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WATER, SANITATION, AND HEALTH

This report is intended as a basis for the technical discussions on the above subject. It gives the background to the problem of supplying populations with the clean water and the basic sanitation facilities that are essential to their health; outlines the present situation throughout the world, and in particular in the Eastern Mediterranean Region; traces the approach that has gradually evolved and the action taken throughout the United Nations system in recent years, culminating in the decade 1981-1990 being declared the International Drinking Water Supply and Sanitation Decade; and suggests priority areas for action on the part of Member States to advance the aims of that Decade.

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I INTRODUCTION

An adequate supply of safe water and basic sanitation is listed as one of eight essential components of the primary health care required for the achievement of health for all by the year 2000. Major health problems in many of the developing countries, irrespective of their stage of development, are the preventable diseases associated with the lack of these basic sanitary measures, which contribute to high infant mortality, morbidity, low life expectancy, and poor quality of life.

It is the object of this paper to highlight the effect of these diseases; to emphasize the overall needs for basic sanitary measures in countries of the Region, with particular reference to the activities to be undertaken by Member States in relation to the International Drinking Water Supply and Sanitation Decade; to pinpoint the constraints on those activities; and to suggest ways of overcoming them.

Water Uses and Requirements

It is the task of the politician, the economist and the planner to ensure optimal use of water resources for the benefit of the whole population. The basic resources are the people (their health, knowledge and skills), along with the land and other natural resources. But in most developing countries the people are an inadequately capitalized asset because their health is too often adversely affected by their environment.

In this context water is frequently of vital importance. It is almost the only compound that exists naturally as a liquid on the earth's surface and has a very wide range of uses, both consumptive and non-consumptive (domestic, agricultural/fisheries, industrial, use in drainage and in energy production; it also constitutes a recreative amenity).

The normal daily water requirement for adults is 2.5 litres (say, 5 1/2 lb). Under conditions of extreme heat or physical exertion this requirement may increase. But in addition to this quantity - which is for alimentation and comes mostly from ingested food - much greater quantities are required for common human activities, domestic, industrial and agricultural. The domestic water demand in a developed country would be a minimum of some 100 litres per capita per day.

While, in general, the availability of water as a resource is not a major impediment, the difficulty lies in providing the consumer with water of sufficient quality and quantity. An adequate supply of safe water implies access to water within a reasonable distance.

Sanitation Requirements

Sanitation is inextricably linked with water supply and has many dimensions that affect the quality of life. The disposal of human excreta is only one of its aspects. Others include personal hygiene, the collection and disposal of solid wastes, wastewater collection, food sanitation, vector control, and household cleanliness. The linking of water supply and sanitation opens up a wide range of alternatives for improving the health conditions of the vast majority of those in the developing world. The quality of life however is influenced not only by quantitative and qualitative improvements but also by other factors such as convenience of location and availability of facilities.

II WATER AND HEALTH

It has been estimated that 80 per cent of all illness in the countries of the Third World is associated with water. Typhoid and cholera outbreaks often occur because water is unsafe. Water is the breeding-place for the insect vectors of malaria, filariasis and yellow fever, and the number of people affected is very large indeed. Some 200 million people suffer from schistosomiasis. And an estimated 400 million people suffer at any one time from gastroenteritis. Diarrhoea is the major cause of sickness and death among children in the developing countries: during 1975, for example, there were approximately 500 million episodes of diarrhoea in Africa, Asia and Latin America among children below the age of five.(19)

In the Eastern Mediterranean Region, it is estimated that out of eleven million children born each year approximately 2 million die before reaching the age of five; and of these 2 million deaths, about 40 per cent are due to diarrhoeal diseases. In Egypt (1973) these diseases were the leading cause of death in children under 3 years of age, accounting for 43 per cent of all deaths in this age group.(23) In Iran (1973) they were the second most prevalent of the diseases with an incidence of 22 per cent in the 0-5 year age group and 14 per cent in all age groups. In Jordan, Saudi Arabia and Pakistan they are the leading causes of hospitalization and deaths.

In all, the diarrhoeal diseases are responsible for between 15 per cent and 22 per cent of all mortality in the Region.

Recent studies[20] have demonstrated that provision of safe supplies of water for drinking is not by itself sufficient to control acute diarrhoeal diseases. This is because they can be transmitted by contaminated water used for bathing, cooking, washing food, etc.; and also because such diseases as shigellosis and rotavirus infections can be transmitted through non-waterborne routes. It has been stated[3] that in India the population at risk from filariasis has increased over fifteen years from about 20 million to over 125 million as a result of improved water supplies without supporting drainage systems. In addition to the supply of safe water, therefore, there must be a combination of efforts to provide means of waste disposal and to educate the public in proper personal and food hygiene practices.

WATER QUALITY

The quality of drinking-water supplies is an essential part of the problem. An increase in quantity alone is not sufficient; the water used by people anywhere in the world must also meet certain minimum hygiene and health requirements.

Chemical Quality of Water

The chemical substances to be found in water do have adverse effects on health, but in general these are mainly of concern in industrial countries where infectious diseases have largely been overcome. Standards for toxic substances such as arsenic, cadmium, cyanide, lead, mercury, selenium, fluorides and nitrites have, however, been laid down by WHO and have been adopted by many countries.[18]

Hardness. In many countries of the Region, deep ground water is being increasingly used for public water supplies. Such water usually contains a higher concentration of hardness-forming constituents as compared with water from springs, shallow wells or even rivers. (Hardness is defined as a direct measure of the concentration of calcium and magnesium ions and is frequently expressed in equivalent amounts of calcium carbonate ($CaCo_3$); water is considered hard if the concentration of $CaCo_3$ is between 150-300 mg/l as against 75 or less for soft waters).

Recent studies have shown a negative correlation between hardness of water and mortality due to cardiovascular diseases; in other words, the harder the water, the lower the cardiovascular disease mortality rate. However, no additional decrease

in that rate was observed when hardness levels progressed beyond 170 mg/l. It is not yet known which water parameters are responsible for this association, although some studies claim an inverse relationship between cardiovascular diseases and magnesium content.

Trace elements. The chemical composition of the food that we eat is influenced among other things by the chemical composition of the water used for food preparation and cooking. Food cooked in water will of course lose minerals; and further loss occurs when it is industrially processed, refined or frozen.(8) Table 1 gives the daily requirements in trace elements by adults. It is even possible that where foods and diets are deficient in minerals, the water used for drinking and cooking purposes could make up for the deficit. The maximum contribution that drinking-water can make to the daily intake of certain essential elements is shown in Table 2.

Among the individual inorganic elements that can make the difference between health and disease are lithium, commonly prescribed for behavioural disorders; chromium, which acts as a co-factor with insulin to maintain normal glucose tolerance; fluorine which, in a proportion of 1 mg/l, is of marked benefit in protecting against dental caries; iodine, deficiency in which is associated with goitre; silicon, calcium and magnesium, the presence of which in water is reported as showing a correlation with a low incidence of cardiovascular diseases.

Demineralization. The practice of softening hard tap water for practical, economic or aesthetic reasons needs reconsideration. Many public health authorities and investigators think that a more prudent attitude should be taken to water softening, and that it might be preferable to maintain the mineral content that is naturally present. A WHO working group (Brussels 1978) recommended that excessive softening of water should be avoided or carried out only in the case of water for industrial use; or in the case of domestic use, only for the hot water line that goes to domestic appliances. Investigations indicate that the optimum range of water mineralization should be between 200-600 mg/l.(8)

Biological Quality of Water

In the developing countries many of the major communicable diseases are waterborne. These may be sub-divided according to the likely effect of changes in water and are of four categories (Table 3). Of the first two, each has its own associated disease changes (categories I and II). Then there are infections which can multiply

at the water source (III); and lastly there are infections carried by vectors which depend on the water supply (category IV).

Waterborne diseases. (Category I) The most dramatic decrease observed in the incidence of disease after improvement of the microbiological quality of urban water supplies has been in the classical waterborne infections, typhoid and cholera (Table 3). Since these diseases were a main preoccupation of municipal suppliers in temperate countries, they have come to dominate the thinking about water supply and the training of public health engineers. They are unusual infections in that the minimal infective dose of organism is so low that even after extreme dilution of the infective material, transmission still occurs. The dimension of epidemic that may result from contaminated water largely depends upon the number of consumers. As the degree of faecal pollution of water increases it becomes possible for other microbes, with a higher minimal infective dose, to be transmitted; paratyphoid fever and possibly hepatitis are in this category. Since such a degree of pollution is intolerable in a municipal source, these infections are likely to be waterborne only in undeveloped communities.

