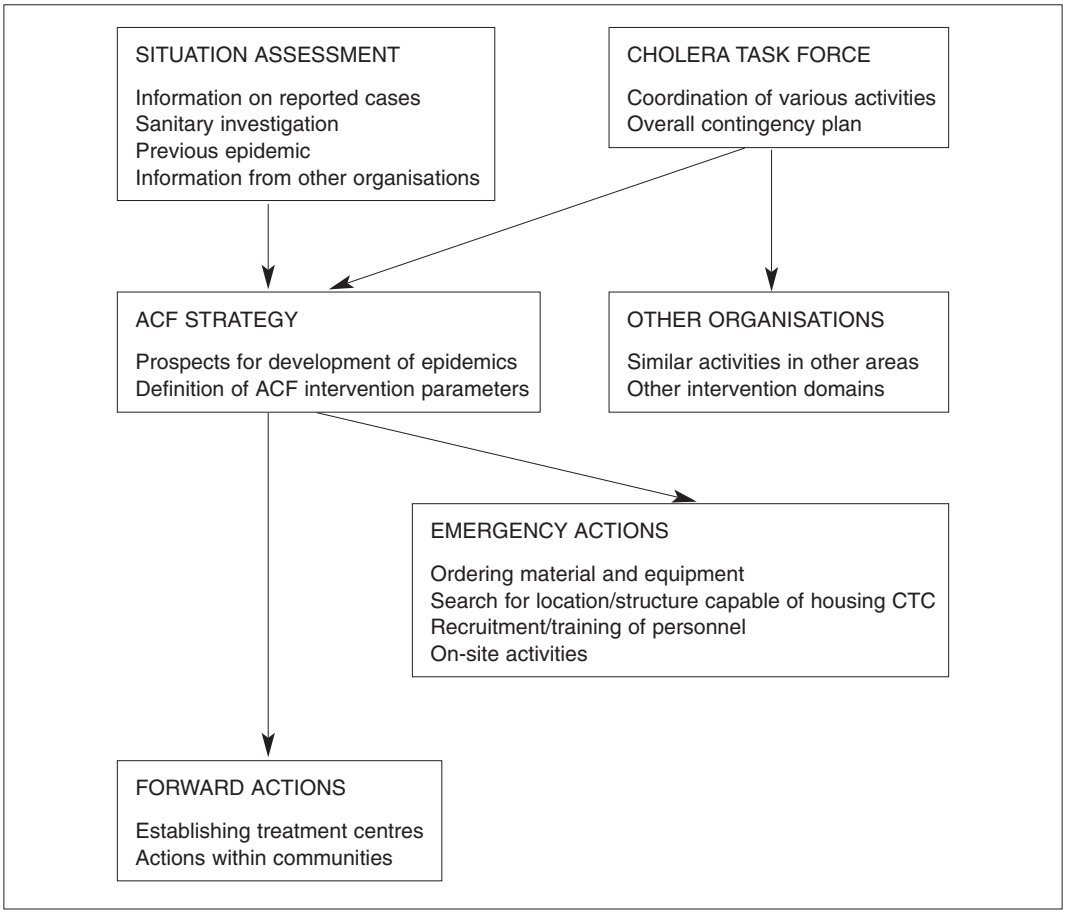

Figure 14.1: Stages in planning and implementing a sanitary programme to control cholera (CTC – Cholera Treatment Centre – see Section 5).

Cholera is just one of many diarrhoeal diseases although it is the best known and the most widely publicised. Other diarrhoeal diseases can create many more victims, with epidemics (for example, in Guatemala 1968, with 120 000 cases of shigellosis and 12 000 deaths in one year), or in situations of chronic poverty (for example, in South America they are responsible for a third of child mortality).

Lack of adequate drinking-water supplies and sanitation, as well as lack of education, all synonymous with poverty, make the fight against diarrhoeal diseases a priority in many countries, regardless of epidemics. In this context, ACF's water and sanitation programmes contribute to a general improvement in health by acting in the complementary fields of improvement of infrastructure and education, for which close collaboration with the medical profession is necessary. Lastly, each intervention in an epidemic depends on the context, so the general principles presented here must be adapted to each specific context.

The medical treatment of cholera, and the sanitary measures aimed at preventing transmission, are not highly technical. The essentials are to respond quickly, to be organised and to have effective logistics. It is therefore necessary to be prepared (Figure 14.1).

In this chapter, the basic facts about cholera are presented, followed by the various stages in the creation and implementation of a sanitary programme.

1 Cholera: general

1.1 Cholera vibrios

Cholera vibrios are bacteria that can cause cholera when ingested. Whether or not the disease develops depends on the quantity of vibrios ingested (the infective dose is in the order of 100 000), and on the organism's ability to defend itself against this infection. To a certain extent, the acidity of the stomach is fatal to vibrios (termed the gastric barrier). It is also possible to be a healthy carrier (see Section 1.3).

The vibrios produce a toxin that stimulates the cells of the gut wall to pump water and mineral salts from the blood and tissues into the intestine.

Outside the human body, cholera vibrios can survive for several days to several months in a favourable environment, such as humid alkaline and saline environments (sweat, brackish wells, sewers). On the other hand, they cannot survive dryness, acidity and exposure to sunshine, and are limited by competition with other microorganisms.

1.2 Clinical signs and symptoms

After a brief incubation period of 2 to 3 days, patients present several symptoms:

– frequent and abundant diarrhoea (several litres in a few hours) with watery, colourless stools, 'rice water' (with lumps), and a slight smell of fish. There is usually no fever;

– vomiting (often), sometimes with painful cramps.

Within a few hours, dehydration and exhaustion can become fatal. Children younger than two are rarely affected, while the death of healthy adults, within 24 to 48 h, is an indication of cholera.

According to WHO (1993), cholera should be suspected when:

– a patient older than 5 years develops severe dehydration from acute watery diarrhoea (usually with vomiting);

– any patient above the age of 2 years has acute watery diarrhoea in an area where there is an outbreak of cholera.

Bacteriological verification is essential to confirm the presence of the epidemic, and it is necessary to carry out an antibiotic survey to determine sensitivity to antibiotics.

1.3 Contamination

Human beings are the main reservoir of vibrios, which are found in considerable quantities in the stools (1 000 000 per g), vomit and sweat of cholera patients, and in dead bodies.

Healthy carriers are also sources of contamination, and are a danger because of their mobility, and their ignorance about their state: in an endemic coastal area of West Africa, there were up to 25 healthy carriers for every sick person. Nevertheless, the proportion of sick people/healthy carriers is usually nearer 1 to 10.

The excretion duration of the vibrio does not exceed 1 week in 70% of cases (90% of the carriers do not excrete vibrios after 2 weeks).

The two main ways that cholera vibrios are carried from stools and vomit are manual contact (cholera is a 'disease of dirty hands') and water (polluted sources and water points). Bad hygiene contaminates the hands, which in turn contaminate food, dishes, clothes, water, and other hands. Whereas manual contact is always a contamination mode, water can, under certain conditions, have little or no effect.

Water, particularly if it is saline and muddy (for example, in ports), is a good reservoir in which vibrio can survive for months; this is the case in Mogadishu, Somalia. If the reservoir is periodically re-supplied by contaminating carriers, it can become permanent. Seaweed, fish, and shellfish also become contaminants by concentrating the vibrios present in the environment.

On the other hand, flies, although commonly mentioned as transmission vectors, are unlikely to carry a sufficient number of vibrios to be a significant vector of cholera.

1.4 Prevention of infection

Action must cover:
– the sick patient (easily identifiable), who must be isolated and treated in specialised centre with strict disinfection measures;
– healthy carriers: non identifiable, persons at risk, including families of sick persons;
– transmission areas: water points, defecation fields, meeting places (markets, schools, churches etc.).

1.5 Treatment

The disease can be fatal, but if patients are hospitalised and treated quickly, recovery is rapid and spectacular. Sick people can sometimes recover without assistance, but in the meantime they will have infected others, who will not always have the same chance of surviving. This is the reason why the treatment includes isolating patients from the community in a specialised cholera treatment centre (Figure 14.2).

Initially, rapid rehydration, depending on the seriousness of the symptoms and the grade of dehydration, is carried out:

– orally, with water and a solution of oral rehydration salts (ORS) if dehydration is moderate (grade A and B of dehydration). ORS have practically the same composition as the losses from the patient, but contain more glucose to facilitate their absorption;

– intravenously (IV), with Ringers lactate (plastic pack containing 1 litre of ready-to-use solution) if dehydration is severe (grade C). This more technical method allows severely ill patients to be saved, but demands precise control and a great quantity of solution (similar to the losses in diarrhoea and vomit, up to 8 l/patient/day for severe cases). The patient should go on to ORS rehydration as soon as possible (when vomiting has reduced).

In order to avoid the development of resistance, and to avoid increasing the complexity of treatment, antibiotics are not administered systematically. However, antibiotic treatment has the advantage of reducing the seriousness and duration of the diarrhoea (and therefore the use of Ringer's lactate, and the time at the treatment centre), and especially of reducing the carrier duration (and therefore the possibility of contamination) to a few days. Prophylactic chemotherapy is very controversial.

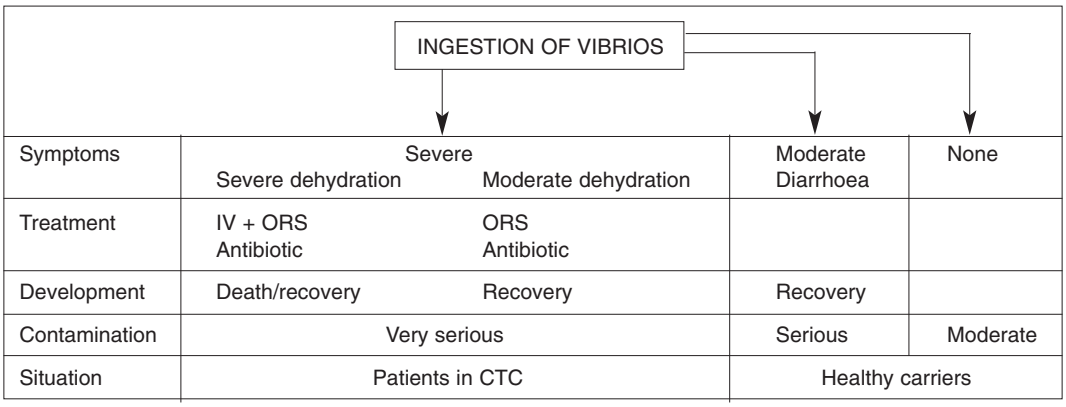

Figure 14.2: Cholera: symptoms, treatments, contamination.

1.6 Vaccination

Vaccination is also controversial: its effect is limited (50%), and delayed (starting one week after the vaccination). The implementation of a vaccination campaign is difficult: it involves significant resources, and can produce a sense of false security with consequent relaxation of hygiene measures.

A new vaccine (oral administration in two doses) exists, but it has not yet been validated on a large scale.

