1 Introduction

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Water is essential to man, animals and plants. Without water life on earth would not exist. From the very beginning of human civilization, families have settled close to water sources, along rivers, beside lakes or near natural springs. Indeed where people live, some water is normally available for drinking, domestic use, and possibly for watering animals. This does not imply that the source is convenient and of sufficient capacity nor that the water is safe and wholesome. On the contrary, in many countries people live in areas where water is scarce. Often women and children carry it over long distances, particularly during dry periods. Scarcity of water may also lead people to use sources that are contaminated by human or animal faeces, and are thus dangerous to human health.

1.1. Water supply, health and socio-economic development

A few litres of water each day are sufficient for a person's basic drinking and food preparation require-ments, depending on climate and lifestyle. Larger quantities are necessary when water is used for personal hygiene, cleansing of cooking utensils, laundry and house cleaning and for meeting basic economic needs within the household, such as the raising of animals and the production of vegetables. Safe, adequate and accessible supplies of water, combined with proper sanitation, are surely basic needs and essential components of primary health care. They can greatly help improve the health of underprivileged populations in rural and urban fringe areas. They are also a source of, and condition for, socio-economic development.

Improved hygiene and health

A sufficient amount of safe drinking water is important in the control of many diseases. The World Health Organization (WHO) has estimated that as many as 80 percent of all infectious diseases in the world are associated with insufficient and unsafe water. This is particularly well established for diseases such as diarrhoeas, cholera, typhoid and paratyphoid fever, infectious hepatitis, amoebic and bacillary dysentery. Table 1.1 gives an overview, along with preventive measures. Which diseases are most prevalent and serious in a particular area depends on local factors such as climate, density of settlement, local practices and socio-economic and gender relations. The type of intervention must therefore also be locally specific and be chosen together with the local users, women and men.

Table 1.1 Transmission patterns and preventive measures for water and sanitation-related diseases

Infection	Transmission pattern	Personal hygiene	Domestic hygiene (and animal manage-ment)	Food hygiene	Water hygiene / safe water consump-tion	Safe human water consump-tion	Waste-water disposal and drainage
Various types of diarrhoeas, dysenteries, typhoid and paratyphoid	From human faeces to mouth (faecal-oral) via multiple routes of faecally contaminated water, fingers and hands, food, soil and surfaces (see Figure 1). Animal faeces (e.g. from pigs and chickens) may also contain diarrhoeal disease organisms.	●	●	●	●	●	
Roundworm (Ascariasis), Whipworm (Trichuriasis)	From faeces to mouth: Worm eggs in human faeces have to reach soil to develop into an infective stage before being ingested through raw food, dirty hands and playing with things that have been in contact with infected soil. Soil on feet and shoes can transport eggs long distances. Animals eating human faeces pass on the eggs in their own faeces.	●	●	●		●	
Hookworm	From faeces to skin (especially feet): Worm eggs in the faeces have to reach moist soil, where they hatch into larvae which enter the skin of people's feet.		●			●	
Beef and pork tapeworms	From faeces to animals to humans: Worm eggs in human faeces are ingested by a cow or pig where they develop into infective cysts in the animal's muscles. Transmission occurs when a person eats raw or insufficiently cooked meat.			●		●	
Schistoso-miasis (bilharzia)	From faeces or urine to skin: Worm eggs in human faeces or urine have to reach water where they hatch and enter snails. In the snails they develop and are passed on as free swimming *cercariae* that penetrate the skin when people come into contact with infested waters. In the Asian version of the infection, animal faeces also contain eggs.	●	●			●	
Guinea worm	From skin to mouth: The worm discharges larvae from a wound in a person's leg while in water. These larvae are swallowed by tiny water fleas (cyclops), and people are infected when they drink this contaminated water.				●		
Scabies, ringworm, yaws	From skin to skin: Both through direct skin contact and through sharing of clothes, bedclothes and towels.	●	●				
Trachoma, conjunctivitis	From eyes to eyes: Both direct contact with the discharge from an infected eye and through contact with articles soiled by a discharge, such as towels, bedding, clothing, wash basins, washing water. Flies may also act as transmission agents.	●	●				

