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PMO

PROJECT FOR THE DEVELOPMENT OF A COMMUNITY PARTICIPATION COMPONENT IN THE TANZANIAN RURAL WATER SUPPLY PROGRAMME

Impact of Water Supply on Hygiene Improvements in Rural Tanzania: A study in 8 villages in Morogoro and Shinyanga Regions

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Yaliyopita si ndwele, tugange yaliyomo na yajayo

(That which has passed away is not sickness, let us cure that which is here and that which is yet to come; Swahili saying)

PREFACE

One of the objectives of rural water supply projects is to stimulate rural development by improving environmental conditions and reducing the high incidence of water and sanitation related disease. For this purpose, many modern water supplies are now being built. In the past, such projects were already considered successful when a large number of people were served with a system that brought more water to them than their traditional sources, in the wet and the dry season, and often at a closer distance.

Nowadays it is recognized that to improve rural health, all people must use these improved systems throughout the year (at least for drinking and food preparation), take care of the facilities and contribute in some way to the establishment and functioning of the service. This in turn presupposes that the supply answers the various needs of the people; only then will they use it and feel responsible for it. Many water supply programmes in rural areas therefore now have accompanying community participation and health education programmes.

The present study is part of a project that reviews the need for and possible content of such a socio-educational support programme. It is carried out by the Research and Planning Division of the Community Development Department in the Prime Minister's Office (PMO), Tanzania, in cooperation with the International Reference Centre for Community Water Supply and Sanitation (IRC), a WHO collaborating Centre in The Hague, the Netherlands. It is supported by the Directorate General for Development Cooperation (DGIS) of the Ministry of Foreign Affairs of the Netherlands in the context of a bilateral water supply project (Ref. 1, 4).

In the first phase of this project, the forms and methods of community participation in the existing rural water supply were analysed resulting in several models for further field-testing. These were presented at a national workshop on community participation in water projects organized by the Institute for Resource Assessment of the University of Dar es Salaam in cooperation with IRC (Ref. 2, 3).

The second phase of the project was developed under the aegis of PMO; this department is in charge of regional development including decentralization of water supply services. PMO has recently re-established its Department for Community Development, with emphasis on the use of people's participation to enhance rural development.

PMO carried out a detailed evaluation in 60 selected villages (20 already served, 20 to be served and 20 not to be served with an improved rural water supply system) in Morogoro and Shinyanga Regions, and tested the achievements possible with enhanced village involvement in water and water-related development.

As part of these activities, a separate study was carried out on water-related health behaviour and conditions in a sample of 8 villages in 3 districts. Household surveys, observations and group discussions near improved and traditional sources were used to collect quantitative and qualitative information.

The main purpose of this study was to investigate whether a positive impact of water projects on village health was likely under the existing technical, social and educational procedures. If this was found not to be the case, the study should suggest how the procedures and organizational structures should be adapted to promote such impacts, and review implications for the various departments concerned.

Issues that are presented and discussed in this report include the patterns of use of improved water sources and reasons for non-use, technical (non-functioning) as well as social; boiling practices as an other mean of getting safe drinking water; risks of contamination of safe drinking water during collection, storage and especially drawing of water; increased use of water for hygiene in villages with an improved supply; and remaining risks of transmission of water-related diseases, in particular through risky waste disposal conditions and behaviour, food hygiene and washing and bathing practices. An attempt at measuring the direct impacts of an improved water supply on village health was made by using two disease recall questions.

During the follow-up, the preliminary results of the health survey were reported to the villages concerned and local participatory programmes were set up to promote better functioning, use and hygiene. The initial effects of these programmes have been evaluated in depth in 2 of the villages. The methods and results of this evaluation will be summarized in the final report.