1.7 Natural immunity

This kind of natural immunity, created as a result of cholera infection, is proportional to the seriousness of the symptoms. The immunity from an infection, symptomatic or not, is rapidly acquired in less than one week, and has a duration of less than three months. It partially explains the fact that, in an endemic area, epidemics may be limited in scale but can recur after a few months.

1.8 Risks to personnel

Personnel working in cholera treatment centres and in contact with patients are no more likely to be affected than the general population if sanitary measures are respected. Furthermore, detection is almost immediate, and so the treatment is quick, and therefore effective.

1.9 Epidemics

Epidemics are classified according to the environment (Figure 14.3).

In a humid area during the rainy season (endemic areas), epidemic outbreaks can affect 1 to 3% of the population, starting from an endemic state linked to a reservoir with a low density of vibrios (the water). Because of the endemic situation, the population is generally aware of the symptoms of the disease and has a certain degree of natural immunity, and medical staff have experience in managing cholera. These factors tend to produce epidemics with a low proportion of sick people, and the following characteristics::

– epidemic peaks after 3 to 4 weeks;
– duration of 2 months;
– example: West African coastal regions.

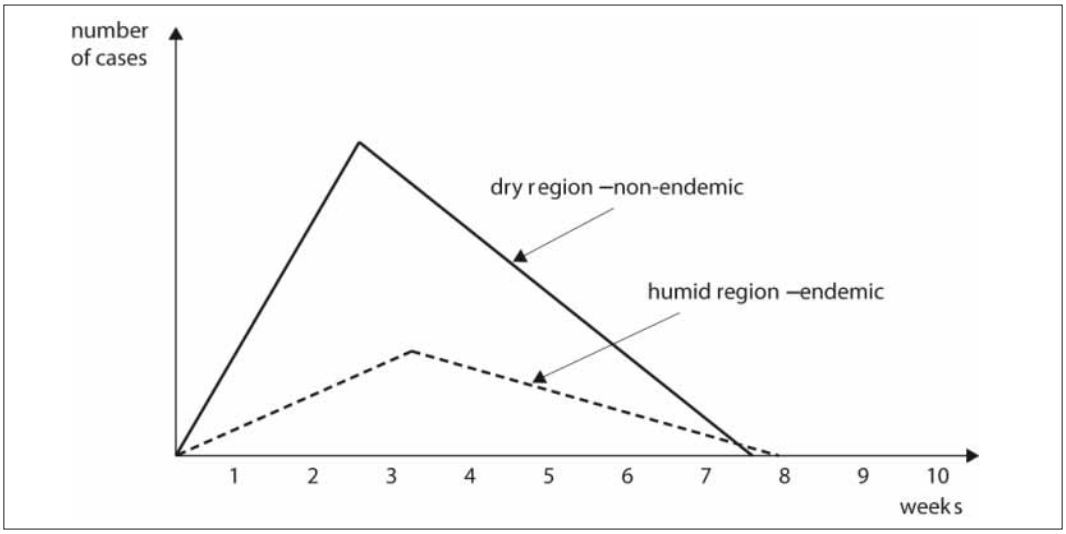

Figure 14.3: Typical epidemic curves.

In a dry area during the dry season, epidemic outbreaks are brief and intense, but can exceptionally affect up to 30% of the population, around foci of infection. Contamination is direct, from individual to individual. It does not become endemic because the environment is not favourable. There is no auto-immunisation through recent previous exposure, and there is a general ignorance of the symptoms. The number of healthy carriers is low (5 carriers per sick person). Good transport links favour the periodic infection of these regions from endemic areas:

– epidemic peaks after 10 to 12 days;

– example: Sahelian countries (Chad, Mali).

In fact, these extremes rarely occur. The characteristics of an epidemic depend on a multitude of factors, mainly human intervention, which can decrease its effect, especially if carried out quickly. In a closed environment (camp), it is relatively easy to monitor water quality and implement disinfection measures that can at least limit the daily appearance of new cases, and decrease the total number of patients. Action is more difficult in an open environment, and requires careful analysis of the origin of cases, as well as a good knowledge of local habits, to identify the specific measures capable of limiting the epidemic.

The notions of peak and duration of the epidemic are somewhat imprecise:

– they apply to a restricted population (a village or small region), but not to a country where the regions are generally affected one after another;

– they assume that the date of appearance of the epidemic is known, which is rarely the case.

1.10 Epidemiological factors

These factors are directly derived from the main contamination mode. The main aggravating factors are poor sanitary conditions (water and sanitation), and a high human concentration (camps, markets, stations, schools etc.).

Climatic factors are secondary and may have differing effects:

– in a dry area, the appearance of the rainy season decreases the concentration of the population around scarce water points, and the transmission of infection seems to reduce because the number of cases decreases, though the link between these factors is not certain;

– on the other hand, in an endemic humid area, epidemics appear during the rainy season (contamination from the main centres of infection).

2 Assessment of the situation

From the first suspected cases declared in countries where ACF is working, it is impossible not to be involved, even if the local authorities seem capable of managing a possible epidemic, and so certain key pieces of information must be investigated and analysed (Table 14.I).

2.1 Confirmation of reported cases, implementation of a surveillance system

The clinical diagnosis of the first cases must be confirmed by stool sample analyses in order to identify the vibrio and determine its sensitivity to various antibiotics.

These biological analyses must be complemented by epidemiological data gathered from health structures and communities. It is therefore essential to create a reliable epidemiological surveillance system as quickly as possible in order to monitor the development of the number of cases over time and area. If at all possible, this surveillance system must be based on the existing national health structures.

Mobile teams (disinfection, education) can complete this surveillance system.

Table 14.I: Assessment of the situation.

Source	Information to be investigated
Reported cases	Location Number Confirmation by laboratory analysis
Sanitary surveys	Number of people and concentration in the risk area Antecedents of previous epidemics: people displaced from an endemic area, local population of a non-endemic area etc. Water resources: springs, streams, wells etc. Vulnerability of water points to faecal contamination Sanitary equipment: latrines, showers etc. Hygiene behaviour List of health structures, knowledge of the disease and sanitary infrastructure
Previous epidemic	Origin, development, means of contamination
Other agencies Cholera task force	Information on cholera

2.2 Previous epidemics

Information on previous epidemics can help confirm the indications of the sanitary survey, especially regarding the origin of the epidemic (wells, ports, markets etc.), and means of propagation of the disease.

2.3 Sanitary surveys

These surveys identify the main infection centres, and provide baseline data for sanitary actions. This work, which must be carried out as quickly as possible, is monitored and refined as effective intervention is carried out on the ground.

2.4 Cholera task force

Co-ordination with other organisations involved locally (by geographical or technical sector) facilitates task allocation and speedier intervention. A working group, sometimes called a 'Cholera Task Force', brings together the parties normally involved, including: Ministry of Health, WHO, UNICEF, UNHCR, Red Cross / Red Crescent and NGOs. To be efficient, this working group must not be too large.

Technical subcommittees (medical, water and sanitation, and hygiene communication) of 6 to 8 people meet regularly, and sanitary actions are coordinated within the water and sanitation committee. At the beginning, it is necessary to assess members' capacity of action in these meetings, taking into account:

– experience on the ground;

– current programmes: location, nature (water and sanitation, medical, education etc.);

– speed of access to financial, human, and logistics resources such as stocks of rehydration salts, medical supplies, and water supply and sanitation equipment.

A plan of action (contingency plan) is developed. The task force guides the intervention by collecting and analysing data on the epidemic, planning activities (opening of treatment centres, water supply, sanitation and hygiene promotion activities), harmonising the interventions of the various organisations and evaluating the impact of the activities carried out.

3 Intervention strategy

3.1 Development of the epidemic

Once the epidemiological data has been collected and the sanitary survey completed, assumptions about the areas at risk (transport routes, markets etc.) and the most important contamination modes (water, market, cheap restaurant food, fish, dairy products etc.) can be formed.

3.1.1 DETERMINING THE NUMBER OF SICK PEOPLE

The estimation of the number of sick people to be hospitalised is made on the basis of the attack rate, i.e. the likely number of sick people per total population. In the absence of information about previous epidemics in the area, it is assumed to be 1% for open environments, and 2% for environments at risk (camps and other closed environments). In dry, non-endemic regions, the attack rate may be far higher (see Section 1.9).

3.1.2 EVALUATION OF THE DURATION OF AN EPIDEMIC

The duration of a 'classic' epidemic is 3 months, at least in its acute phase. After that, it is necessary to consider the withdrawal of international NGOs, and the reinforcement of local structures to continue the activities.

3.2 Sanitary strategy/actions

The actions to be implemented have the objective of reducing contamination, and are based on two approaches: hygiene promotion and disinfection. One cannot occur without the other, since cholera is, above all, a disease of lack of hygiene, caused by risky hygiene knowledge and practices and/or lack of sanitary structures. The intervention strategy must prevent, or at least limit, the contamination routes identified in the assessment.

Secondary infection centres are:

– in the community: water points, dwellings and surroundings of sick people, defecation fields, public places (markets, restaurants etc.);

– at the treatment centre: contact with patients/personnel/visitors.

Sanitary activities (Table 14.II) are carried out in the cholera treatment centre, where everything must be done to guarantee a healthy environment with effective sanitary barriers, but also in the community, where actions targeted on areas at risk are essential: disinfection of drinking water and sick people's dwellings, and health information in the local radio, for example.

4 Types of intervention

4.1 Large cholera treatment centre

Context

When no government structure can or will treat patients on a large scale.

Advantages

– Possible dissociation of medical and sanitary interventions (possibility of allocating tasks between the various NGOs).

– Purpose-built, highly operational centre (strict sanitary barriers, adequate capacity), with specialist input from an NGO experienced in water supply and sanitation (though this needs to be coordinated with medical activities).

Table14.II: Sanitary activities.

	CTC	Community
Targets	People at risk – patients – carers – personnel	Environment of patients – family – neighbours Public buildings – schools – market – mosque/church/temple
Potable water	Supply Storage, chlorination and distribution	Quality analysis and, depending on results: – point disinfection – periodic chlorination (up to twice a day) – improvement/protection – closure of water point – substitute supply
Sanitation and disinfection	Building of infrastructure: latrines, showers, footbaths Disinfection: stools, vomit, fabrics, soles of feet and shoes, water points Hand-washing	Case detection and visit to key areas: – families and neighbours of the patients – schools, markets etc. Disinfection of areas at risk: – houses and latrines of patients' contacts – schools, markets, restaurants etc.
Education/ information	General information about cholera and acquaintance with hygiene measures Explanation of the actions taken in the community	

– Possible control of recruitment, training and management of personnel (on condition of being able to pay salaries or allowances – sometimes food for work).
– Rigorous epidemiological monitoring.

Disadvantages

– Large investment in financial and human resources over 3 months.
– The centre is only built when the epidemic has been confirmed: building a large CTC as a preparedness measure is only done in very particular situations.

4.2 Small-scale cholera treatment centre

Context

When the size of the affected area does not allow sick people to reach one large CTC (large cities, most rural areas).

These small and decentralised centres are generally linked to existing health structures, and allow early detection of cholera diarrhoea and treatment within easy reach of the population.