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Infection	Transmission pattern	Personal hygiene	Domestic hygiene (and animal manage-ment)	Food hygiene	Water hygiene / safe water consump-tion	Safe human water consump-tion	Waste-water disposal and drainage
Louse-borne typhus, Louse-borne relapsing fever	From person to person: Through bites of body lice which travel from person to person through direct contact and through sharing clothes and bedclothes, particularly when underwear is not regularly washed.	●	●				
Malaria, yellow fever, dengue	From person to person through the bite of an infected mosquito. The mosquitoes breed in standing water.		●			●	
Bancroftian Flariasis	From person to person through numerous bites by infected mosquitoes. The mosquitoes breed in dirty water.	●		●			●

Source: Boot, M. and Cairncross, S. (eds.), 1993

Diseases caused by a lack of water are a serious health hazard. When women, men and children use very little water, either because there is little available or because it is too far away to be carried home in quantity, it becomes impossible to maintain a reasonable personal hygiene. There may simply be too little water for washing oneself properly and cleaning food, utensils and clothes. Easy access to a sufficient amount of water, reliably delivered to every household, is essential for the prevention of diarrhoeas, dysenteries, typhoid, schistosomiasis and skin and eye diseases.

Diarrhoeas in particular remain a killer disease, especially for babies and children below the age of five. Research has shown that in diarrhoea prevention more water used for hygiene and better sanitation is more important than better water quality. It has shown too that for a positive impact, at least three quarters of the families must use, and be able to continue to use, sufficient amounts of water for hygiene. They must also use hygienic methods of excreta disposal (Esrey, 1994).

These conditions have important implications for the design and planning of water improvements. Projects that aim to improve health must not only improve water services, but also sanitation and hygiene behaviour. For sanitation, it is often necessary first to raise the demand for improvements. For hygiene, information alone is insufficient. Improved hygiene behaviour comes not from just telling women and men, girls and boys how diseases are transmitted or what to do and not to do. High quality hygiene promotion programmes are needed which use participatory learning and action methods or effectively market a small number of locally desired improvements.

To improve health, improved water services need a critical mass of users. Year-round use by almost all people only happens when the users both want to use and sustain

a service effectively, and are able to do so. The implication is that the outsiders involved in a water project or programme - politicians, planners, engineers, sociologists, economists, educators - cannot impose a service. They must create a service for widespread and sustained use that meets the perceived needs of the users. This can only be done in partnership with those who will use and sustain it: the community women and men and their organisations.

Water quality, quantity and drainage

Water that is contaminated by people or animals will transmit diseases that are water borne, such as bacillary dysentery, cholera, or typhoid, or those that are water based, that is need snails or cyclops that live in the water to pass the disease on. Examples of water-based diseases are guinea worm and schistosomiasis. Control of these diseases means improving the quality of the drinking water and discouraging people from wading into the source, e.g. to bathe, collect drinking water or wash clothes. Many diarrhoeal diseases are caused more by a lack of an adequate quantity of water than by its quality.

During warm weather, biting insects are common. Most of these, notably mosquitoes, breed in pools or other open water, and sometimes even in household water containers. Tsetse flies are also active near water. An improved water service may actually increase health risks from insect breeding. The risks arise when the *water in = water out* principle is neglected (i.e. no provision is made for safe drainage of wastewater) or when the design allows breeding in the system itself. Pools of stagnant wastewater from lack of good drainage at distribution outlets are unfortunately still very common. They, and/or the stagnant water in other parts of the system have brought new or extra transmission risks of malaria, filariasis, dengue and yellow fever.

Socio-economic development

As well as better public health, improved water services are also a source of, and condition for, socio-economic development. Development comes both from the services themselves and from the processes of their planning, establishment and management. The water supply itself reduces the drudgery of women and children if it brings water closer to or into their homes, in acceptable amounts and of the desired quality, throughout the year.