Infections from washing in polluted water, (Category II). There are many infections, especially in the tropics, which decrease markedly when the volume of water available for washing and personal hygiene is increased. Most of these are infections of the gastrointestinal tract or of the skin. Although diarrhoeal diseases may sometimes be spread in this way by polluted water, it seems clear that many of the infections in question are not waterborne in the strict sense. Studies have shown that they decrease with proximity to a water source and are relatively unaffected by its microbiological quality. Cutaneous infections are among this group, as are skin sepsis due to bacteria, and cutaneous fungal infections.

Water-based diseases. (Category III). Several parasitic worms are dependent on aquatic intermediate hosts. Eggs or larvae carried by infected persons may reach the water and infect the intermediate host and after a time large numbers of larvae infective to man will be present in the water. Schistosomiasis and guinea worm are two such water-based diseases. The schistosome larvae develop in certain aquatic snails and the infective cercariae invade man through the skin. The guinea-worm larvae escape from man by way of lesions on the leg and develop in small aquatic crustaceans. Man is reinfected by drinking water containing the intermediate hosts. Infections produced by these helminths differ from the waterborne

infections of category I in their cumulative effect: the worm burden can build up, even in small communities, if the source of water is polluted.

Water-related insect vectors of disease. (Category IV). The insects responsible for transmitting several major tropical diseases are associated with water in one of two ways. Mosquitoes, which carry malaria, filariasis, etc., and Simulium which transmits onchocerciasis, breed in water. Other insects, particularly the tsetse fly (Glossina) of the palpalis group, bite near water by preference and may transmit sleeping sickness to those coming to fetch water.

CONSEQUENCES OF IMPROVING WATER SUPPLIES

It is well known that, even given ideal water supplies, few infections disappear completely, with the possible exception of guinea worm.[3] Studies suggest that half to three-quarters of the prevalence of bacillary dysentery and of roundworm (Ascaris) are due to inadequate water supplies. Data from American cities showed that the provision of safe water was accompanied by a 90 per cent fall in the incidence of typhoid (Figure 1) but there was little change in the incidence of diarrhoeal diseases overall.[13]

The main diseases of category III are of two types. Most of them are infections of skin and eye and are a consequence of an insanitary environment. The number of cases increase when there is a shortage of water for washing or where there is dust pollution. They would diminish with a more accessible and greater volume of water supply even without improvement in water quality. The diarrhoeal diseases also decrease when water supplies are made more accessible. However, prevalence can vary between areas with a comparable water supply: a hot dry climate and an insanitary environment particularly favour the diarrhoeal diseases and they therefore flourish both in crowded urban and in arid rural areas.

A good supply of water is therefore essential, but how much water is enough? Very few data are available on this aspect although it is crucial to the engineer and others. Of the studies specifically relating to the relationship between volume of water and burden of disease one was made in parts of California where dysentery caused by Shigella is very prevalent. The studies[3] showed that, although any type of sanitary improvement tended to decrease the prevalence of Shigella, the big reduction came when water was available inside the house rather than outside, even if nearby. Additional observations made in East Africa showed that water use does not significantly increase when the distance to the water-point changes,

provided that in the first place it is not more than a mile away or is not inside the house.(3)

Diseases are thus affected in different ways by changes in the water supply. Some are more responsive to a change in the quality of the water, and others to an increase in the supply available. The threshold for the improvements to take effect, and the form of relationship between water quality and incidence of a disease, will vary according to the particular infection and the environment.

Improvements in water supply can be made in many ways but they do not necessarily have to be carried out all at once. Each single improvement will produce specific changes in the quantity or quality of water supplied. The diversity of diseases and the benefits accruing from water improvement can however be reduced to practical proportions. Figure 2 shows the annual per capita disease costs to the community, estimated for each habitat and improvement level, on an arbitrary scale on which 100 represents the disease cost of unimproved supplies in a semi-arid tropical area and zero represents the disease cost where there is a supply of adequate pure water.

Three general conclusions have been drawn from this. First, that not all improvements of comparable cost produce similar benefits. Secondly, that similar improvements in different habitats may have different effects on health. Thirdly, that the relation between the cost of improvements and the health benefits derived is by no means linear. Where resources are limited and the long-term goal of ample safe water cannot be achieved in the near future, there is a wide range of partial improvements that can be undertaken and will bring consequential advantages and benefits to health.

HEALTH ASPECTS OF WATER RESOURCE DEVELOPMENT PROJECTS

Water, which is indispensable to the survival of man, sustains the life of other organisms as well. Some of these organisms can be harmful and their presence in water comes from the interference of man, e.g., its pollution by defaecation or by disposal of sewage, an interference that favours the propagation of both vectors and hosts of disease. The water-related vectorborne diseases include malaria, schistosomiasis, yellow fever, and many others. The major diseases prevalent in the Eastern Mediterranean Region due mainly to water resources development without due attention to proper drainage and wastewater disposal, are briefly discussed below.

Malaria. Over the past thirty years, the countries of the Region have undertaken important water development schemes for irrigation, energy, production, and other purposes. While much benefit has been derived in the form of higher food production and better socioeconomic conditions, the environmental changes brought about by such schemes have favoured the spread and multiplication of malaria vectors and have often produced a dramatic increase in the prevalence of this disease.

In the Gezira irrigation scheme area of Sudan, malaria cases have risen to epidemic level. In 1975, similar effects were reported from Pakistan after the development of the Indus Basin Canal irrigation schemes; the cost of malaria control measures for Pakistan now amounts to some $ 20 million per annum. Egypt, after construction of the Aswan High Dam, is experiencing similar problems. Almost identical situations can be cited for the Khuzistan irrigation projects in Iran, the Mussayels area project in Iraq, the Ghab Valley and Euphrates Dam and related projects in Syria, the North Jordan Valley irrigation works, the Abijan cotton plantation project in Democratic Yemen and the Johar sugar plantation project in Somalia. Obviously the campaign against malaria calls for control measures to eliminate or reduce breeding-places, through construction of drainage and wastewater disposal systems.(2)

Schistosomiasis. Schistosomiasis is one of the world's longest known and documented diseases. It plagued the Egyptians for centuries, parasite eggs having been found in Egyptian mummies dating back to the XX Dynasty (1250-1000 BC). The Nile provided suitable ecological conditions.(24) It was an established disease in Iraq along the Tigris and Euphrates rivers. It is now widespread in tropical and subtropical zones in Africa, Japan, the Philippines, Thailand, other parts of Asia and the Middle East, the West Indies, and parts of South America, altogether in a total of seventy-one countries. Currently it affects over 200 million people and many more are liable to infection, since in recent years, many water development projects have been undertaken, and the connection between water/irrigation development and the disease is beyond question.

It is difficult to quantify accurately the economic losses due to schistosomiasis. It was stated by Obeng(2) that such losses in the Philippines were about $ 6.5 million per year. She based this 1963 estimate both on the cost of medical care and on the decrease in productivity of those suffering from the disease. She also estimated the economic loss to Egypt to be about $ 560 million per year.

Obviously the economic loss for 1980 would be much higher. But the example serves to highlight the significance of the disease and the need to control it.

Control measures include both environmental management and engineering methods, e.g., the reduction of snails through habitat management; the prevention of access of schistosome eggs to snail habitats by construction of excreta disposal systems; the reduction of human contact with water, through provision of safe water; and health education of the community.

III SANITATION AND HEALTH

PUBLIC HEALTH IMPORTANCE OF SANITATION

The need for adequate sanitation is as great as the need for safe water. In fact, water supply and sanitation measures are truly efficient only if they complement each other.

Human excreta constitute the principal vehicle for the transmission and spread of a wide range of communicable diseases. Some of these diseases rank among the chief causes of sickness and death in societies where poverty and malnutrition are ubiquitous: diarrhoeas, for instance are - together with malnutrition, respiratory disease and endemic malaria - the main causes of death among small children and infants in developing countries. Cholera, whether endemic or epidemic in form, is responsible for numerous deaths in all age groups, although under endemic conditions it is the children who suffer the most fatalities. Other diseases, such as hookworm infections and schistosomiasis, produce chronic debilitating conditions which impair the quality of life and make individuals more vulnerable to superimposed acute infections.