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I INTRODUCTION

1. Relationship between Water and Village Health

The construction of improved domestic water supplies can contribute significantly to rural development by, among other things, reducing the incidence of water- and hygiene-related diseases. Conditions for an optimal effect are that the supplies function well, giving enough and safe water for all households; that all or almost all households always use this water, at least for drinking purposes; that this water is collected, stored and drawn in a safe way; that more water than before is used for personal and household hygiene; and that other routes along which these water-related diseases are also transmitted (especially unsafe waste disposal) are blocked at the same time.

2. Measurement of Health Impact of an Improved Water Supply

It is not easy to determine if an improved water supply project has actually had a beneficial effect on village health. Theoretically, a lower incidence of water-related diseases should be reflected by the village health statistics. A review of such statistics for one ward in the project area showed however a number of practical limitations:

- Not all diseases are reported at the dispensaries. Underreporting is especially likely for diseases that do not (on the face of it) interfere much or a long time with daily life, e.g. mild diarrhoeas, children's eye infections, schistosomiasis and worm infectations.
- Diagnosis of a water-related disease is not always possible (e.g. stomach aches) or reliable (e.g. malaria). Often only symptoms are written down which point at several different diseases, both water-related and others.
- Clinics and dispensaries serve more than one village. Not all of these necessarily have an improved water supply. To distinguish between cases from villages with or without an improved water supply, the village of origin of each patient must be noted.This is not always done, so that one then has to rely on information by the health assistant as to what village the patients come from.
- The improved water supply can have no effect when it is out of order for prolonged periods or when it is not generally and continiously used. Records of periods in which the water supply did not function are therefore essential, but are not always kept (especially not with handpumps). Recall of breakdown periods by villagers is far less reliable. For non-use, a survey is needed, to identify households that go on using traditional sources and if necessary (in case of many households) relate this information to the clinic records.
- Secondary factors, such as irregular supply of medicines and records books and replacement of clinic staff, can greatly influence the statistics.

The last three reasons in particular, impeded the use of Feachem's guidelines for determining public health impacts of improved water supplies on the basis of clinic statistics[1)].

1) Feachem, Richard, Public Health Studies in Phase II of the Slow Sand Filtration Project, SSF Occasional Paper No. 16, Rijswijk, WHO International Reference Centre for Community Water Supply and Sanitation, 1981.

AS AN ALTERNATIVE ONE CAN THEREFORE INVESTIGATE HYGIENE CONDITIONS AND BEHAVIOUR IN THE VILLAGES CONCERNED THIS ASSUMES THAT BETTER ENVIRONMENTAL HYGIENE CONDITIONS + BEHAVIOUR WILL LEAD TO A LOWER INCIDENCE OF WATER RELATED DISEASES

An an alternative one can therefore investigate hygiene conditions and behaviour in the villages concerned. The underlying assumption hereby is that villages with better environmental health conditions and behaviour will also have a lower incidence of water- and sanitation-related diseases.

3. Study on Environmental Hygiene Conditions and Behaviour

The above mentioned alternative[1)] was chosen for the present study on rural water supply and village development in two regions of Tanzania. The study was carried out by the Division of Research and Planning of the Department of te Community Development in the Office of the Prime Minister, in cooperation with the International Reference Centre for Community Water Supply and Sanitation (IRC) in The Hague, The Netherlands. The activity was part of the PMO/IRC Project for the Development of a Community Participation Component in the Tanzanian Rural Water Supply Programme, and was carried out in the context of the Dutch bilateral support programme to rural domestic water supplies[2)].

Purpose of the study was (a) to investigate the likelihood that rural domestic water supply projects as presently implemented will lead to an improvement of village health; (b) to establish a baseline for the evaluation of the impact of the community participation component on hygiene conditions and behaviour; (c) to collect detailed information about environmental conditions and behaviour as an additional input into the participation programme in the villages concerned and d) to determine if a behavioural study is a suitable tool in the evaluation of the impact of a water supply project on village health.

The study consisted mainly of interviews and observations on household conditions and behaviour, but two additional questions were asked on recalled incidence of water-related diseases for each household member. Besides, some general village observations were carried out.