Reducing time and energy for water collection may bring more equity between the sexes. In many tropical countries women work longer hours than men due to, among other things, the long distances for collecting water and fuel wood. The carrying sometimes takes as much energy as the heaviest agricultural tasks done by men, with the difference that water carrying is a daily chore. The reduced working hours and increased rest brought by an improved water supply benefit women's health and thereby the well-being of the whole family. Local access also increases the safety of

women and children who no longer need to leave their communities for their daily water requirements.

Alternatively, women have chosen to use time and energy savings of an improved water supply for their domestic, economic, social and managerial tasks. Time saved is used for household and child care, including the collection of more water for hygiene. Or it is used to free children from water carrying and give them more time for school and/or play. Unfortunately, these benefits often still go only to boy children.

Women also use time and water gains to increase their domestic productivity. They utilise them, for example, for animal raising and vegetable gardening. Cases of successful productive use, e.g. in micro-enterprises, are found in situations where time gains have been large and reliable and women have access to organisation, training, credit and markets. Men have also used water supplies productively, for example, for animal raising and brick making. Economic studies have shown that the income raised is an important contribution to family livelihood and comes at critical times when income from other sources is not available.

Less time and energy for water collection has also benefited women's many social tasks in the extended family and as neighbours, and their work in community development, including work for the local water service. There are, however, also examples of negative impacts. A new water service has, for example, reduced the opportunities for young women and girls to move outside their house. Or it has increased women's work in agriculture or animal husbandry, but this work has not benefited them and their children, as husbands spend the proceeds on other than family interests. There have also been examples of competition and conflicts over water between different user groups, when the design and management has overlooked the different demands for domestic and productive use of water between and within households.

Development benefits also come from the process of participatory planning, implementation and management. Involving women and men community members from the different sections of the community in the planning and establishment of the new service means that local resources are recognised and utilised. At the same time, the involved groups acquire new knowledge and capabilities. The water services also create new functions, jobs and, sometimes, whole enterprises. Positive experience and new skills in transparent and socially equitable community organisation, decision-making, financing and management benefit not only the water service but also other community development projects. More details on planning, implementation and management processes and their social equity aspects may be found in the next chapter.

1.2 Small community water supplies in developing countries

Communities in developing countries that want to establish and run an improved domestic water supply vary greatly. Some are small and rather isolated. They may have a scattered population, a subsistence rather than a cash economy, a limited demand for water, strong leadership but with limited administrative skills, a strong social cohesion and a long tradition of self-help and mutual support.

Others are bustling trading centres. They are situated on major roads and railways, have a cash economy, administratively experienced leaders, considerable differences between the rich and the poor, a great variation in water demands and little time and readiness for voluntary community development activities.

Some are on the outskirts of major cities or are low-income communities in inner cities. The legal status and social, cultural and economic characteristics of these more urban communities usually varies greatly. Some are former rural communities that have been engulfed by the urbanisation process, with a legal status, a high social cohesion, and a varying quality of initiative and leadership. Others are the result of urban migration and unauthorised settlement. They have been formed through an organised invasion of rural families from the same rural area under local leaders. Or they have resulted from a gradual process of settlement either by male household heads and single men who left their families in the rural areas or by whole families from the same villages or from quite different rural areas.

In the past, projects and programmes have often overlooked the different nature and history of small communities. They have applied a so-called blanket approach, using the same technology and service level, and the same maintenance, management and financing systems in every community. Implementation followed the same national design criteria and the same technical and social processes everywhere, irrespective of local social and economic conditions. It is hardly surprising that the resulting services were often unsustainable.

Nowadays, water projects and programmes increasingly recognise that different types of communities want and can sustain different solutions, not only for technologies and service levels, but also with regard to local maintenance, management and financing arrangements. The technology options may range from the improvement of the existing indigenous water sources and water transport systems to the installation of new water supplies with public facilities, group facilities and/or private facilities. Other options are a combination of traditional and improved systems for complementary use or a sequence of different systems during the rainy and wet season. One example of a climbing frame of water technology options is given in figure 1.1.