These diseases, and many others, begin their journey from an infected individual to a new victim when the causative agent is passed on in the excreta. The collection, transportation, treatment and efficient disposal of human excreta are of much importance in the protection of the health of any community; they are particularly important in those societies which need to make use of human excreta in agriculture, aquaculture or gas production and which therefore reuse, rather than dispose of, the raw and treated wastes. Such reuse systems have a positive role in supporting economic activity and food production and are often cheaper than alternative methods of disposal. However, they present a challenge for designing and developing technologies that will not pose unacceptable risks to health.

A good example of the effect of sanitary excreta disposal on the incidence of typhoid and paratyphoid is given by Fair and Geyer[6] in a study made in West Virginia, USA, where a privy construction programme was undertaken: the death-rate attributable to these diseases was cut by two-thirds and eventually reduced to nil (Figure 3). It is stated however that improvements in other sanitary conditions probably occurred at the same time.

SANITATION AND DISEASE TRANSMISSION

In the transmission of sanitation-related diseases from the sick or the disease-carrier to the healthy, the chain of events (Figure 4A) is similar to that of many other communicable diseases. In order to transmit disease, the following factors are necessary: (1) a causative or aetiological agent; (2) a reservoir or source of infection of the causative agent; (3) a mode of transmission from the reservoir to the potential new host; (4) a mode of entry into the new host; and (5) a susceptible host. The control of a single one of these five conditions makes the spread of the disease impossible.

There are many ways in which the causative agent of an enteric disease reaches a new host. In different parts of the world, different modes of transmission may assume different degrees of importance: in some areas, water, food and milk may be the more important; in others, flies or other insects; and in others direct contact may play a major role. The objective of sanitary excreta disposal is therefore to isolate human wastes so that the infectious agents they contain cannot possibly get to a new host. Figure 4 B shows the place at which sanitation can intervene by erecting a barrier to check the chain of disease transmission from excreta.

EXTENT OF THE PROBLEM

Of the total population of the developing countries, which constitutes some 2 000 million, 70 per cent live in rural areas. A vast majority of that population at one time or other suffers from typhoid fever, diarrhoeal, enteric, helminthic and other diseases. Of the helminthic infestations, a member of WHO's Executive Board, Dr van Zile Hyde, once said:

> "The dire effect of all this upon a rural nation was clearly brought home to me by a statement that the worms infesting the people of the country metabolize more of the produce of that country than do the inhabitants. Half the work of a sick peasantry, therefore, goes into the cultivation of food for the worms that make them sick".[9]

In most cases in rural and small communities, almost all the elements of sanitation are absent and indiscriminate fouling of the soil with human excrement is common. Such conditions are also often found in rural areas near towns and aggravate the urban situation. The economic losses that result from such lack of sanitation often reach high proportions.

Atkin,[1] analyzing data available for several countries, found that infant mortality from typhoid fever, diarrhoea, and enteritis were in inverse proportion to per capita income. The cost of these diseases (Table 5) and the per capita cost of rural water supplies and latrines (Table 6) were estimated. It was concluded that in each of the countries considered, it would be possible within a period of five years to amortize the cost of rural sanitation facilities from the savings that would accrue from the reduction in typhoid fever, diarrhoea, and enteritis. Further advantages would accrue from the control and reduction in incidence of cholera, the dysenteries, ascariasis, guinea worm, hookworm and other enteric and parasitic diseases, not to mention the indirect benefits from the facilities, such as the convenience and saving of time.

IV PROVISION OF BASIC MEASURES FOR WATER SUPPLY AND SANITATION

EVOLUTION OF APPROACH TO THE PROBLEM

The problem of providing safe drinking-water and adequate sanitation are not new to the governments of the Region, nor indeed to the developing world as a whole. For many decades they have tried in various ways to bring these basic amenities to their populations. Progress has however been slow for a variety of reasons.

In the 1950s, pilot and demonstration projects were started in a number of countries to find out how water supply and sanitary waste disposal could be brought to people at a cost they could afford. The emphasis was on finding simple technologies. Mainly with assistance from UNDP and the World Bank, pre-investment surveys and sector studies were carried out in a number of countries; they were mainly in urban communities.

In the mid-seventies the previous approach of concentrating first on viable urban communities and then proceeding to the poorer sections was modified: governments, individually and collectively, declared their intent to reorient their plans, policies and programmes so as to serve directly the poorest sections of the community.

In 1972, the United Nations Conference on the Environment (Stockholm) gave international expression to governments' concern. This was reiterated in 1976 at the Conference on Human Settlements (Habitat) in Vancouver, Canada. At that Conference, the target of providing clean water to all people by 1990 and a major thrust to provide adequate sanitation were adopted; it was recommended that the target should be considered by the imminent United Nations Water Conference.

The Water Conference (Mar del Plata, Argentina, March 1977) adopted the targets and a Plan of Action, and declared the Third United Nations Development Decade (1981-1990) to be the International Drinking Water Supply and Sanitation Decade, during which these targets were to be achieved. The period up to the commencement of the Decade was considered a preparatory phase, during which governments were requested to assess their needs and resources and reorient their programmes, through appropriate strategies, towards achieving the goals of the Decade.

The Conference on Primary Health Care (Alma Ata, USSR, September 1978) stated in no uncertain terms that safe drinking-water and sanitation are basic elements of primary health care - which is the approach for all countries to reach the goal of health for all by the year 2000. This approach was approved by the United Nations General Assembly at its thirty-second session. WHO was designated as the executing agency.(19)

GLOBAL SITUATION

World Health Statistics Report, 1976(25) indicates that in 1975 approximately 1 100 million people, or 80 per cent of the rural population[1], did not have reasonable access to a safe water supply. Furthermore, 23 per cent of the urban population[1], frequently the poorest and most underprivileged sections of the community, were also without adequate water supplies.

Sanitation and waste disposal improvements have lagged behind even farther than water supply, particularly in rural areas where only one person in seven has adequate excreta disposal or household conveniences. In 1975 an estimated 150 million people (25 per cent) in urban areas were not served by any sanitary system whatsoever, while in rural areas 1 200 million (85 per cent) lacked sanitary facilities.(25)

Owing to the rapid and unplanned growth of cities in the developing world the situation will continue to deteriorate, and will become even more hazardous to health

[1] refers to the developing countries excluding China.

in peri-urban areas, unless attention is directed to them. To date, however, the major thrust of activities has not been in either rural or peri-urban areas.

During the five-year period 1971-1975, investments totalling some US $ 9 000 million were made for urban water supply, US $ 3 400 million for urban sewage disposal, US $ 2 250 million for rural water supply, and US $ 450 million for rural sanitation (1973 US $ equivalent). It is estimated that roughly 75 per cent of these investments came from internal resources.(19) But the result of these investments was an overall global increase during the period of only 9 per cent more people with access to adequate water supply, and 6 per cent more people with access to some form of excreta disposal.(25) In order to attain the United Nations Water Conference targets by the year 1990, it is estimated(19) that the current annual level of investment must be stepped up as shown below, assuming that the same level of services and methods of implementation are continued:

		Step-up of annual investment
Urban	Water supply	1.2 times
Urban	Sewage excreta disposal	2.1 times
Rural	Water supply	3.9 times
Rural	Excreta disposal	4.0 times

The above global averages do not reflect the considerable differences existing between regions and from country to country. Moreover, it must be emphasized that many urban water supply systems are overloaded to the extent that intermittent supply has to be resorted to, so as to ensure water to all areas: in 1970, as much as 54 per cent of the population served by public piped water received it only on an intermittent basis. A considerable quantity of water is also "unaccounted for" (undetected leakage, unauthorized use, unmetered supply, etc.); while no firm data are available, the approximate figure is put at between 20 per cent and 50 per cent of the treated water leaving the waterworks.(19)

STATUS OF SERVICES IN THE EASTERN MEDITERRANEAN REGION

The Region, consisting of twenty-three developing countries, has a population of more than 230 million (1975 figures) out of which some 160 million (i.e., seven out of every ten people) live in rural areas. By the end of 1980, the figure will have increased to 186 million, while the urban population will have built up to 80 million, the annual growth rate being between 1 per cent and 4 per cent. The shift from rural to urban living is another feature of all these countries.

The level of social development that has been reached differs from country to country and the range of their economic development is quite wide. Within the group lie some of the richest countries in the world, measured in terms of gross national product per capita; while alongside are some of the poorest countries, engaged in a continuing struggle for self-improvement.