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1) Other alternatives (stoolsamples, disease surveys) were rejected because of manpower, organizational and budget restrictions.

2) For a full account of this project, a list of project documents is attached as Annex 1.

II METHODOLOGY

1. Survey Sample

The village sample for the PMO/IRC Project for the Development of a Community Participation Component in the Tanzanian Rural Water Supply Programme consisted of 60 villages in Morogoro and Shinyanga Region: 20 already served, 20 to be served and 20 not to be served with an improved water supply. As far as possible, these villages were selected in different socio-ecological zones of the Regions, although not all zones are represented (see Preliminary Report, Map 1 and 2).

For the environmental health study, one village was selected from each category (served, to be served, not to be served) of the main village sample. The selected villages were as much as possible matched for population size. Data on other characteristic (economic base, infrastructure, religion, ethnic groups, village income and health education activities) were collected in each village to identify any basic socio-economic differences between the villages compared. In total, 9 villages were selected in 3 districts (Table 1).
In these villages, household observations and interviewed were carried out on environmental conditions, behaviour and health in a 10% sample of randomly selected village households.

The choice to carry out in a rather extensive survey in a relatively small number of project villages was made for the following reasons:

a) Little research has as yet been done on the utilization patterns of improved water supplies and on related environmental conditions that may block the positive influence that such an improved supply can have. The present study should give more insight into the most crucial points of risk in the areas studied;

b) With the great increase of rural water supply projects in the country, there is an urgent need for easily measurable yet valid indicators of an appropriate utilization of the improved water supply and of other human behaviour affecting the transmission of water-related diseases. This would greatly facilitate periodic evaluations by the project organizations, and other agencies (included village governments) interested in water development and village health;

c) As part of the greater community participation project, a prolonged stay in each study village was necessary, to allow for the organization of a village meeting to report the survey findings and discuss any follow-up action by the village water sub-committee;

d) The Community Development Workers were unable to combine household surveys in some of their project villages with the general community participation activities.Also the training period was too short to include the survey training as well. The detailed household survey was therefore fitted into the supervision schedule of the Tanzanian project manager, an experienced sociologist[1].

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1) An additional advantage was that all respondents (adult female household members) could be interviewed by a woman. This facilitated in particular the interviewing on latrine use practices.

2. Readjustment to Design and Implementation

Three of the villages selected on the basis of regional data as "not served" (Mhenda, Minepa and Mwaweja) were in fact found to be served, while one "served" village (Mzelezi) was in reality not served. Also, the only village where the survey was carried out by one of the CD workers (Jomu) had to be dropped from the sample, because a quarter of the questionnaires got lost during transfer from the region and a first analysis of the remaining ones showed some problems of reliability.

The sample therefore ultimately consists of 4 villages with an improved water supply in addition to the already existing traditional ones (Mhenda, Madoto, Minepa and Mwaweja) and 4 villages with only traditional sources (Kihelezo, Kilosa kwa Mpepo, Mzelezi and Seseko) (Table 1).

Mhenda and Mwaweja are still "to be served" because the number of handpumpwells in these village is not yet up to design standard. All interviews and observations were carried out during the dry season of 1982/1983.

Region	District	Villages to be served	Villages served	Villages not to be served
Morogoro	Kilosa	Mhenda	Madoto	Kihelezo
	Mahenge	Kilosa kwa Mpepo	Minepa	Mzelezi
Shinyanga	Shinyanga	Mwaweja	(Jomu)	Seseko

Table 1: Location and type of villages for detailed study on environmental hygiene. The villages underlined are partly or fully served by an improved water supply.