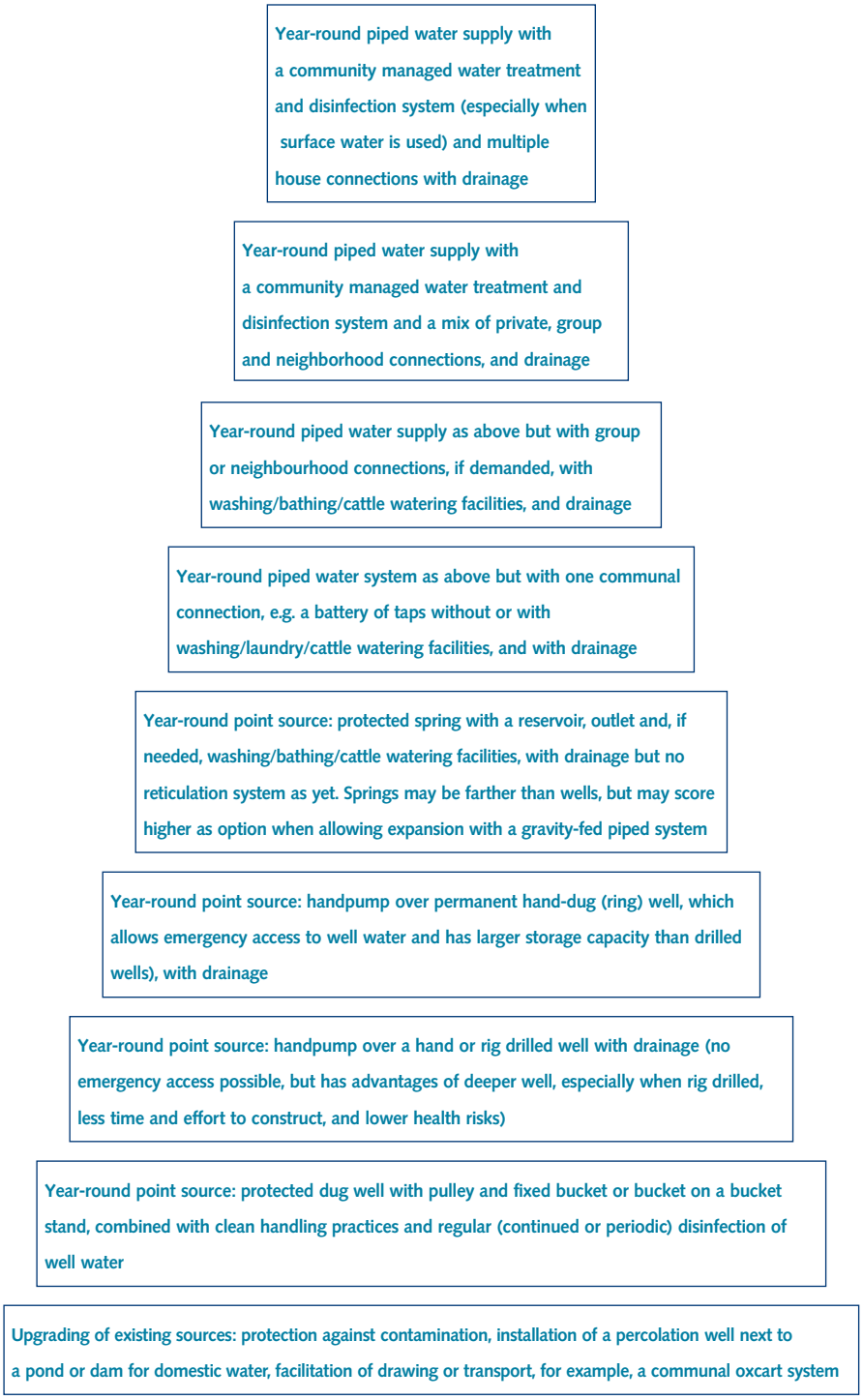

Fig. 1.1. A climbing frame of choices for improved community water supplies

Apart from helping communities to match their choice to their current needs and potentials, it is also possible to choose designs that allow moving up or down the climbing frame. A piped water supply, for example, may be designed in such a way that later, when the community has become more developed, it may be expanded with a distribution network. Alternatively, a user group may decide on dug wells rather than drilled wells with handpumps, because this makes it possible to open the well or use the manhole when for one reason or another a handpump cannot be repaired. In such a case, the users should be made well aware of the risks of contamination and be ready and able to protect the water quality through a safe alternative way of drawing (e.g. with clean buckets and ropes) and well chlorination. Where user groups decide to go for wells that are only operable/operated through handpumps, they need to take account of the scope for speedy repair and temporary sharing arrangements in the case of breakdown.

In the past, external projects have one-sidedly decided not to give such options to the users and sustainers of water supplies, because of the risk of contamination. This has only meant that when handpumps on drilled wells broke down and could not be repaired either immediately or at all, the wells became useless. The women had either to use another well with problems of distance, queuing, conflict and a lower water use, or turn to other, and riskier water sources.

Considering the pros and cons and the implications of each option and comparing them with the demands of the different user groups and the available resources is therefore a crucial part of decision-making. The processes for such planning and decision-making are discussed in chapter 2, along with some of the emerging options for maintenance, management, and financing of water services.

Bibliography

Ahmed, M. Feroze and Mujibur Rahman, M. (2000). *Water supply and sanitation: rural and low income urban communities.* Dhaka, Bangladesh, ITN Centre for Water Supply and Waste Management.