As regards water supply and sanitation services in the Region's Member States, these range from 20 per cent to 100 per cent for urban water supplies, from 3 per cent to 90 per cent for rural water supplies, from 20 per cent to 100 per cent for urban sewerage, and from total sanitation provision to very low services indeed in rural areas. It may be of interest to note that the recorded infant mortality rate ranges from 160 per 1 000 live births to 22; the literacy figures vary from 12 per cent to 60 per cent; and the lowest life expectancy index is 42 years, and the highest 59. The quality of life index (QLI)[1], which is based on an assumed relationship between infant mortality, life expectancy, and literacy, ranges in countries of the Region from 11 to 85, on a total scale of 100.(21)

An overall picture, for each of the Region's Member States, with respect to their achievements, constraints and tasks required to be performed for achieving water supply and sanitation decade targets is presented in Table 7.(21) Taking the Region as a whole it can be stated that the proportion of rural population having adequate supplies has remained static at about 20 per cent since 1970, while the urban population has marginally increased from 77 per cent to 80 per cent in spite of the fact that urban population growth has been much higher (about 7 per cent compared to under 2 per cent in rural areas).

NEEDS FOR AND CONSTRAINTS ON SUCH SERVICES

It is quite clear that total investment in the water supply and sanitation sector will have to be stepped up significantly if the targets of the International Drinking Water Supply and Sanitation Decade are to be reached. It will require further mobilization of resources and involve major political decisions, reordering intersectoral

[1] The quality of life index (QLI) measures data for infant mortality (i), life expectancy (l), and literacy (Lt) on a scale of 1 to 100, within which countries are ranked according to their performance. For infant mortality, for example, the most favourable figure achieved (8 per 1 000 live births) is rated 100 and the poorest (163 per 1 000) is rated 1. The same procedure is used for life expectancy at birth (75 years = 100), versus 39 years = 1). Literacy figures range from 5 per cent = 1 to 100 per cent in various developed countries. By using the formula Index for Country (X) = i (x) + l(x) + Lt(x) ÷ 3, the QLI for each country can be calculated.

and sectoral priorities to give special emphasis to rural areas. It will also call for a concerted effort to surmount major constraints and ensure community participation.

According to the classification(21) based on income and water service levels of Member Countries[1], the range of the scale varies from 1A to 4C. Countries seem to be equally divided among the three classifications A, B and C. As regards GNP per capita, only five are capital-surplus (class 4); four have more than US $ 100 per capita (class 3); and the majority fall into classes 1 and 2.

The countries in classes 3 and 4 face the same problems with regard to their water supply and sanitation programmes as those belonging to classes 1 and 2 in terms of shortage of managerial and technical skills, need for institution-strengthening, and weak coordination among related institutions. Because they have adequate financial resources, however, these countries are able to import technology, technical skills, and sometimes even labour to realize their development programmes. This situation does not eliminate the constraints which other countries of the Region (classes 3 and 4) face, though it may alleviate the adverse effects on the implementation programmes.

The critical problems faced in particular by the remaining countries include:

(a) constraints at resource level, because of competition from other development sectors for the use of the limited available human, financial and material resources;

(b) lack of awareness among public opinion moulders of the needs and aspirations of the people, which would require higher priority to be given to the provision of basic sanitary services;

(c) lack of knowledge, understanding and motivation on the part of public administrators as to the importance of water supply and sanitation in a country's development;

(d) lack of knowledge as to the social and cultural aspects of sector development, particularly sanitation;

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[1] This classification is as follows:

1 = <300 $ per capita
2 = 300 - 1 000 $ per capita
3 =>1 000 $ per capita
4 = capital surplus country

A = <35 per cent service
B = 35 per cent to 70 per cent service
C = >70 per cent service

(e) fragmentation of responsibilities among many agencies, resulting in uncoordinated programme activities;

(f) absence of realistic financial policies, particularly for smaller communities and rural areas;

(g) lack of trained manpower;

(h) lack of appropriate technology and lack of use thereof.

The development of the water supply and sanitation sector is a capital-intensive and complex multidisciplinary exercise. As regards complexity, it is one of the most difficult of development activities in that it does not depend solely on the "hardware" aspect (finance, material and equipment) but also on cultural, institutional, socioeconomic, industrial and community attitudes.

Most of the constraints encountered are not confined to countries of the Eastern Mediterranean Region, but are common, though at different levels of importance, to all developing countries.

Some of the principal constraints in the development of this sector are presented below.

Resource level

Climatological. Since all the countries of the Region are situated in the subarid to arid climatological belt, water sources are scarce, development costs are high, and the results are not always reliable either as regards quantity or quality.

Manpower. The dearth of managerial, technical and semi-skilled personnel is a major constraint in all aspects of development, but the problem is more acute in the water supply and sanitation sector. This is because, by their nature, most water supply and sanitation projects are comparatively small projects from the investment point of view - and even junior technicians derive more professional satisfaction from working in large "prestige" projects, where the salaries and amenities offered are far better than in the water and sanitation sector. Hence, the drain of national managerial and technical staff to other development projects.

Logistic difficulties in obtaining a consistent supply of material and equipment further hamper programmes in this sector. Although the material and equipment needed for projects are not sophisticated, in most cases they have to be imported, as do also the spare parts. The prevailing economic situation in most countries

does not always allow for this to be programmed and the resultant delays can upset established projects. Moreover, even if the availability of the "hardware" is secured, difficulties in storing, transport, etc., can jeopardize the programming and planning.

Informational. As the data on which they must be based are either nonexistent or at best incomplete, the elaboration of the water supply and sanitation sector activities of national socioeconomic plans are far from being adequate.

Projections of expenditure for the different years of the development plan are either under- or over-estimated, so that the financial provision from the national budget tends to vary. Furthermore, the funds generated from existing water schemes generally fall short of the anticipated revenue, for various reasons. At the same time, the foreign exchange component of the sector's expenditure cannot be consistently covered either by the national budget or by the somewhat uncertain contributions of foreign assistance.

Technological Level

In most instances, in developing countries, various technologies are imported exclusively from the economically developed world. This is due to the fact that the responsible professionals are either trained in those developed countries or are oriented towards their standards, criteria and practices. Even the specialized workers that are imported have been conditioned to the environment in which they were trained and are inclined to apply the "stock-in-trade" models of that environment to the developing countries, instead of trying to find the most appropriate technology for water supply and sanitation schemes (they also would rather be associated with "prestige" technology projects). The absence and use of the appropriate technology makes water supply and sanitation schemes expensive to build and difficult to operate and maintain.

The following description of the situation in one of the developing countries could be applied to some of the countries in the Eastern Mediterranean Region:

> "To emulate the developed nations in providing potable water to rural communities, many nations have imported conventional water treatment (coagulation, sedimentation, rapid-sand filtration and chlorination) as a panacea for their rural health and water ills. For several reasons this has proved to be a disillusioning experience. Capital costs are high, and each plant must generally be tailored to a local set of conditions. This means that design and construction are time-consuming

and require well-trained personnel. In Thailand operational difficulties in rural communities were found to be more numerous; laboratory equipment was not available for daily or weekly jar tests to determine proper chemical doses; operators were not sufficiently trained to perform or understand coagulation jar test results; chemical costs were expensive in rural areas and operators often tried to cut back on chemical use to reduce water treatment costs; chemicals ran short and ordering in advance or obtaining additional chemical deliveries on time was not always a simple task in distant communities; without proper dosages the chemical coagulation-sedimentation portions of the plant operated ineffectively with the result that turbidity loads were almost entirely handled by the rapid-sand filters; understanding of why or when to backwash the rapid-sand filter was generally not known; proper sizing of sand was often overlooked during construction in some areas; good sand was difficult; and lack of sufficient operating funds often curtailed use of chemicals and limited plant operation to 4-6 hours per day of discontinuous production. These difficulties leave village leaders and villagers alike feeling cheated and deceived when what they received was seemingly an out-of-place and unworkable technology"(4)

Institutional Level

The proliferation of agencies and institutions often leads to duplication, overlapping, and inefficient functioning. This is particularly true in the water and sanitation sector. In cities, the water supply is often under a different management from waste collection and disposal. In rural areas, domestic water may be handled in a variety of ways - as a principal aim; as a subsidiary to irrigation; as a sector of the national water agency; or as a sector of the ministry of public health. The same is true of sanitation.

Community Level

Community participation and self-reliance are major problems in developing and operating water supply and sanitation schemes. Because of the different socio-economic conditions in different parts of a given country, it is not possible to adopt a tailor-made model for community participation in such schemes. A case-by-case, project-by-project approach to securing community involvement in terms of money and/or labour for implementation, maintenance and operation of the schemes needs to be studied and put into effect. Users must be consulted about design, and should be involved not only in maintenance but in promoting the use of the facilities.