If the local treatment capacity is exceeded, local patients can be transferred to other structures.

Advantages

– Global intervention (medical and sanitary) by a single NGO.
– Reduced setting-up and operating costs.
– Retention of some treatment capacity in small structures, which takes the pressure off large treatment centres.
– Reduction in the number of serious cases at admission thanks to early detection and treatment over a large area.

Disadvantages

– Difficulty of transferring seriously-affected patients: the patient's family may disagree with the decision (to a great extent, agreement depends on the staff's interpersonal skills).
– Quick overload of the CTC if transfers are not possible.

4.3 Attachment to local structures

Context

Small cholera treatment units can be attached to local health structures (health posts or dispensaries) that are supported with supplies (ORS, medicines), training and technical support (medical, water and sanitation).

Advantages

– Rapid detection and treatment due to the proximity of sick people.
– Low investment required for the improvement of existing structures.
– Regular training, monitoring and supply ensured by a mobile team covering several centres.

Disadvantages

– Variable local competences and availabilities.
– Need to ensure a minimum standard, from a medical and sanitary point of view, in structures ill-fitted for this purpose.
– Difficult mobilisation of personnel without a financial incentive (salary or food-for-work).
– Capacity quickly exceeded in a densely populated area (urban environment).
– Low geographical coverage.
– Isolation of patients is more difficult.

4.4 Health Ministry support

Advantages

– Quick and effective supplies (mainly of Ringer's lactate) ensured.
– Ready-trained personnel.
– Existing structures.

Disadvantages

– Difficult control of medicine supply (possible diversions).
– Collection and management of epidemiological data may not be sufficient.
– Additional sanitation facilities are required (existing facilities are difficult to adapt, particularly in hospitals).

Appropriate arrangements

– The NGO supplies the treatment centres directly, rather than supplying a central pharmacy.
– Weekly supplies against presentation of epidemiological data.
– Training on the use of chlorine in the centres.
– Implementation of sanitary protocols in the centres.
– Joint sanitary supervision by NGO and Ministry of Health.
– Depending on the strategy adopted, and the context (sanitary action alone, or medical plus sanitary action), emergency actions are implemented as soon as the first cases are declared, to allow full-scale action as soon as the epidemic is confirmed.

4.5 Emergency actions

It is possible to order ready-made cholera kits for the CTCs, but supplies and equipment should be bought locally if possible (see Section 5.5.8). Whatever the option chosen, 200 kg of HTH and

10 sprayers should be purchased immediately. Recruitment and training of medical, sanitary and hygiene-promotion personnel (see Section 5.8) should also begin.

Home visits (hygiene education/disinfection and collection of information) can start very quickly (see Section 6).

5 Cholera treatment centre (CTC)

Concentrating patients in one centre ensures both patient care and avoidance of contamination. This is enabled not only through the administration of medicines (ORS, Ringer's lactate), or the essential use of disinfectant (chlorine etc.). The routine of a centre is organised around a set of actions (disinfection of hands, feet, stools etc.), that are simple, but often new for patients and carers who just stay for a short time. In order for these actions to be assimilated and put into practice as quickly as possible by new arrivals, it is necessary to do the following:

– equip the centre with specific tools to make these actions automatic or compulsory (isolation barrier, footbath for the disinfection of feet/footwear etc.);

– inform people (with notices, via the personnel) of the reason for and nature of these actions (how and why);

– monitor these actions and make them compulsory, since people tend to avoid following rules.

The structure and capacity of the centre depend on the attack rate of the epidemic, which is estimated according to the context (Table 14.III and Box 14.1).

5.1 Planning

In order to act as quickly as possible, and be sure to meet all needs, the opening of the CTC can be done in successive stages. For an estimated maximum capacity of 300 patients, three separate openings of structures for 100 sick people each can take place. The peak of the epidemic usually occurs after 3 to 4 weeks, so it is necessary to plan one phase per week so that capacity is not exceeded*.

Box 14.1
Example of CTC in North Mogadishu, 1994.

Estimate
Affected population = 500 000 in a 'natural' environment (no large camps).
Total number of patients: At = 1% of the population = 5 000.
Number of daily admissions: Da = 2.6% of At = 130.
Capacity of the CTC: Cm = 4 x 130 = 520.
Total HTH consumption= 2 000 kg.

Achievements (actual)
At = 4 900 (the CTCs treated 3 900 patients, of whom about 1 000 were treated in 6 small structures).
Da = 105.
Cm = 350.

Area of the CTC
Cm = 350.
– site 350 x 15 = 5 250 m^2
– or building of 350 x 5 = 1 750 m^2 + 500 m^2 for sanitary installations.

Water
70 x 350 = 24 500 l/day.

* An overcrowded installation, originally planned for 100 patients, can work for a few days with 120-130 patients, but it quickly becomes unmanageable with 150.

Table14.III: Key quantities.
These quantities are only estimates developed using ACF's experience in the field: they can help to establish a realistic budget, and to choose a large enough location for the CTC.
Average hospitalisation time can be reduced to 3 days if doxicycline is used in single dose, and if patients are hospitalised at a stage of moderate dehydration (ease of transport or concentrated population, and good coverage by home visitors). It can increase to 5 days if antibiotic therapy is carried out during 3 days, if the centre is not very accessible (distance, no security at night etc.) and if it receives a high proportion of serious cases. Finally, good preparation (an intervention plan), efficient coordination and a sufficient drinking-water supply reduce hospitalisation times.

Aspect	Rough estimate of quantity
Total number of patients to be treated	At = 1% of the total population At = 2% in areas at risk (camps)
Number of daily admissions	Da = 5% of At for At = 500 Da = 3% of At for At = 3 500 Da = 2.6% of At for At = 5 500
Capacity of the CTC	Cm = 4 x Da
Area of the CTC	For a new site: 15 m^2/patient For buildings: 3 to 5 m^2/patient + 500 m^2 for sanitary installations Equal distribution between ORS and IV phases
HTH consumption	Daily: 1 kg/10 patients Total: HTH kg = 4 x At/10
Water consumption	60 to 80 l/patient/day
Chlorine solutions used in the centre (see Section 5.5)	Solution A: 2% chlorine Solution B: 0.2% chlorine Solution C: 0.05% chlorine

Extensions must be built without disturbing the centre's work – only patients in the ORS phase (see Section 5.3) can be moved. More often than not it's the sanitation works that delay the extension of the centre: therefore these can be carried out in advance, and no extension should be opened if the sanitary installations are not ready. On the other hand, the tents must be erected as needed (always one in reserve).

It is better to build some basic structures quickly, even if it means having to improve them later on. In any case, it is necessary to avoid building a small paradise (in relative terms) which patients do not want to leave (especially if there is food), and where the patients' families come to have a shower.

5.2 Choice of site

Area

Related to the maximum capacity, Cm (see Table 14.III).

Location

Easy access for everybody, near the centre of the epidemic area concerned if possible, but sufficiently far from centres of people at risk (schools, orphanages, camps etc.).

Isolation from the outside (enclosure wall, thorns, wire fencing etc.).

Access to trucks – essential during construction (materials) and operation (water tankers etc.).

Building

There are no absolute rules.

A new site requires intensive construction work (erecting tents, plastic shelters etc.), but it also offers greater design freedom, approaching the ideal. During the rainy season, drainage must be given careful attention. This is usually the NGOs' option for large centres.

Installation in an existing permanent building, which is often in poor condition, imposes certain construction limitations, but allows a quick start to activities. It is generally the option chosen by health authorities and/or NGOs for small centres.

Water supply

Ideally, choose a site with a reliable water point (well, connection to distribution system etc.).
In the absence of water points, organise the distribution of water by tanker.
Verify the flow of existing wells or boreholes to check whether the yield is sufficient.
Install an elevated water-storage tank in order to distribute the water by gravity.

Sanitation

Install latrines, excreta-disposal pit and showers.
Take particular care with drainage of wastewater.
Check for contamination of nearby water points.
Maintain a minimum distance of 30 m between sanitary structures and groundwater abstraction points (may vary depending on hydrogeological conditions).

Electricity

This is a bonus, especially if an electric pump has to be used on a well. A generator is not essential if electricity is to be used only for lighting (oil lamps and electric torches are adequate).

5.3 Layout of a CTC

The layout principles depend upon the medical and sanitary constraints which can be represented by the different routes that patients take in the centre (Figure 14.4). All areas must be differentiated and isolated from one another, and they must be arranged so as to reduce movement of people in the centre to a minimum (Figure 14.5 & Table 14.IV).

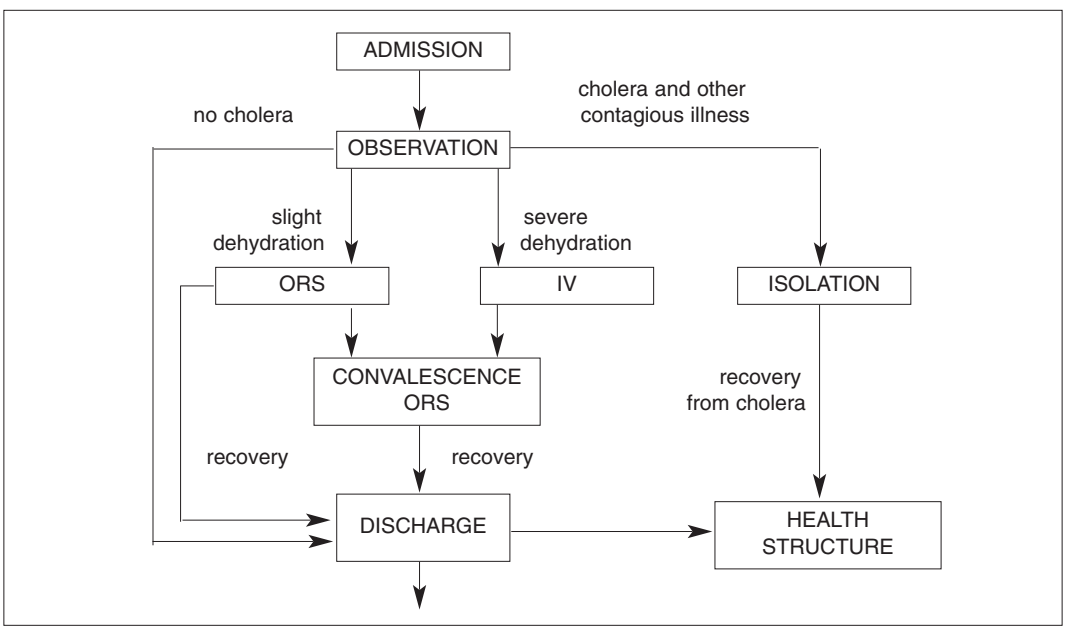

Figure 14.4: Patient progressing through a CTC.