Boot, Marieke and Cairncross, Sandy (eds.) (1993). *Actions speak: the study of hygiene behaviour in water and sanitation projects.* The Hague, The Netherlands, IRC International Water and Sanitation Centre and London, UK, London School of Hygiene and Tropical Medicine.

Davis, Jennifer ; Kang, Alic ; Vincent, Jeffrey and Whittington, Dale (1999). *The value of improved water supply to microenterprises in sub-Saharan Africa: the case of Wobulenzi and Lugazi, Uganda.* (Consulting Assistance on Economic Reform II discussion paper; no. 49). Cambridge, MA, USA, Harvard Institute for International Development. Also available from http//: www.hiid.harvard.edu/caer2/htm/content/papers/paper49/paper49.htm (1 December 2001).

Esrey, Steven A. (1994). *Complementary strategies for decreasing diarrhea morbidity and mortality: water and sanitation.* Paper presented at the Pan American Health Organization March 2-3: Celebrating 25 years of ORT. Ste Anne de Bellevue, Canada, McGill University.

Cairncross, Sandy and Feachem, Richard G. (1993). *Environmental health engineering in the tropics: an introductory text.* 2nd ed. London, UK, John Wiley.

Fernando, Vijita (1996). *Water supply.* (Series Energy and environment technology source books). London, UK, ITDG Publishing.

IRC ; SEWA and Foundation for Public Interest (2001). *Transforming water into money: an assesment of gender specific impacts from improved water supply in Banaskantha District, Gujarat, India: final research report.* Delft, The Netherlands, IRC International Water and Sanitation Centre. An article summarising the study is available in: Scott, Rebecca (ed.) (2002). People and systems for water, sanitation and health: proceedings of the 27th WEDC Conference, Lusaka, Zambia, 2001. P. 452-455. Available from: http://www.lboro.ac.uk/departments/cv/wedc/conferences/27contents.htm

Rosen, Sydney and Vincent, Jeffrey R. (1999). *Household water resources and rural productivity in sub-Saharan Africa: a review of the evidence.* (Development discussion paper; no. 673). Cambridge, MA, USA, Harvard University, Harvard Institute for International Development. Also available from: http://www.hiid.harvard.edu/pub/pdfs/673.pdf (1 December 2001).

Wijk, Christine van and Murre, Tineke (1995). *Motivating better hygiene behaviour: importance for public health mechanisms for change.* New York, NY, USA, UNICEF. Copies also available from IRC.