Operation and Maintenance

Too often, even where technical design and capital investment costs are carefully taken into account, the estimates for operation and maintenance are either neglected or are imperfectly planned, and the consequence is neglect of the installations and the eventual decline or failure of the programme. It is therefore essential that the community should be involved in this task; that training of community personnel should be undertaken; but also that governments should share the cost of maintenance and operation of facilities.

Education of the Community

People do not always appreciate the benefits they can derive from water supply and sanitation, and this is an obstacle to their participation in the planning, operation and maintenance of facilities. Education, through schools, and through the mass media should be undertaken before the facilities are installed. Such education should also cover the appropriate use of the facilities, including personal hygiene practices.

Main Information Gaps

The areas where information is required for sector development in the countries of the Region are those relating to:

- water sources (reliable data, both qualitative and quantitative);
- appropriate technology, design, construction, operation and maintenance, criteria and standards;
- medium-term and short-term planning and programming policies and procedures;
- community participation, motivation and incentives;
- manpower requirements;
- manpower training;
- water quality monitoring and control;
- level of services and financial aspects,
- drinking water supplies and sanitation;
- inventory of existing schemes;
- organizational structures for sector.

V ACHIEVEMENT OF THE GOALS OF THE INTERNATIONAL DECADE

Priority Areas where Action is Required

In the general context as well as in relation to the International Drinking Water Supply and Sanitation Decade (1981-1990), action must focus on promoting:

(a) increased awareness of the problem;

(b) commitment of governments to providing all people with water of safe quality and adequate quantity as well as basic sanitary facilities, giving priority to the poor and less privileged and to areas where water is scarce; and

(c) a larger allocation to this sector from the total resources available for general economic and social development.

Action must be taken to remedy the constraints of manpower shortage (especially at intermediate and lower levels); inadequacies in institutions and agencies; and lack of the use thereof appropriate and cost-effective technology.

Communities must be effectively educated in domestic hygiene and must be motivated and involved as appropriate at every level of the programme, including the planning, construction, operation, maintenance and financing of services, and the monitoring and safeguarding of the quality of the water supplied.

Recommendations for Action

Countries should:

(a) develop national plans and programmes for community water supply and sanitation and set intermediate milestones for such development within the context of the socioeconomic development plans and objectives, giving priority attention to the segments of the population in greatest need;

(b) initiate engineering and feasibility studies on projects considered to be of the highest priority and based on a cost-effective technology appropriate to local conditions, providing for community participation, good management, and due attention to operation and maintenance;

(c) assess the manpower situation and on the basis of this analysis, establish or strengthen training programmes at national level, to meet immediate and future needs for additional professional staff, intermediate-level technicians, and village technicians;

(d) promote well-thought-out national campaigns to educate public opinion with regard to health benefits of basic sanitary services;

(e) coordinate the efforts of all sectors active in rural areas, utilizing the manpower and other resources available, to ensure the provision of technically and socially acceptable sanitary facilities in these areas;

(f) develop a national revolving fund for water supply and sanitation financed in the first instance from substantially increased loans and grants from national or foreign sources, which will encourage both the mobilization of resources for this sector and the equitable participation of beneficiaries;

(g) promote research by institutions and universities on problems of water supply and sanitation with a view to evolving economical and appropriate technologies.

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TABLE 1

BODY CONTENT, DAILY REQUIREMENTS AND DAILY INTAKES OF TRACE ELEMENTS IN ADULTS (APPROXIMATE VALUES IN mg)[a]

Element	Body content	Daily requirements	Dietary intake	% absorbed from diet
Si	18000	5	20	1
Fe	4200	10	13	7
F	2600	1	0.3	85
Zn	2300	3	13	40
Cu	75	2	5	35
V	25	0.003	2	5
I	20	0.2	0.2	100
Se	20	[illegible]	0.1	60
Sn	17	3	3	1
Mn	15	2.5	4	3
Ni	10	0.02	0.4	5
Mo	9	0.1	0.2	50
Cr	6	0.2	0.1	10
Co	1.5	0.00004	0.3	80
Ca	10 [illegible]	800	1000	30
Mg	19000	350	300	35

[a] Data taken from various sources.

TABLE 2

MAXIMUM CONTRIBUTION OF DRINKING WATER TO TOTAL DAILY INTAKE OF SOME ELEMENTS (APPROXIMATE VALUES)[a]

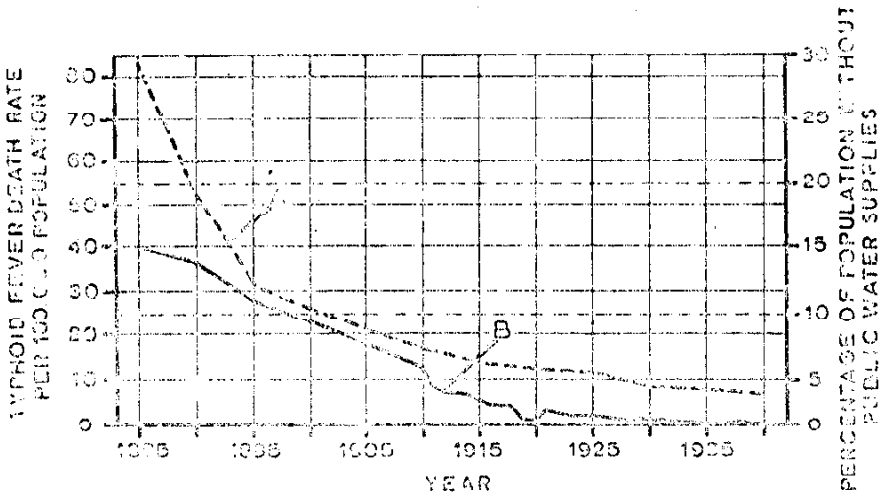
Element	Total daily intake (mg)	Maximum daily intake			
		from tap water (mg)	(%)[b]	from mineral water (mg)	(%)[b]
Li	0.1	0.02	20	7.5	>100
Mo	0.2	0.0004	0.2		
Se	0.2	0.005	2.5		
Sn	0.2	0.012	6		
Cr	0.2	0.01	5	0.06	30
I	0.2	0.005	2.5		
Ni	0.3	0.026	9	0.22	73
F	2.4	1.4	60		
V	2.0	0.012	0.6		
Cu	2.5	0.7	28	0.06	2.4
Mn	3.0	0.12	4	2.2	73
Zn	10	1.4	14	0.12	1.2
Fe	23	3.0	13	9	39
Mg	250	45	18	250	100
Ca	1000	280	28	900	90

[a] Based on SCHROEDER (see Table 3) and ZOETMAN, B. C. J. & BRINKMANN, F. J. J., Human intake of minerals from drinking water in the European communities, *In*: Hardness of drinking water and public health, *Proceedings of a Colloquium, Commission Eur. Communities*, Luxembourg, 1975, pp. 173-202. Blank spaces indicate that data are unavailable.

[b] As percentage of total daily intake.

FIGURE 1

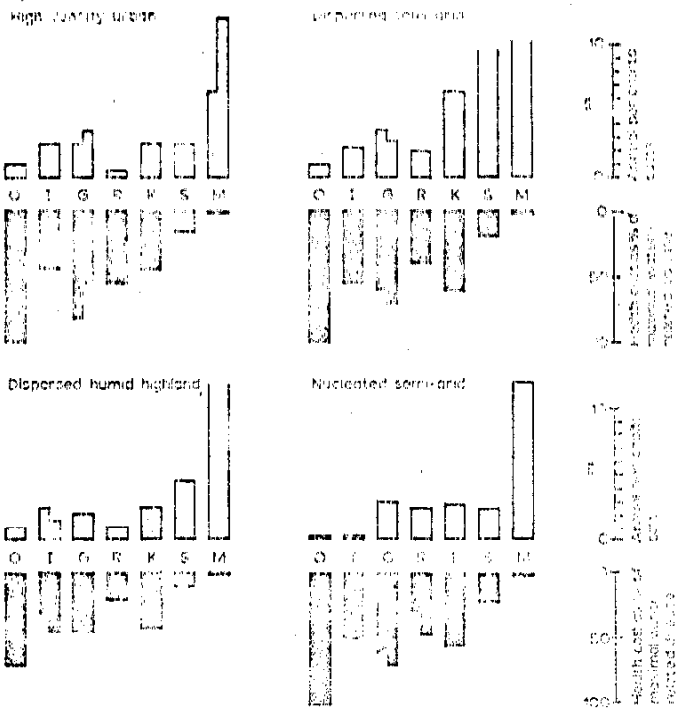
RELATION OF TYPHOID FEVER DEATH RATE TO PERCENTAGE OF POPULATION WITHOUT PUBLIC WATER SUPPLIES IN THE STATE OF MASSACHUSETTS, USA



A = POPULATION WITHOUT PUBLIC SUPPLIES
B = TYPHOID FEVER DEATH RATE

FIGURE 2

THE DIVERSITY OF DISEASE-COSTS AND THE VARIABLE BENEFITS RESULTING FROM DIFFERENT IMPROVEMENTS TO WATER SUPPLIES IN FOUR DIFFERENT HABITATS IN DEVELOPING COUNTRIES



Improvement categories: O, nil; I, individual; G, small group improvement; R, rural pipelines; K, kiosk or municipal standpipe; S, single tap in house; M, multiple taps in house.