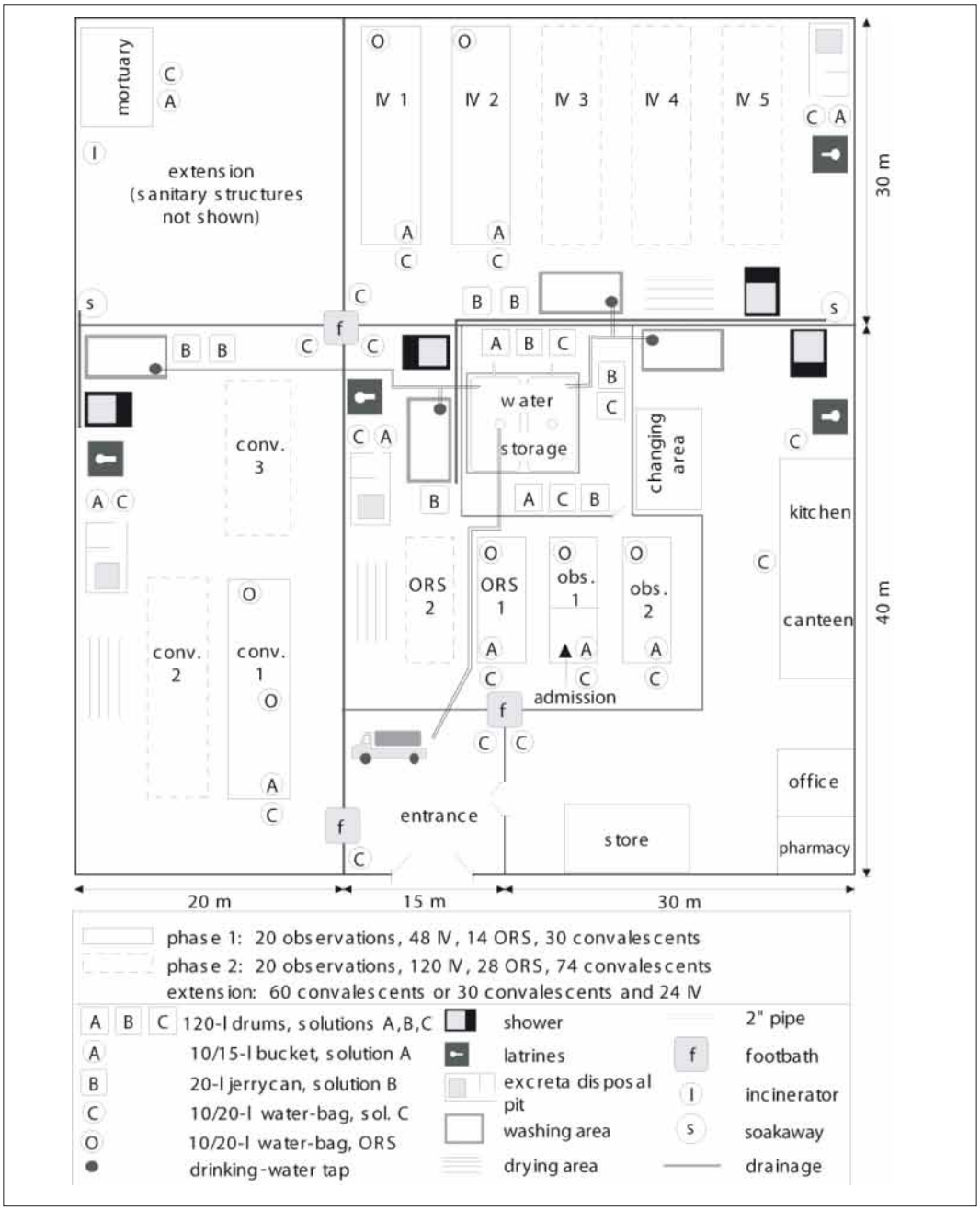

Figure 14.5: Plan of a typical CTC for 300 patients.

The patients arrive at admission (registration) and then, after a possible stay in observation, are:
– sent to another health structure if they do not have cholera;
– treated in the isolation section if they have cholera and another contagious disease (tuberculosis, measles, hepatitis etc.);
– treated in an ORS area, and then discharged if they are not seriously dehydrated;

– treated in the IV area if they are seriously dehydrated (separation provided for children and pregnant women), and then in convalescence/ORS and discharged (or taken to the mortuary).

The duration of stay at the centre is around 3 days for patients admitted directly to an ORS area, and 5 days for those admitted to an IV area and then transferred to an ORS area.

Table 14.IV: Zones and sanitary equipment of a CTC.

Zone	Sanitary structures
Admission/Observation	
Entrance to the centre: all new patients are registered and directed to the area corresponding to their condition (*Observation, ORS* or *IV*) Plan 1 or 2 tents with space for 10-12 people each The observation area for uncertain cases is located near to admissions (in the same tent) Average duration of stay - 1 day When possible, patients move to the treatment area or are discharged	Footbath Drinking-water point Chlorine-solution points Latrines Excreta-disposal pit Showers Clothes-washing slab Waste-bins Stretchers to transfer non-cholera patients and for internal transport – to be differentiated! In every tent: ORS point + hand-washing water-bag C + bucket A
ORS rehydration (part of the Admission/Observation area) Initially, patients with moderate dehydration (grade A and B) are treated in the ORS structures of the Admission/Observation area. Plan for 2 tents with space for 10-12 people	
IV Rehydration	
Patients with serious dehydration (grade C or B with vomiting) (also very contagious) To facilitate the work of the personnel and the organisation, units of 20-25 (tents, shelters, wards) mounted progressively Plan 4-5 m^2 per patient Children, who are usually the most vulnerable and seriously affected, are collected into paediatric units As soon as rehydration by ORS is possible (after 1 to 2 days), the patient is transferred to the *Convalescence/ORS* area The incinerator and mortuary are located in the IV area (or in the area planned for the last extension).	Beds for cholera patients Drinking-water point In each tent: ORS point + hand-washing water-bag C + bucket A Points for chlorine solutions A and C, inaccessible to the public Clothes-washing slab with barrel of solution B Latrines Excreta-disposal pit Showers Footbath Waste-bins
Isolation (part of *IV rehydration area*) A small isolated tent in the IV area houses those patients affected by cholera and another contagious disease Another unit is reserved for pregnant women, to manage childbirth, postnatal care, and miscarriages (frequent with cholera); a simple screen can be used to isolate from the other patients visually	
Convalescence/ORS	
Patients in the recovery phase Mats and plastic sheets under large tents or shelters (30 patients): 3-4 m^2/patient Normally, the patient can go to the latrines: excreta-disposal pits are planned for new arrivals treated with ORS Generally after 3 days (but never before the end of the antibiotic treatment), the patients are discharged and must leave the centre	Drinking-water point In each tent: 2 ORS points + hand-washing water bag C + bucket A Chlorine solution points A and C, inaccessible to the public Clothes-washing slab with barrel of solution B Latrines Excreta-disposal pit Showers Footbath Waste-bins

Table 14.IV: Zones and sanitary equipment of a CTC.

Zone	Sanitary structures
Mortuary	
Bodies are cleaned with solution A, and then wrapped in a large cloth sprayed with the same solution	Bucket A + water-bag C Stretchers (a minimum of 3)
The wrapped body can be placed in a large plastic bag or a piece of plastic sheeting for transport: this contaminated plastic must be recovered by the undertaker	Solution A sprayer Solution B sprayer
The majority of bodies are collected by the family, who take care of the burial	
For uncollected bodies, plan a place to bury them on-site, or make arrangements with the community (see the authorities)	
Neutral area (accessible only to personnel)	Drinking-water point
Warehouse for sanitary products, food and rehydration products (Ringer' lactate (very bulky) and ORS)	Point for solutions B and C Showers
Dispensary (2 days of stock) is a closed area (if possible the one permanent building on site, otherwise a tent)	Latrines Footbath
Daily re-supply from an external stock in case of poor safety	
Office for the administrator, expatriates, supervisors, etc.	
A canteen for personnel (to eat, drink tea etc.), which doubles as a meeting room	
A changing-room for the personnel (to change clothes and disinfect working clothes)	
There are several possibilities for meal preparation:	
– food for patients, carers and personnel prepared in a kitchen	
• it limits the coming and going of food carriers, but	
• it leaves the door open to abuse, and is an expensive solution (200 patients + carers + personnel = 500 meals)	
• it uses logistics resources and energy	
• it does not facilitate the departure of patients who have recovered	
• this is a solution to be avoided	
– meals for patients and personnel prepared in a kitchen	
• good organisation	
• a less costly solution than the previous one	
– no kitchen	
• feasible at the start-up	
• involves visitors coming and going, and requires reinforcement of disinfection and control systems at the entrance	
• no food going out (since it is assumed to be contaminated), disinfection of dishes	
• to be retained if too much energy used in establishment and management, or if storage of food is dangerous	

5.4 Water supply

A supply of 60 to 80 l/patient/day is necessary.

Drinking-water must be chlorinated to obtain 0.5 mg/l of free residual chlorine at the tap. This chlorination is done in the tank.

In addition to this, three different chlorine solutions are used in the centre:

– solution A (2% chlorine), used to disinfect patients' stools and vomit, and dead bodies. Storage period one week;

– solution B (0.2% chlorine), used to disinfect beds, stretchers, clothes, eating utensils, the patients' homes, and vehicles (spray). Storage period one day;

– solution C (0.05% chlorine), used to disinfect skin (mainly hands). Storage period one day.

Preferably, these solutions should be prepared with HTH, which has a strong concentration of chlorine, and keeps well. Otherwise, and only as a provisional measure, they may be made with any product containing chlorine (see Chapter 12). It is essential to establish a chlorination protocol for staff to follow.

5.4.1 STORAGE

Ideally the water-storage tank (capacity equal to daily consumption) is located on an elevated site (mound or embankment) in the middle of the centre: this facilitates concentration of all sanitary structures and simplifies their supply with water and chlorine solutions, and rationalises drainage.

The water tank can nevertheless be placed outside the centre, as long as it is well protected by a fence.

5.4.2 DISTRIBUTION

Distribution to the water points (each with 1 or 2 self-closing taps) is gravitational, via 2" semi-flexible reinforced pipes (low head loss). If some parts of the centre cannot be served by gravity, 1-m^3 plastic tanks, placed at a height and periodically refilled with a motor pump, are used instead.

5.5 Sanitary facilities

5.5.1 FOOTBATHS AND HAND-WASHING FACILITIES

These are the compulsory entry-and-exit route between the different areas of the CTC, to ensure disinfection of shoe soles and feet (footbath, solution B– Table 14.III) and hands (hand-washing facilities, solution C). They provide sanitary barriers and control people's movement.

A footbath technician is always on duty to:

– check disinfection;

– make sure that people pass through the footbath fully. Solution B can discolour and even damage shoes, and it becomes muddy and unpleasant quite quickly;

– inform and convince people that a small inconvenience is better than a large problem.

It must not be possible to avoid the footbath, which should be filled with a maximum of 2 cm of liquid. The solution must be renewed when it becomes too muddy: laying gravel, at least on the paths, improves the situation. To empty the footbath, a small soakaway at the side, or a concrete pit, can be considered.

At the doors of buildings, plastic basins with some solution at the bottom can be used. Jute sacks soaked in solution are not acceptable, because they quickly become clogged with mud and dust, and are difficult to clean.