FIGURE 3

REDUCTION IN THE DEATH-RATE
FROM TYPHOID BY SANITATION OF EXCRETA DISPOSAL

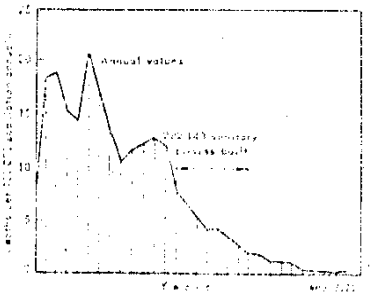
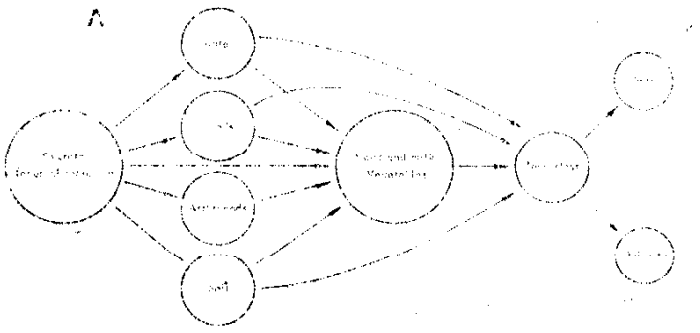


FIGURE 4

TRANSMISSION OF DISEASE FROM EXCRETA



STOPPING THE TRANSMISSION OF FAECAL-ORAL DISEASES
BY MEANS OF SANITATION

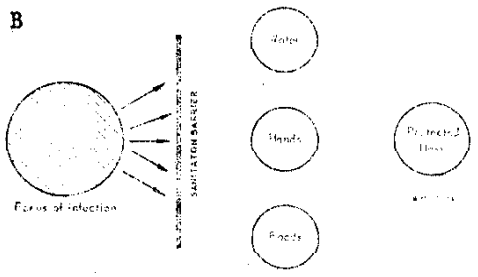


TABLE 3

CLASSIFICATION OF DISEASES RELATED TO WATER SUPPLIES AND SANITATION

Category	Examples	Cause	Relevant improvements
I Waterborne infections			
(a) classical (b) non-classical	Typhoid, cholera, infective hepatitis	Water which has been contaminated by poor sanitation acts as vehicle for infecting agent.	Ensure microbiological sterility Improve sanitation and water quality
II Infections from washing in polluted water			
(a) Diseases due to lack of water for washing	Scabies, trachoma, bacillary dysentery	Insufficient available water to allow people to wash regularly; infections develop.	Provide more water Improve personal cleanliness
(b) Diseases from washing in polluted water	Skin sepsis, cutaneous fungal infections		
III Water-based diseases			
(a) Penetrating skin (b) Ingested	Schistosomiasis Guinea worm	Essential part of life cycle of infecting agent takes place in aquatic animal; person drinks or walks in the water.	Avoid infested water Protect source
IV Infections carried by water-related insect vectors			
(a) Biting near water (b) Breeding in water	Sleeping sickness, malaria, yellow fever	Infection-carrying insects breed in water and bite near it, especially when water is stagnant	Water piped from source Water piped to site of use

TABLE 4

MAIN INFECTIVE DISEASES IN RELATION TO WATER SUPPLIES

Category	*Disease*	*Frequency*	*Severity*	*Chronicity*	*% reduction by water improvements*
Ia	Cholera	+	+ + +		90
Ia	Typhoid	+ +	+ + +		80
Ia	Leptospirosis	+	+ +		80
Ia	Tularaemia		+ +		40?
Ib	Paratyphoid	+	+ +		40
Ib	Infective hepatitis	+ +	+ + +	+	10?
Ib	Some enteroviruses	+	+		10?
Ia, IIb	Bacillary dysentery	+ +	+ + +		50
Ia, IIb	Amoebic dysentery	+	+ +	+ +	50
Ib, IIb	Gastroenteritis	+ + +	+ + +		50
IIa	Skin sepsis and ulcers	+ +	+	+	50
IIa	Trachoma	+ + +	+ +	+ +	60
IIa	Conjunctivitis	+ +	+	+	70
IIa	Scabies	+	+	+	80
IIa	Yaws	+	+ +	+	70
IIa	Leprosy	+ +	+ +	+ +	50
IIa	Tinea	+	+		50
IIa	Louseborne fever		+ + +		40
IIb	Diarrhoeal diseases	+ + +	+ + +		50
IIb	Ascariasis	+ +	+	+	40
IIIa	Schistosomiasis	+ +	+ +	+ +	60
IIIb	Guinea worm	+	+	+	100
IVa	Gambian sleeping sickness	+	+ + +	+	80
IVb	Onchocerciasis	+ +	+ +	+ +	20?
IVb	Yellow fever	+	+ + +		10?

TABLE 5

ESTIMATED COST OF TYPHOID FEVER AND OF DIARRHOEA AND ENTERITIS PER 100 000 POPULATION IN CERTAIN COUNTRIES FOR THE YEAR 1949

Country	Income per caput (US $)	Typhoid fever		Diarrhoea and enteritis		Total deaths	Total cases	Funeral expenses [c] (US $)	Medical care [c] (US $)	Value of lives lost [c] (US $)	Value of working time lost [c] (US $)	Total cost (US $)
		deaths [a]	cases	deaths [b]	cases							
USA	1 452	0.1	1	5.7	285	5.8	286	1 130	21 450	17 701	14 035	55 049
France	450	2.0	20	21.4	1 070	23.4	1 090	1 450	29 000	33 600	17 250	73 000
Portugal	140	8.6	86	195.2	9 760	203.8	9 846	3 930	72 330	66 840	43 950	191 330
Japan	98	1.3	13	83.0	4 400	89.3	4 413	1 200	22 500	18 300	15 250	57 750
Colombia	100	12.4	124	128.1	6 405	140.5	6 529	3 675	68 900	76 800	46 200	195 775
Ceylon	83	12.0	120	63.5	3 475	81.5	3 595	900	16 700	22 000	10 500	49 100
Dominican Republic	94	13.5	135	118.2	5 910	131.7	6 045	1 700	27 550	33 350	19 250	80 850
India [d]	31	23.6	234	60.8	3 290	124.4	3 524	825	9 610	40 700	6 800	58 259

[a] Typhoid fever mortality rate assumed to be 10%.

[b] Diarrhoea and enteritis mortality rate assumed to be 2%.

[c] Funeral expenses based on $200 in USA;[19] medical care costs based on $75 per case in USA;[19] value of lives lost (ages 0–42) from typhoid and paratyphoid fevers estimated at $15 500 and from diarrhoea and enteritis (ages 0–45) at $2650 for USA.[19] Working time lost per case assumed to be two weeks, with a value of $50 in USA. The estimated unit cost of funerals and medical care and the value of lives and working time lost for countries other than the USA were assumed to be in the same ratio to similar costs and values in the USA as the *per caput* income for those countries to that for the USA.

[d] Mortality rates for typhoid fever and for diarrhoea and enteritis are not available for India. The rates and values listed are those for cholera and for diarrhoea and dysentery.