The personnel of the centre must be equipped with boots to avoid the irritation caused by repeated contact with chlorine.

The hand-washing facilities are placed by the footbath, on the inward side. They usually consist of a jerrycan of 10 to 20 l (or, even better, a water-bag), equipped with a tap, filled with solution C and placed on a shelf or stool (Figure 14.6).

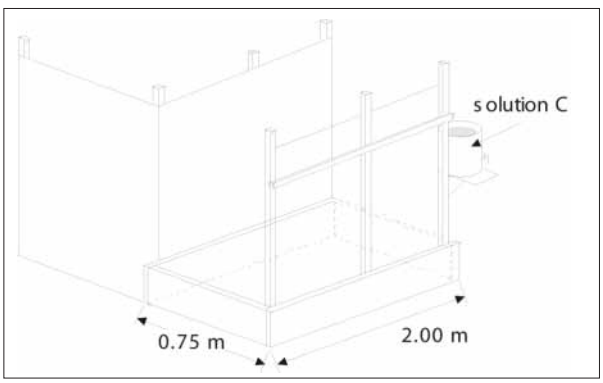

Figure 14.6: Footbath and hand-washing facility.
Materials: 4 pieces of sheet metal (10 x 200 cm), 5.5 m planking (20 x 2 cm) (+ 8 m if base is to be of wood), 8 posts (4 x 200 cm). Plastic sheeting 2.5 x 1.25 to cover the base.

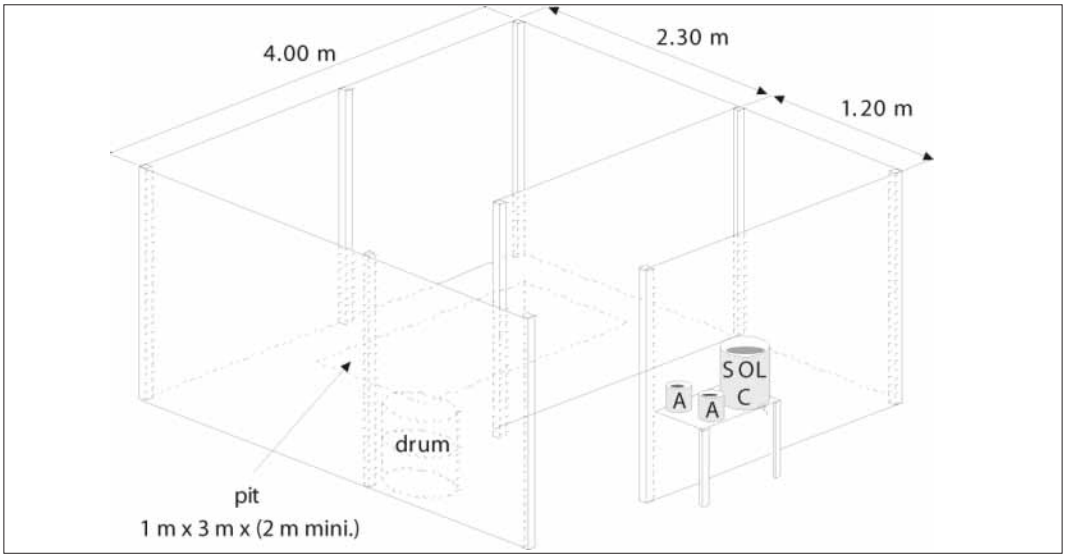

Figure 14.7: Example of excreta-disposal pit.
Materials (without roof): posts, 27 m (8 x 8 cm), 36 m (4 x 8 cm). Plastic sheeting, 36 m^2.

5.5.2 EXCRETA-DISPOSAL PIT

This is not a standard latrine (see Chapter 13), but a structure for disinfecting the stools and vomit of patients in the IV, observation and ORS sections.

In general, patients are incapable of controlling themselves or walking to a toilet initially, and use a bucket at best. Their carers must then empty the contents of the bucket into a plastic barrel (50-100 l), situated by the excreta-disposal pit (Figure 14.7). Then the bucket must be completely rinsed with 0.5 l of solution A: this disinfection solution is also poured in the barrel. Pouring the solution in the barrel leaves chlorine enough time (20 to 30 min) to act on the faecal matter, after which only decontaminated waste will be poured into the pit. Carers leave after having washed their hands with solution C at the exit. An employee on duty must explain to all new arrivals how the pit works, and help them if necessary.

5.5.3 LATRINES

Standard temporary simple latrines (see Chapter 13) are reserved for carers, personnel, and patients in the convalescent phase (rehydration by ORS).

Solution C is available by the latrines for hand-washing and anal cleansing. The latrines are regularly disinfected (sprayed with solution B) and cleaned with solution A.

5.5.4 SHOWER

A concrete slab draining into a soakaway (see Chapter 13) is more functional than a simple layer of gravel, because it is easier to clean and disinfect by spraying solution B.

5.5.5 INCINERATOR

Medical waste (ORS sachets, Ringer's lactate packaging, needles etc.) is collected and burned in an incinerator.

The combustion residues are dumped in a narrow, deep pit.

5.5.6 ORS POINTS AND HAND-WASHING FACILITIES

These consist of plastic recipients fitted with a tap and filled with various solutions.

The ORS points are located inside the wards, and contain chlorinated water in which the rehydration salts are dissolved.

For hand-washing facilities outside the buildings, 10 to 20 l of solution C should be provided.

5.5.7 WASHING AREA

A barrel of 100 to 200 l of solution B and some basins for soaking laundry are provided for this purpose.

A cement slab and a small channel running towards a soakaway are essential.

The laundry hanging and drying areas must be covered during the rainy season.

Finally, a hand-washing point, containing 10 to 20 l of solution C, is located at the exit.

5.5.8 SOLUTION PREPARATION FACILITY

Whenever possible, a single point near the water tank is reserved for this purpose. By having centrally-located storage and preparation points, transport of water and solutions is kept to a minimum. Plastic barrels of 100 to 200 l, provided with taps and placed on tables, are used.

The barrels of solution B are directly accessible to the public (for clothes-washing), whereas the barrels containing solutions A and C are only for personnel who come to refill smaller containers.

A (daily) stock of HTH is kept in an well-ventilated box, locked and in the shade, with an entry/exit log.

Table 14.V: List of minor equipment needed.

2 buckets per patient in the IV phase, 1 for the stools and usually 1 for vomit, both re-usable Plan a margin in relation to the maximum capacity of the IV section (half of the maximum capacity of the centre): number of buckets = 1.2 maximum capacity of the centre
Buckets with a cover for solution A (1 per unit)
Buckets for showers
1 cholera bed per each patient in IV or observation phases, or individual plain plastic sheets (0.70 x 2 m)
Basins for clothes-washing with a capacity of 20 to 50 l
Mats or plastic sheets for patients in ORS phase (2 m^2): the cured patients feel less tempted to take small sheets with them
Table (for medical items) and stool (personnel, hand-washing facilities) in each IV unit and in each area (ORS, Observation, Admission, staff room, office)
10 to 20-l plastic barrel or water-bag, fitted with a tap, for the hand-washing facilities C: 1 for 20-25 patients in IV phase, 1 for 40-50 patients in ORS phase, 1for each footbath, latrine and excreta-disposal pit, and 1 each for the kitchen and canteen
10 - 20-l plastic barrel or water-bag, fitted with a tap, for the distribution of ORS: 1 for 20-25 patients in IV and Observation phases 2 for 30 patients in ORS and Convalescence phases
120 to 200-l plastic barrels fitted with taps for the preparation of solutions A, B, and C
If necessary, 500-l plastic barrel or 1-m^3 water tank as a reserve for outer areas

5.5.9 MINOR EQUIPMENT

All the equipment necessary (Table 14.V) must be marked (place of usage and contents; for example: *IV2/solution A*) with an indelible marker, and managed by the person in charge, the sanitary technician who uses them.

5.5.10 DRAINAGE

The high consumption of water means that large quantities of wastewater must be disposed of. It is therefore necessary to plan the general drainage of the centre.

If the showers, water points and washing areas are concentrated, it is simple to collect wastewater into a system of small channels that transport it quickly and without stagnation, even if the slope is slight.

The size of the soakaway depends on the permeability of the ground: if it is low, several soakaways must be planned; alternatively, infiltration trenches may be dug.

Small soakaways are also necessary for the hand-washing facilities, footbath waste outlets, and cleaning-water from the tents. To avoid filling the soakaways with soap and grease, it is essential to install simple grease traps.

A network of drains around the tents removes rain water towards a ditch in a natural low point.

5.6 Shelters

The shelters can be simple tents, or alternatively they can be built with plastic sheeting (the tents are retained for future extensions).

It is essential to lay a plastic groundsheet, easy to wash and disinfect periodically. A small central channel leads the washing-water to a soakaway.

The shelters must be sprayed with a persistant insecticide (e.g. deltamethrine) before being used. Gravel paths, roofs over all sanitary installations, and good rainwater drainage, must all be provided during the rainy season.

5.7 Sanitary barriers

The purpose of these barriers is to avoid contamination from inside or outside the centre.

To avoid contamination of the outside:

– it is essential to isolate the centre with walls, fences, or barbed wire, with a single entrance/exit. A second exit, padlocked, is only used for the removal of bodies of deceased patients;

– the limitation of movement means that it is only possible for one relative to accompany every patient;

– everyone leaving the centre must wash their hands (solution C), disinfect their soles/feet in the footbath (solution B) and, when necessary, disinfect their dishes (solution B);

– stretchers and vehicles that have transported sick people must be thoroughly disinfected.

Inside the centre:

– at the entrance/exit of each unit (IV, ORS, Admission etc.), disinfection of soles /feet (footbath - solution B) and hands (solution C);

– disinfection of patients' stools and vomit, as well as the buckets used to contain them (solution A);

– disinfection of dead bodies (solution A), and isolation in plastic bags;

– disinfection of latrines (regular spraying and cleaning with solution B; occasionally with solution A);

– disinfection of patients' clothes (solution B), burning them if possible in the most serious cases;

– disinfection of eating utensils (solution B) and then rinsing with water.

5.8 Management

5.8.1 ORGANIGRAM

The organigram is shown in Figure 14.8.

5.8.1.1 Expatriate personnel or Senior staff

Expatriates and other senior staff play a fundamental role in the recruitment, training, organisation and supervision of local personnel. Their presence and numbers are decisive when starting up a centre, decreasing rapidly in the case of logistics personnel, and more slowly in the case of medical staff, depending on the development of the epidemic. To start up a high-capacity centre, five senior staff are essential:

– 1 in charge of building and supply logistics,
– 1 in charge of sanitary aspects,
– 3 medical staff (one must be a physician).

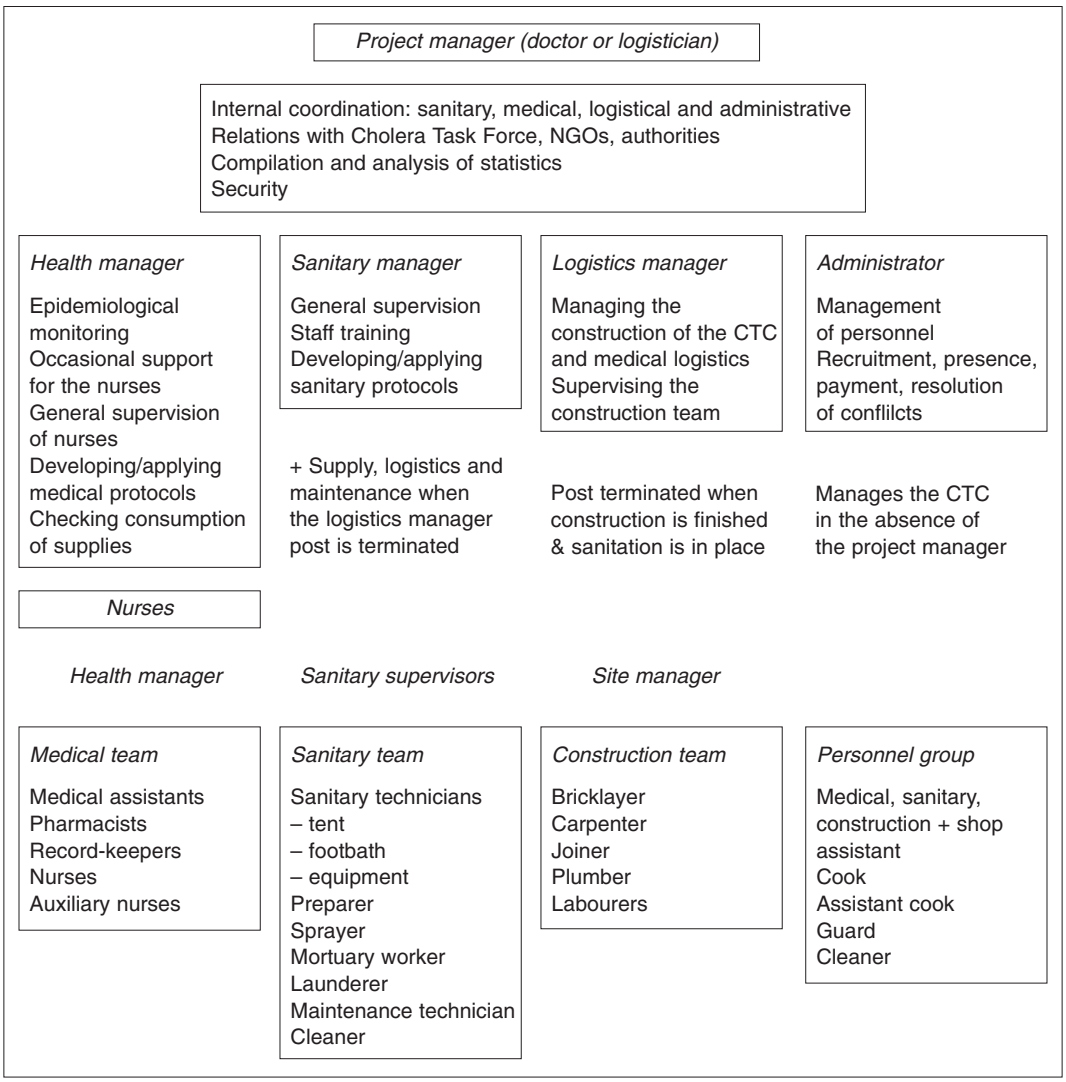

Figure 14.8: Personnel chart for a CTC.

In certain cases, for very large operations, a project manager may be needed for coordination.

All roles must be clearly defined. In particular, one member of the team, for example a logistician or a physician, must be in charge of daily meetings, work with the administrator, and external relations.

Progressively, the team will be reduced to one or two people (logistician and physician).

5.8.1.2 Local personnel

Everyone working at the centre must be given a job description, covering their tasks, personal equipment, list of equipment for which they are responsible, their timetables, allowance (money or food-for-work) or salary, and a reference to the internal regulations. This document is signed by both parties, and can easily be transformed into a work contract if legislation permits.

Successful round-the-clock operation of the centre, which guarantees low mortality and limitation of the epidemic, always depends on the medical and sanitary personnel. These people have the difficult task of looking after patients and their carers, informing them, and encouraging them to perform essential tasks (hand-washing, use of latrines etc.). Furthermore, this must be done constantly, because of the constant turnover of patients and carers.

From the beginning of the project it is necessary to recruit a competent local administrator to take part in the recruitment of personnel, establish the personnel list, manage them daily, and pay them. This person also resolves conflicts, and manages the whole centre when the expatriate manager is absent.

Finally, it is necessary to plan daily timetables for 24-hour operation.

5.8.2 DESCRIPTION OF SANITARY POSTS

5.8.2.1 Sanitary supervisor

One person:
– supervises the work of all sanitary personnel;
– manages the water supply;
– refers to the expatriate sanitary manager, who takes the decisions needed for improving the work, in collaboration with the sanitary supervisor;
– withdraws HTH from the storekeeper, and checks its consumption on the file;
– temporarily replaces a person absent from the team (especially the person who prepares solutions).

5.8.2.2 Preparer of solutions

– prepares solutions A, B, and C for the various units;
– manages the water supply (supply, treatment);
– receives HTH from the supervisor and keeps a file of entry and production of solutions.

Above a certain volume of activity, the preparer is helped by an assistant, capable of taking over if necessary; this assistant ensures the supply of solution B and C at the footbaths.

5.8.2.3 Sanitary facilities technician

One person per set of facilities:
– in charge of the latrines, excreta-disposal pits, showers and washing areas;
– specifically in charge of the disinfection of stools and vomit in the excreta-disposal pits, explains procedure to patients and visitors, or carries them out personally, if necessary;
– keeps containers of solution A (0.5 l) and hand-washing facilities filled with solution C at the entrance to latrines and excreta-disposal pits;

– periodically empties the barrel of disinfected matter into the excreta-disposal pit;
– makes sure that showers, latrines and washing slabs are used correctly;
– supervises the jobs of the cleaner and sprayer.

5.8.2.4 Tent sanitary technician

One person for 20 to 25 patients in IV and Observation phases.
One person for 30 to 50 patients in ORS and Convalescence phases.
This technician, who is the first contact for carers and patients, has an essential role:
– informs the patients and carers about cholera contamination modes;
– explains the various measures for reducing transmission: disinfection of stools, vomit, hands, soles, clothes, dishes etc. with chlorine;
– also explains how to use the various facilities (excreta-disposal pit, footbath etc.);
– provides one or two buckets per patient, explains how to use them and makes sure that they are properly used;
– refills the small barrels of solutions A and C from the storage barrels;
– may have to prepare ORS (substituting the ORS area nurse);
– following medical advice, transports patients to the Convalescence area with the help of maintenance workers;
– supervises the sprayer and the cleaner.

5.8.2.5 Tent cleaner

One person per 25 patients in IV and Observation phases, one for 50 in ORS and Convalescence phases:
– keeps the unit clean (rubbish – waste-bin);
– disinfects (with solution A) any place that has been soiled (bed, ground, mat etc.);
– is at the disposal of the sanitary technician and nurses to give them any help they may need.

5.8.2.6 Sprayer

One person for 50 patients in the IV area, and one for the Convalescent area.
One person for the Observation/ORS area (plus one in the Admission area when the number of admissions is more than 30-40):
– uses solution B;
– sprays inside and outside the tents, especially in soiled places;
– disinfects beds and mats (especially after the discharge or transfer of patients);
– regularly disinfects latrines and showers.

5.8.2.7 Entrance sprayer

One person at the main entrance (solution B):
– sprays soles/feet, dishes and objects that people going out may be carrying;
– sprays vehicles, stretchers, cloths and any other item in contact with new patients during their transfer to the centre.

5.8.2.8 Sanitary technician/sprayer of the Neutral area

One person, who works only during the day:
– is responsible for all the sanitary equipment of this area;
– disinfects the clothes left in the changing room.

5.8.2.9 Footbath sanitary technician

One person for each footbath:
– is responsible for the footbath (availability of solutions);
– limits the entry of visitors;
– makes sure that people going out disinfect their hands (solution C) and feet (solution B).

5.8.2.10 Maintenance worker

Two people, who work only during the day:
– collect all the waste-bins and burn the waste;
– are available for carrying out odd jobs (stretcher-bearing, maintenance etc.).

Table 14.VI: Summary of sanitary personnel for a CTC with a maximum capacity of 300 people. With the centre working 24 h/24, three teams with the same composition follow one another on a 3 x 8 basis (or rather 7 + 7 + 11 h 30, including crossover times, bearing in mind the lower rate of night-time activity). Each week, the teams can change timetables, in order to balance the number of work hours. In a centre with 300 patients, there are therefore 67 sanitary technicians at the start-up of the centre, and 118 at the peak of the epidemic.

Job	Number or ratio	Number at start-up	Number at max. capacity
24 h/24 team			
Sanitary supervisor	1	1	1
Preparation of solutions	1 + 1 Asst.	1	1 + 1
IV			
Sanitary facility technician	1 per facility	1	2
Tent sanitary technician	1 per 20 to 25 patients	2	6
Footbath sanitary technician	1	1	1
Tent cleaner	1/ per 0 to 25 patients	2	6
Sprayer	1 per 50-patient unit	1	3
Convalescence			
Sanitary equipment technician	1 per facility	1	1
Tent sanitary technician	1 per 50 patients	1	3
Footbath sanitary technician	1	1	1
Tent cleaner	1 per 50 patients	1	3
Sprayer	1	1	2
Admission/Observation/ORS			
Sanitary equipment technician	1	1	1
Tent sanitary technician	1 per 25 patients	1	2
Footbath sanitary technician	1	1	1
Tent cleaner	1 per 50 patients	1	1
Sprayer	1	1	1
Entrance			
Sprayer	1	1	1
TOTAL		20 x 3 = 60	37 x 3 = 111
Only during the day			
Sanitary technician / Neutral-area sprayer 1	1	1	
Maintenance worker	2	2	2
Mortuary worker	2	2	2
Laundry worker	2	2	2
GENERAL TOTAL		67	118

5.8.2.11 Mortuary worker

Two people (one man and one woman), who work only during the day:

– transport the deceased to the mortuary, plug all orifices (cotton impregnated with solution A), clean the bodies with solution A, and wrap them in a shroud and then in a plastic sheet or bag;
– if the family members wish to clean the body, they explain the need for this procedure, and supervise it;
– make sure that the family members disinfect themselves after touching the body;
– urge the family of the deceased to bury the body as quickly as possible;
– monitor the funeral.

5.8.2.12 Laundry workers

Two people, who work in the IV area, only during the day:
– disinfect (10 min soaking in solution B),
– and then wash the centre's cloths and blankets.

5.8.3 RECRUITMENT AND TRAINING

As soon as the layout and equipment of the centre have been determined by the medical personnel and the logistics manager, the main task of the sanitary manager is to recruit and train personnel. It may take eight to fifteen days between the job announcement and the recruitment of 75 sanitary technicians ready to work. This is also the time necessary for recruiting and training the medical team.