TABLE 6

ESTIMATED PER CAPUT COST OF RURAL WATER SUPPLIES AND LATRINES AND COST OF TYPHOID FEVER AND OF DIARRHOEA AND ENTERITIS PER 100 000 POPULATION FOR CERTAIN COUNTRIES IN 1949

Country	Cost *per caput* of water supplies (US $) [a]		Cost *per caput* of latrines (US $) [a]		Total cost per 100 000 population (US $)	Cost of typhoid fever and of diarrhoea and enteritis per 100 000 population (US $)	Approximate number of years required for amortization of water supply and sanitation facilities from savings
	capital cost	maintenance	capital cost	maintenance			
USA	17.00	0.55	14.00	5.75	3 730 000	55 720	63
France	5.25	0.17	4.35	1.80	1 157 000	73 000	13
Portugal	1.65	0.05	1.35	0.55	360 000	191 230	2
Japan	1.15	0.04	0.95	0.40	254 000	57 750	5
Colombia	2.05	0.08	1.65	0.80	516 000	195 775	3
Ceylon	0.93	0.03	0.80	0.33	214 000	49 120	4
Dominican Republic	1.10	0.04	0.94	0.38	246 000	80 850	3
India [24]	0.53	0.02	0.52	0.21	138 000	58 259	3

[a] This includes the cost of labour, materials, and equipment. These costs could be reduced considerably by the use of voluntary labour and materials available locally to the householder.

TABLE 7

NATIONAL AND SECTOR DATA RELEVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

No.	Country	*National Data: Population m	Population u/r %	GNP $ Per cap.	**Social Indicators: Poorest in % of population	Quality of Life Index	Sector Data: Safe Water Urb Pop %	Safe Water Rur Pop %	Adequate Sanitation Urb Pop %	Adequate Sanitation Rur Pop %	Sector Organization	Strategy and Planning	Cost, Investment, Finance	Classification of Country	Remarks
1	Afghanistan	15.5	15:71 with 14.0 Nomads	190	63	i = 1 = 42 lt = 12	20* HC = 7 SP = 13	3*	low	very low	Three main govt.agencies responsible for sector; institutional reforms required; manpower shortage; expatriates; low community participation; manpower development required.	Planning cycle 79-84 with targets water u 50%, r 13%; sanitation neglected; no Decade plan, planning assistance, adapted technology and pre-investment studies needed	Sec low priority (especially in r) with 1.3% of tot inv; low int cash generation; shortage of funds for O & M in r; new tariff urgent; many ext fin ag.	1A	* Irterm (other than in Kabul) and insufficient quartities
2	Bahrain	0.34	78:22	3 790			100 HC = 100 SP = 0	100*	100	100	3 ag responsible for sec; a re-organization within General Authority for elect, water and sewerage planned; lack of trained manpower; expatriates; training prog required; legislation for water resources use and sewerage effluent necessary	National targets and Decade Plan being defined; 3 aquifers depleted and contaminated by saline intrusion reverting to costly desalinated water; water conservation priority; treatment and re-use of sewerage effluent recommended	O & M cost* twice revenue with poor collection; existing tariff not based on capital charges and not conducting to conservation, metering and new tariff recommended	4C	* Based on national report to WHO 1980
3	Cyprus	0.60		1 830	7	85	100 by HC	100 HC = 98 SP = 2			3 ag responsible for sec; good coor; design and construction of proj by international firms.	Main problem is development of additional water resources; mainly surface supplies; proper allocation of water resources between domestic and agricultural use necessary.	Govt finances up to 50% of proj costs; ext TA and CA required.	3C	
4	Democratic Yemen	1.9	33:57 10% Nomads	340		i = 40 40 l = 47 lt = 27	68 HC = 34 SP = 22	24*	Low	Very low	3 main institutions responsible for sec: PWC, Local Admin. Org & Local Cooperatives, need strengthening managerial staff shortage; poor O & M due to lack of funds; non-availability of suitable construction contractors & constraint.	Draft Plan 79 - 83 prepared with priority to sec; many proj in progress; no sec goals but Govt strategy is to achieve Decade targets; TA for hydrogeologic survey and proj prep needed.	Low internal cash generation; new tariff structure needed; many ext ag (mainly JN); increased CA required.	2A	*Irregular and of dubious quality and critical in desert areas.

* Population and GNP data are mostly for 1977 and urban/rural distribution data for 1975 (World Bank Report, 1979)

** Population subsisting below a line of minimum income necessary to buy basic requirements of food, clothing and shelter (OECD Observer; Overseas Development Council, Washington, 1978).

NATIONAL AND SECTOR DATA RELEVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

No.	Country	National Data: Population m	u/r %	GNP $ Per cap.	Social Indicators: Poorest in % of population	Quality of Life Index	Sector Data: Safe Water Urb Pop %	Safe Water Rur Pop %	Adequate Sanitation Urb Pop %	Adequate Sanitation Rur Pop %	Sector Organization	Strategy and Planning	Cost, Investment, Finance	Classification of Country	Remarks
5	Djibouti	0.30	91:9	580			53* HC = 40 SP = 13	20	43	20	LED responsible for water supply in u; Génie Rural for r; Ministry of Public Works responsible for san in u, local authorities in r; weak coor; manpower shortage; lack of spare parts are major constraints; intensive training prog urgent.	No planning mechanism, no Decade plan, proj executed according to availability of ext CA; planning assistance and pre-investment studies required.	Low int cash generation; proj implemented out of ext grants; need for continued CA for sec dev.		*Interm serv and dubious quality other than Djibouti town
6	Egypt	38.5	42:58	320		41 i = 101 l = 54 lt = 44	97* HC = 88 SP = 9	56	70**		Ministry of Housing and Reconstruction controls sec with GOPW in charge of r, CCWA in Cairo, AWA in Alex for water, local authorities for other centres; GOSSD responsible for san, SCA responsible for Canal Zone; inadequate institutions; skilled manpower shortage.	Plan cycle 76 - 80; no decade plan but Govt committed to achieve decade goals by increasing sec allocations; pre-inv studies and well-prepared projects required.	Sec 3.5% of tot inv; mainly from Govt contributions; low int cash generation; low absorptive capacity due to lengthy procedures; need for extensive CA, and new tariff.	2A	Excessive system leakage, interm serv. **With overloaded and poorly maintained sewerage systems.
7	Iran	34.8	45:55	160	5	37 i = 120 l = 52 lt = 50	86 HC = 68 SP = 18	33			Regional Water Boards for water in large u centres, municipalities, lt small centres Ministry of Energy responsible for san ir u; Ministry of Health responsible for water and san inv; staffing problems; manpower training prog required.	With Planning Cycle 78 - 83, Sec planning by Govt agencies; community involvement encouraged inv; Govt committed to achieve Decade goals for water no targets for san.	Sec. 3% of tot public inv cost of sec prog for present Plan $ 700 m of which $ 500 m for water as Govt grants to sec ag; low int cash generation.	3B	Sector ... mation as ... 1978

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8	Iraq	12.0	64:36	1 550	11	45 i = 104 l = 55 lt =	90*	14	Low**	Low	5 Ministries involved in sec; re-organization in one State Org completed; Baghdad has Water and Sewerage Boards; poor O & M; shortage of skilled manpower, training prog required; community participation in r to be strengthened.	Plan cycle 76 - 80; no sector targets but Govt committed to Decade goals; hydro-geologic survey and planning assistance needed.	Sec 2% of tot inv; of which 70% for water; low inv cash generation not covering O & M; under-expenditure of Govt allocations; estimated inv for Decade; water $ 1 510 m, san $ 2 750 m.	3B	*Interm serv other than Baghdad, excessive leakage. **Many sewerage schemes under construction.
9	Jordan	3.2	55:45	710	19	46 i = 22 l = 56 lt = 59	60* HC*** = 48 SP = 12	55	60 *** Unsatisfactory	Low	6 sec ag involved with weak coor but re-organization planned by merging into one (WSC) in 85; poor O & M, low community participation in r; inadequate manpower; training prog required.	Plan cycle 76 - 80; no targets for sec; dev plan especially for management of water resources and adapted techn in r needed; good prospects to achieve Decade goals if funds become available.	Sec 4% of tot inv; of which 3% for water supply; CA 40% of tot inv by many ag but with u bias; low int cash generation (hardly cover O & M); continued CA required.	2B	*Interm serv excessive leakage. **In Amman City. ***A health hazard due to discharge of untreated effluents but many projects are in progress or planned.
10	Kuwait	1.3	84:16	12 270	Less than 5	73 i = 44 l = 69 lt = 60	95* HC = 70 Vendors = 25		20**		Ministry of Elect and Water in charge of water supply; Ministry of Public Works for Sewerage; weak institutions and weak coor manpower shortage; expatriates.	Plan cycle 76 - 81; sec has priority; Decade targets will most probably be achieved; long-term planning for water resources and re-use of sewerage effluents for agriculture being prepared.	No financial constraints; high cost per capita due to desalination process; water tariff does not cover operating cost, no revenue from brackish water or sewerage.	4C	*Dual system, desalinated water for drinking and brackish for gardening and fire fighting. **Connected to public system; ongoing projects will allow 100% by 1990