5.8.3.1 Staff profiles

In the first place, people with some experience in public health, teachers who are not afraid of getting their hands dirty, and people whose information and advice will be well accepted by those concerned, will be preferred.

Other criteria vary depending on the post:
– supervisor: good understanding of water supply and sanitation, team leader, 'presence' (person of a certain age), clear expression, good knowledge of an international language;
– preparer of solutions: understanding of health information, ability to do calculations, sense of responsibility, international language;
– tent sanitary technician: knowledge of health information training / explaining skills, international language if possible;
– sanitary facilities technician: knowledge of health information, authority, training / explaining skills, international language if possible;
– footbath sanitary technician: authority, knowledge of health information;
– mortuary worker: knowledge of health information, training / explaining skills;
– sprayer: previous experience, technical skills;
– cleaner, laundry worker, maintenance worker: ability to act in any context.

5.8.3.2 Training

The training involves theoretical, technical, and practical sessions.

Theoretical training (half a day per group) gives a knowledge of cholera and its modes of contamination and disinfection. It is intended to motivate personnel to apply and maintain actions they may normally regard as bizarre. A previously-trained supervisor can simplify this training for the group of cleaners-sprayers.

The technical and practical training (half a day per group) begins with a reminder of the theory, which is followed by a presentation of the plan of the centre and its medical and sanitary functions.

A visit to the centre, during which the various jobs are explained, is organised. This training finishes with a presentation of the internal regulations.

At the end of this general training, job appointments are established and the candidates are informed. The three teams (morning/day/night), and their respective supervisors, are chosen. From that moment on, the work is done by groups of work posts, under the responsibility of supervisors. These supervisors are not always immediately appointed, but chosen after some days of work, except when training has been long and comprehensive enough to identify leaders. A detailed job description must be drawn up:

– making the person concerned responsible for materials and equipment used during their shift;
– identifying the supervisor as responsible for the sanitary team;
– making it clear that appointments are not permanent, and can be modified at any time.

In urgent cases, where a centre must be opened immediately (even if the installation is not complete), a reduced team is quickly recruited, and trained on the job, using the job description as a basis. In this case the practical training must be complemented by close supervision. Theoretical training takes place later.

5.8.4 INFORMATION

Inside the centre, posters are placed in front of each sanitary point to facilitate the quick uptake of hygienic practices, and to avoid any improper use of the solutions. These posters must describe, with simple and unambiguous drawings, the operation to be carried out: drinking, washing hands, doing washing etc. A local artist is perfectly adequate for the task of portraying these messages.

Outside, messages broadcast to the population by all media (radio, television, newspapers, religious gatherings etc.) deal in general with preventive hygiene measures, and what to do to combat the disease. It is advisable to complement these messages with some information about the treatment centres, insisting especially on the reasons for, and the importance of, measures such as the limitation of the number of carers, systematic disinfection at the exit etc. These restrictive measures are generally better accepted coming from local or religious authorities.

5.9 Other structures and contexts

For other cases (use of a building, or low-capacity centre), the principles are the same as those already mentioned, with exceptions that must be applied to each particular case.

5.9.1 BUILDING

If the capacity of a building is not sufficient, inside space is allocated as a priority to the dispensary and to patients in the IV phase.

Even though a tiled floor facilitates periodic disinfection of the building, it is nevertheless necessary to provide some basins for collecting wastewater.

Specific sanitary facilities (toilets, excreta-disposal pits, and showers) are built for cholera treatment.

5.9.2 LOW-CAPACITY CENTRE

A low-capacity centre is usually set up in a permanent building. The sanitary facilities are simplified, retaining:

– one or more 250-litre plastic reservoir(s) for water storage;
– some 20-litre containers for preparing and storing chlorine solutions;
– plastic basins for footbaths.

In addition, a smaller number of staff are required, and they are less specialised: the supervisor prepares solutions, the sanitary technician sprays etc.

If there is no available site for the sanitary facilities, the building's toilets can be used, reserving one for patients in the IV phase. The disinfection procedure is then carried out in a small barrel, which is periodically emptied into the toilet. The latter must never, under any circumstance, be used directly by patients, especially if it is connected to a sewage network. This kind of arrangement is not really advisable, but may be unavoidable if an existing CTC or health structure is used.

Patients in IV and ORS phases must be kept isolated as much as possible.

6 Actions in the community

6.1 Information and hygiene advice

In villages, information about cholera and hygiene measures aimed at the whole population is sometimes provided by international organisations such as WHO and UNICEF, or by the Ministry of Health, who use both traditional and modern communication channels, especially the media.

Local and international NGOs, possibly with assistance, form excellent information relays in urban neighbourhoods and in villages for spreading information and advice about cholera.

In a rural environment, and in the absence of NGO partners, the intervening NGO has to develop hygiene messages and spread them via civil and/or religious authorities.

Teams composed of one hygiene educator and one or two sprayers try to limit the primary infection centres by disinfecting soiled places in the homes of patients (floors, beds etc.). These teams are also in charge of providing hygiene information to patients' contacts. The teams are connected to the CTC, where they gather information and select the sites to be treated (6 to 8 sites/team/day). Depending on population density, these teams are either on foot in the case of small area centres, motorised in the case of centres in rural areas or a mixture of the two, usually in urban areas, with the vehicle being used for the transport to the working area, supervision, and possibly transfer of a mobile team to dispersed sites beyond walking distance.

The hygienist must address messages to the relatives and neighbours of patients, to inform them, explain the sprayers' work and detect more suspected cases.

The messages describe the symptoms of the disease, where to go for treatment, and prevention methods: food preparation, hand-washing, choice of water source, treatment of drinking water etc.

The sprayers use two types of solution: solution B for clothes, dishes, beds and houses, and solution A for latrines and defecation fields. Disinfection by spraying must normally be carried out for three successive days. This is not always possible over the whole area, so there is a need to prioritise areas at risk, and in those areas to identify centres of infection by studying the origin of cases.

6.2 Improving water quality

The following actions, listed in order of priority, must be planned:

– use the existing supply (wells, distribution systems, boreholes etc.) if water quality can be guaranteed by effective actions such as disinfection;

– provide an alternative supply, usually by water trucking to distribution points and/or a mini-supply system on a borehole or a mini treatment station;

– improve the quality of water for consumption by distribution of chlorine to households, and jerrycan-disinfection points.

Some standard actions are given below.

6.2.1 CHLORINATION OF WATER POINTS

Disinfection must be verified by measuring free residual chlorine. Depending on the context, it can be:
– chlorination of the mains water, and verification of the amount of free residual chlorine at the water points;
– daily chlorination of wells carried out by local teams;
– chlorination of other sources of water supply.

6.2.1.1 Municipal water-distribution system

Theoretically, the system should deliver water containing a level of free residual chlorine of between 0.3 and 0.5 mg/l at the tap. In times of cholera, it is absolutely essential to increase this level: a level of free residual chlorine of 0.8 to 1 mg/l must be measurable at the tap.

In 1991, in Peru, a problem with the chlorination system, together with pollution of seafood, were the origin of a high attack rate in coastal regions (1.5%).

Some support can be given to treatment stations:
– technical: daily monitoring of chlorine level at water points;
– logistics: supply of chlorine and other consumables;
– emergency: rehabilitation of water points.

Finally, it is necessary to ensure that the population is well informed (press, radio, authorities), so that people go only to chlorinated water points.

6.2.1.2 Shallow boreholes and wells

The sanitary conditions of these water points depend on the quality of their construction, protection measures (cover, handpump etc.), and the sanitary conditions of the surroundings (see Chapters 7 and 8). They are an important source of supply, and therefore must not be neglected. The actions to carry out are:
– chlorination (Box 14.2) and monitoring of the amount of free residual chlorine (once or twice daily);
– cleaning and disinfection when pollution is evident (Box 14.3);
– emergency rehabilitation (surface works, waterproofing);
– closure if any of the above actions cannot be efficiently implemented and if the population has an adequate alternative water supply.

6.2.2 DISTRIBUTION OF DISINFECTANT TO HOUSEHOLDS

Water can become contaminated between the distribution and consumption points: dirty recipients and plugs, wooden ‘wavebreakers’ in buckets, open storage vessels, water taken from storage vessels by dipping in contaminated cups etc. This kind of water is an excellent culture medium for the cholera vibrio if it does not contain enough free residual chlorine. The chlorination of water points must therefore maintain a level of free residual chlorine of 1 mg/l in order to provide the water with sufficient self-disinfecting capacity. If this is not possible, it is advisable to carry out domestic chlorination. This approach is logistically quite difficult: each family is given enough 1% stock solution to disinfect their drinking water for a week (the solution only remains active for this period of time), and then must be given a new supply.

Another approach (more expensive but easier to implement logistically) is the distribution of NaDCC (sodium dichloro-isocyanurate) tablets: one 167-mg tablet treats 20 to 25 l of water.

In Mozambique, ACF developed a similar action by establishing chlorine solution distribution points in the village. This programme was implemented with Culima, a local organisation that already had a very good knowledge of the area.

Box 14.2
Chlorination.

In recent years, ACF has attempted to develop a continuous chlorination system in order to get an appropriate amount of free residual chlorine in wells or tanks, as an alternative to "one shot" chlorination. Major issues are:
– controlled diffusion and acceptable levels of residual free chlorine (WHO recommendations);
– involvement of the local population and acceptance;
– easy implementation and low cost;
– low maintenance and infrequent need to reload the chlorination system.

1) *Periodic method*
This is the traditional chlorination method and was used for a long time in Mogadishu. The stock solution concentration is 1% of chlorine. The stock solution concentration to apply is chosen according to the average water quality in Mogadishu. (Figure 14.8.a: results from 173 wells in 1998. Analysis method: DPD1 and colorimetric chart.)

2) *Pierced recycled jerrycan*
From October to December 1998, ACF tested a chlorination procedure that uses local materials and provides continuous slowly-diffused chlorine for a period of 12-15 days. Pierced recycled 5-litre oil jerrycans were used, with successive layers of gravel, sand, sand/chlorine mix, sand, and then gravel again. In January 1999 this system was implemented in all wells that ACF chlorinated in Mogadishu. (Figure 14.9.b: results from 919 wells. Analysis method: DPD1 and colorimetric chart.)

3) *Immersion of chlorine tablets*
Since the 2000 cholera outbreak, ACF has used a continuous chlorination technique adapted from swimming pool chlorination. Chlorine tablets (125 grams of HTH 75% chlorine) are made locally with a manual press. These slow-dissolving tablets are then inserted in pierced pipes. The pipes are immersed in the wells, tied to the surface with a rope. The chlorination teams visit the wells at least twice a week to ascertain the chlorine level and replace tablets. Each well has its own protocol, depending on its volume and yield, that is established empirically by the chlorinators. They also inform the population about the technique, as well as appointing a well caretaker from the community. (Figure 14.9.c: results from 98 wells in January 2000. Analysis method: DPD1 and colorimetric chart.)

As can be seen from Figure 14.9, only 4% of the wells disinfected with chlorine tablets tested in 2000 had no residual chlorine (Figure 14.9.c). This is an improvement of 27% over the situation two years before, when 31% of the wells showed no trace of chlorine (Figure 14.9.a). This can be directly attributed to the improved chlorination system that provides a simple slowly-diffused continuous source of chlorine, replacing the old system, of someone dumping a quantity of chlorine into the well once a day, that only provided chlorinated water for roughly a one hour period.

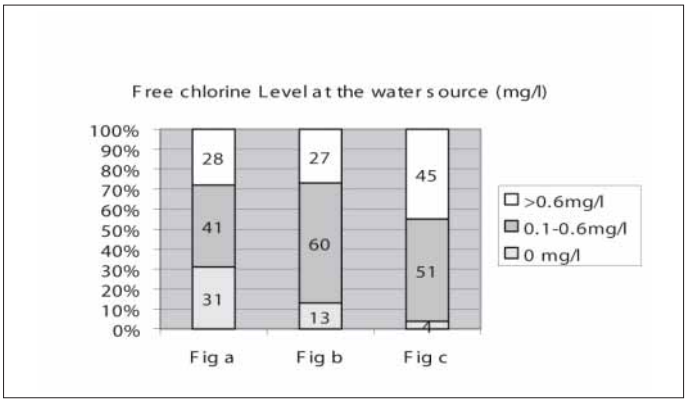

Figure 14.9: Comparative performance of different well-chlorination techniques.

Box 14.3
Disinfection/closure of wells.

Wells are disinfected when it is suspected that they are contaminated, either because of one-off contamination (dead body of an animal or waste), or because a detailed study of the CTC files indicates a number of sick people whose families draw their water from the same well.

When there is no possibility of preventing pollution of a water point (see Chapter 8), its closure is considered (with the intervention of the local authorities), while proposing another supply source to its users (for example, another well that will be properly protected). It is always better to look for agreement than to impose a decision that may be easily ignored.

6.3 Examples of specific actions

The community must perceive these actions as appropriate, or they risk being inefficient or rejected. Therefore, only general advice can be given; this must be adapted or improved with local conditions in mind, while attempting to ensure the participation of the authorities (religious, secular, modern and traditional) in the preparation and implementation of specific measures.

The beginning of the process requires holding a cholera information session with the authorities to underline possible actions to be taken in the community, while looking for people with positions of responsibility and trying to assess their possible roles.

6.3.1 CLOSED RISK AREAS: CAMPS

Using home visitors, hygienists cover the camp to convey information and recommendations about cholera, reinforce basic hygiene measures (hand-washing), detect suspect cases of diarrhoea, and inform the treatment centre immediately. Frequently, a hygiene education programme already exists, so it is only necessary to provide the hygienists/home visitors with some complementary training about cholera.

Ideally, disinfection of the surroundings of sick people should be immediate: sprayers must be ready to act under the supervision of hygienists.

At public assembly points (high risk areas), such as markets, schools, places of worship and food-distribution points, the messages must focus on hygiene information, and on the recommendations in case of suspected diarrhoea: disinfection of public latrines (slab, walls, door, handle, fittings etc.) and defecation fields with solution A, and finally, waste collection and the disinfection of the area at the end of the day.

6.3.2 OPEN RISK AREAS: LARGE TOWNS AND EXTENDED RURAL AREAS

Ideally, all the actions described above should be carried out, but this is rarely possible in large towns or extended rural areas. Therefore the focus is on sites at clear risk and for which effective action can be guaranteed. These sites often include markets, schools and orphanages.

It is also difficult to intervene in disadvantaged urban areas, that is to say in highly-populated areas with old or faulty sanitary infrastructure and polluted water points. With inadequate sanitation and water supplies, and without specific measures similar to those implemented in camps, these areas are badly affected during cholera outbreaks. Nevertheless, to achieve a certain impact, those sites at highest risk will have to be selected, and sometimes in this context, education and domestic chlorination will be the only effective measures.

7 End of the intervention

It is usually easier to start an intervention than to finish it. Management of CTCs or support for local centres can sometimes be on a scale similar to the management of a business, with hundreds of employees or food-for-work volunteers who must be managed as in any normal firm. This managerial role is a position which must be continued until the end of the intervention. When a regular decrease in the number of cases occurs, this large human and financial investment becomes no longer justifiable: this is the time to disengage, but also to evaluate the operation.

7.1 Disengagement

7.1.1 TREATMENT CENTRE MANAGED OR SUPPORTED BY AN NGO

The larger the CTC and the involvement of the NGO, the more delicate disengagement is. Nevertheless, centres cannot continue to be managed or supervised by ACF until there are no more admissions.

There are no universal disengagement criteria: in Somalia, the threshold used by ACF is 21 cases per treatment centre per week over 3 consecutive weeks.

If the local partner cannot take charge of a CTC that is no longer suitable for the decreased seriousness of the epidemic, the centre can be closed, and all responsibility devolved to a small specialised structure, perhaps within a dispensary or hospital. Small urban centres usually close progressively when a referral centre for the whole town has been set up. On the other hand, centres in a rural environment remain open for longer, because the transport of patients to a referral centre is usually difficult.

If the CTC is transferred to a partner, the ideal is to know that partner from the start of the operations in order to involve them as much as possible in the management of the centre. Some potential partners are the Ministry of Health, a group of doctors trying to create a local structure, or an NGO (local or international) with a programme and medical structures.

Whatever form it takes, disengagement must be complete:

– fix the conditions of the handover clearly and precisely;
– provide a final delivery of supplies (enough for about one month);
– pay the salaries or food-for-work plus bonuses;
– space supervision out progressively, and then stop it completely.

7.1.2 VERIFICATION AND IMPROVEMENT OF WATER QUALITY

Chlorination of wells is only carried out during the epidemic. It is therefore necessary to keep it up when there are risks, but not once they have disappeared. Sometimes chlorination may be extended up to a month after the last cholera case, but in practice this time limit is difficult to determine, bearing in mind the proliferation of non cholera-related diarrhoea at the end of the epidemic, which may nevertheless be classed as cholera. In the long term, only the rehabilitation of wells, and surface protection works can decrease or eliminate their contamination. This rehabilitation must be complemented with educational actions if the water is to remain potable.

Even though the reappearance of cholera may be dramatic, it is only episodic, whereas other diarrhoeal diseases remain prevalent, and are an important cause of child mortality. Water-quality monitoring must therefore continue: it must target certain water points that have problems and/or are highly frequented, and should be geographically spread over the whole area. Water quality is determined by regular bacteriological analysis (see Chapter 4).

7.1.3 SELECTIVE TRAINING/DISINFECTION TEAMS

Closure of the centres means the deactivation of the teams that have been created. Nevertheless, some may continue to work under the control of the remaining referral centres, which maintain some logistics capacity for work in their area.

It is also advisable to maintain this activity on a smaller scale to collect field data with which to monitor the development of the epidemic, together with data from treatment centres that are still working. Some outbreaks can still appear in certain areas in case of endemic cholera, and the disinfection teams are then able to detect them and act accordingly. These actions, which are not very expensive, also allow indirect monitoring of the quality of the water points.

At the end of the epidemic, the cholera monitoring system is included in the national surveillance system.

7.2 Evaluation

Analysis of the epidemic based on epidemiological data enables the efficiency of the intervention, and in particular that of ACF, to be evaluated and compared to the initial objectives. (Has the defined intervention strategy met the needs?)

The key points to be examined are the speed of implementation and supply, the quality of staff training, and the effectiveness of the coordination between the various intervening organisations and individuals.

7.2.1 INITIAL ASSUMPTIONS

Were the initial assumptions confirmed (attack rate, affected areas, rate of expansion etc.)? If not, why not?

Was the development of the epidemic anticipated, or did it exceed all expectations? Was reliable information lacking? Was the analysis insufficient? Did unforeseeable events take place?

7.2.2 EPIDEMIOLOGICAL DATA

When the epidemic is considered to be over, some definite figures are established:

– total number of cases, overall attack rate, and distribution over time;

– geographical distribution of the cases, and attack rate (per neighbourhood or village);

– distribution per age group and sex of declared cases and deaths;

– number of secondary cases (including family), ratio of secondary cases to total cases (and development);

– number of deaths, and case-fatality rate (number of deaths per number of cases) as a whole, and per treatment centre;

– seriousness of the cases at admission (grade of dehydration on admission);

– treatment provided (what treatment and under what form, oral or intravenous).

The attack rate is carefully analysed, because it reflects the characteristics of the environment, the population's hygiene habits, and the ability of the responding organisations to achieve the (provisional!) improvement of sanitary conditions using hygiene promotion, disinfection, rigorous management of the CTCs (isolation), and water supply. The number of secondary cases is also a good indicator of conditions and hygiene habits. The development of the ratio of secondary cases to total cases should be compared with the activities of the disinfection and water-supply chlorination teams.

The geographical distribution of the attack rate is an important factor: geographical differences can be interpreted as environmental differences (water supply/sanitation/housing), or as differences in the effectiveness of intervention. In similar environments, what are the actions (or their mode of application) that have caused those differences? In any case, a relatively low attack rate can sometimes be explained by patients being treated at home for reasons of distance or insecurity, or because information has not been effective.

Lastly, the case-fatality rate is an important indicator. According to WHO, when it is less than 1%, it indicates good control of the epidemic by the medical and sanitary intervention (rapid case detection and management in particular). This figure is significant only in relation to a given envi-

ronment: in practice, the medical personnel on the ground have a better knowledge of the significance of the 'control' of the epidemic (what was avoidable and what was not). In some situations, given all the constraints faced, a 10% case-fatality rate can be considered a positive result (without treatment it can reach up to 50%).

The high number of barely quantifiable factors which can cause contamination makes it rather difficult to interpret epidemiological figures. The main thing is to evaluate trends and to establish comparisons. In any case, there is always some uncertainty about the validity of the records kept.

7.2.3 COSTS

Three balance sheets are drawn up for the intervention:
– total cost: medical and sanitation products, rehabilitation material, water-supply and other equipment, logistics, salaries;
– cost per patient treated;
– cost per product consumed (HTH, ORS, Ringer's lactate, antibiotics etc.).

7.3 After the cholera response

A cholera intervention consumes a lot of energy, sometimes to the detriment of an NGO's ongoing programmes, but it also allow it to do the following positive things:
– identify new areas at risk in terms of water and sanitation;
– work with local NGOs, and evaluate their efficiency;
– create a certain dynamic around sanitation in the community and among decision-makers;
– reinforce the links between the international intervening parties and the national technical authorities who coordinate their actions;
– measure (and justify, retrospectively) the impact of ongoing programmes in terms of prevention, with the analysis of CTC statistics.

Therefore, the intervention also improves knowledge of the geographical area covered, which can be the beginning of a possible reorientation of activities.

ACTION CONTRE LA FAIM

Water, sanitation and hygiene

for populations at risk

HERMANN

ACTION CONTRE LA FAIM

Water, sanitation and hygiene for populations at risk

HERMANN ÉDITEURS DES SCIENCES ET DES ARTS

The illustration on the cover is from Souffles du monde–BKK, Erik Sampers, ACF Liberia.

ISBN 2 7056 6499 8