NATIONAL AND SECTOR DATA RELEVANT TO [illegible] DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

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11	**Lebanon**	2.9	70:30			i = l = 65 lt =	Last events that affected Lebanon make it difficult to present accurate and up-to-date information regarding the water supply and sanitation at present.				Service des Eaux of the Ministry of Hydraulic and Electical Resources in charge of water supply.	Attention is now given to rehabilitation of systems, as many were seriously damaged during the conflict.			
12	**Libyan Arab Jamahiriya**	2.6	44:56	6 680	Less than 5	43 i = 42* l = 55 lt = 45	100**	100**	20		Ministry of Municipalities responsible for sec with 3 Directorate General; need for better coor; institutional reforms to avoid overlapping of activities	Plan cycle 75 - 80; unprecedented acceleration of sec during last plan; inf/data systems, Decide plan; proj identification and preparation needed.	Sec 5.3% of tot inv, p.c cost high for water supply proj ($ 700 - 1 000), double for sewerage; no fin constraints but limited absorptive capacity	4C	*Est. **Interm serv. and doubtful quality in some areas
13	**Oman**	1.7	22:78*	2 540	14		37**	65	60		***Ministry of Elect and water resonsible for drinking water supplies, Min of Land Affairs and Municipalities for r & u sew. schemes. Manpower shortage; expatriates, weak coor.	Plan cycle 76 - 80; no sec targets; national water supply plan being prepared by consultants; san not priority.	Sec 2.85% of tot inv; Govt only source of capital dev; high p.c. cost for water and san.	3A	*Est. **Excessive leakage, many proj under construction. ***Based on National Report sent to WHO.
14	**Pakistan**	74.9	28:72	190	34	28 i = 113 l = 51 lt = 21	68* HC = 40 SP = 28	17* HC = 3 SP = 14	42*	2*	Sec responsibility under under Min of Local Govt in bigger provinces & Min of Public Works for smaller provinces; poor O & M due to fin constraints; national expertise adequate except for large proj; community motivation and involvement in r need strengthening.	Plan cycle 77 - 83; current plan targets for water 84% u, 37% r, for san 61% u 10% r; san in r severe problem; low cost technology for u and r san required.	Proposed sec allocation 5.5% of tot inv; funding is major constraint; tariffs low; collection poor; CA about 50% of inv by many ag.	1A	*Average values conditions vary from province to province
15	**Qatar**	0.21		2 [illegible]			100*	83	100	100	Rapid Assessment Work was not carried out for Qatar				* 1975 figures
							HC = 99 SP = 1								

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NATIONAL AND SECTOR DATA RELIVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

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16	Saudi Arabia	7.6	59:41	6 040	10	29 i = l = 48 lt = 15*	100 HC = 69 SP = 31	84	99	100	Min. of Municipal & Rural Affairs responsible for water supply; shortage of professional and skilled personnel; expatriates; intensive training prog priority.	Plan cycle 75 - 80; very large-scale dev prog under way since 1970 with u bias and desalination plants; water resources and conservation major problem; need to establish water code; new technology for water purification required; well-defined national water policy needed.	Govt subsidizes water sales; no financial constraints.	4	*Est.
17	Somalia	3.6	27:73	110	75	19 i = l = 43 lt = 50	58 HC = 9 SP = 49	20	low	very low	WDA in charge of water supply other than hargeisa & Kisimayo; WRDC advisory body but not active; poor coor; shortage of skilled personnel; low community involvement in r.	Plan cycle 74-78; about 30% of national water supply prog 76 - 83 now completed; need for planning assistance, ground water survey and adapted technology especially in r.	Sec 3.6% of tot inv; low absorptive capacity; low internal cash generation; many ext ag; lack of well prepared proj; continued CA required.	1A	*A sewerage system for Mogadishu will be constructed
18	Sudan	16.9	20:80	290	43	18 i = 132 l = 46 lt = 20	49* HC = 37 SP = 12	45*	80**	very low	4 Min share responsibility for sec; weak coor; poor O & M; excessive leakage in distribution systems; institutional reforms required.	Plan cycle 78 - 83; no long term plan; no Decade plan; planning assistances, pre-inv studies and ground water survey needed.	Sec 8% of tot inv; low int cash generation; low absorptive capacity; many ext ag with 60% of tot inv; substantial CA necessary to achieve Decade goals.	1B	*In the Northern Region; situation lagging in Southern Region. **Of which 3% by waterborne sewerage, the balance by individual systems.

NATIONAL AND SECTOR DATA RELEVANT TO INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE, 1981 - 1990

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19	**Syrian Arab Republic**	7.8	47:53	910	10	64 i = 22 l = 57 lt = 53	90* HC = 75 SP = 15	55	70	10-15**	Many ag, weak coor; manpower constraints; training prog in progress; institutional strengthening required.	Plan cycle 76 - 80; sec is priority; national dev plan needed. Decade targets likely to be achieved if funds be made available; san lower priority and needs special attention in view of increasing pollution of water resources.	Sec 4.8% of the inv of which 60% for u water; low int cash generation; Central Govt principal source of dev funds; many ext ag; limited absorptive capacity; est for Decade $ 1 432 m of which $ 1 044 m for water.	2C	*Interm serv excessive leakage; **in large r communities; no data for small r villages.
20	**Tunisia**	5.9	48:52	860	10	35 i = 128 l = 57 lt = 38	96 HC = 67 SP = 29	29 HC = 4 SP = 25	64**	60	SONEDE responsible for water supply; ONAS for sewerage; better coor required study in progress; good performance of sec ag; adequate manpower.	Plan cycle 77 - 81; aims at total coverage of 74% water supply and san by 81; u bias; decade targets likely to be achieved; san lagging but now receiving attention; scarcity of water resources = a problem; long term planning and management of water resources priority.	Sec 6% of tot inv with $ 464m for water (75%) and $ 153m for sewerage; low int cash generation; new tariff introduced; many ag notably World Bank.	2B	*WB Country Economic Memorandum, November 1978 **Connected to public sewerage systems.
21	**United Arab Emirates**	0.8	86:14*	14 420		34 i = l = lt =	88**	50	24***		Many ag; divided responsibility and weak coor; inadequate staff; expatriates; weak institutions; Org for water use and control under consideration.	Sec priority construction aspect has been greatly accelerated, no long-term planning but Min of Planning established; master plan for water resources under prep; pre-inv studies required.	No fin constraints; budgetary allocations on annual basis and earmarking on ad hoc basis high p.c. cost; Govt provides all dev funds; revenue from water cover 1/10 - 1/3 cost of O & M; no charges for sewerage; new tariff structure needed.	4C	*Est. r includes nomads. **Interm serv uncertain quality, excessive leakage ***Connected to sewerage Systems.
22	**Yemen Arab Republic**	5.0	8:92	430		11 i = 160 l = 47 lt = 13	30* HC = 15 SP = 15	2	Low*	Very Low	Min of Public Works responsible for sec; NWSA responsible for water and san in u; severe shortage of skilled staff; TA personnel needed.	Plan cycle 76 - 81; sec priority but with many constraints: fin, manpower low motivation of communities for san in r, poor accessibility of many localities; hydrogeologic survey and planning assistance needed.	Sec 10% of dev prog budget; many ext ag with 70% of tot inv; est inv for current plan $ 119 m; low absorptive capacity.	2A	*Expected to rise to 50% in 198 after completion of Saraa proj

i	infant mortality (age 0-1) per 1 000
l	average life expectancy at birth (years)
lt	adult literacy rate in % (15 years and over)
ag	agency
av	average
CA	capital assistance
com	committee
coor	coordination
dev	development
est	estimate
exist	existing
ext	external
fin	finance
HC	house connections
inc	including
int	internal
interm	intermittent
intl	international
inv	investment
loc	local
m	million
Min	Ministry
O & M	Operation and maintenance
org	organization
p.c.	per capita
p.y.	per year
pol	policy
pop	population
prep	preparation
prog	programme
proj	project
r	rural
reg	regional
rev	revision
SP	standposts
san	sanitation
serv	service
TA	technical assistance
tot	total
u	urban