III VILLAGE CHARACTERISTICS

1. Population Features

As shown in Table 2, the villages with and without an improved water supply in each district are fairly similar in their population characteristics. Remarkable is only the high average household size (over 10 members per households) and the relatively high number

District	Kilosa			Mahenge			Shinyanga	
Village	Mbenda	Madoto	Kihelezo	Kilosa kwa Mpepo	Minepa	Mzelezi	Seseko	Mwaweja
Population								
No. households	450	523	380	210	250	230	260	250
No. adults	881	2530	819	614	} 986	608	} 1949	
No. children	1369	2820	500	?		686		
Religion								
Muslim	-	-	-	-	x	-	-	-
Muslim+Christian	x	x	x	x	-	x	-	-
Traditional+Christian	-	-	-	-	-	-	x	x
Ethnic Group								
Homogeneous	-	-	-	x	-	x	x	x
Mixed	x	x	x	-	x	-	-	-
Agriculture								
Maize	x	x	x	x	x	x	x	x
Millet	x	-	-	-	x	x	x	x
Cassava	x	x	x	x	x	x	x	x
Rice	x	x	x	x	x	x	x	x
Cotton	x	x	-	x		x	x	x
Vegetables	x	x	x	x	x	x	-	-
Fruit	x	x	x	x	x	x	-	-
Fish	-	-	-	x	-	-	-	-
Livestock	-	-	-	-	-	-	x	x
Infrastructure								
Primary School	x	x	x	x	x	x	x	x[1)]
Dispensary (near)	x	x	-?	x	x	x	x	-
Godown	-	-	x	x	-	x	x	x
Dry Season Road	x	x[2)]	x	x	x	x	x	x
Bus Service	-	x	-	-	-	-	-	-
Village Shop(s)	x	x	x	x	x	x	-	x
Private Shop(s)	x	x	-	-	-	-	-	x
Coop. Farm	x	x	x	?	x	x	?	?
Improved Water Supply	x	x	-	-	x	-	-	x
Flour Mill	x	-		x	-	-	-	-
Market	x	x	-	-	-	-	-	-
Restaurant/Beershop	x	x	-	-	-	-	-	-

1) The village has a Village Health Worker
2) Also a railraod station at 4 km.

Table 2: Main characteristics of Study Villages

of adults per household (almost 5) in the population figures reported by the village authorities of Madoto.

This may point at a great number of three-generation households, polygamous households and/or households with many children ranging from babies to young adults. However, the data on household size and composition of the 10% random sample give only a partly confirmation: there are relatively few children under 15 in these households (35.9%), but the average household size of the sample was only 4.4. It can therefore either be concluded that the population figures are incorrect or that smaller households (starting and/or terminating ones) are over-represented in the sample. The latter may influence survey results, e.g. in a relatively lower water use per head. For the other villages, household sizes in the sample were more in accordance with those reported for the whole village: differences in average household size of sample and total population varied from 0.8 to 1.9 members.

Other differences between villages with and without water supply also exist (e.g. in religion, ethic groups and infrastructure in Kilosa District) but they are unlikely to have a great influence on results, as the general socio-cultural setting is fairly homogeneous.

2. Economic Base and Village Infrastructure

In all villages, agriculture is the main source of income, with both cash crops (cotton or rice) and subsistence crops (maize, millet, cassava, fruit and vegetables). In Madoto village, due to a shortage of land there is however hardly any cash crop production, except for the village cotton farm. However, there is some seasonal labour at the nearby sugar estates. In Kihelezo and Mhenda casual work is done at the government sisal estates and cotton farm respectively. As to industrial production, only Mhenda has a few brown sugar jaggeries.

In the three Mahenge villages, both subsistence and cash crop farming takes place. Fish (which is carried by foot to be sold in Songea, at a distance of 120 km) is an additional source of income in Kilosa kwa Mpepo.

In Shinyanga District, subsistence crops include maize, millet, cassava, sweet potatoes and rice. Cotton is cultivated as cash crop. Besides cattle, goats and sheep are widely kept and are used for food as well as cash.

Differences in infrastructure are also small. Only Kihelezo is slightly more isolated and has fewer institutions in comparison with Madoto and Mhenda. This is probably due to its more recent settlement by people from the neighbouring villages and does not point at less contact with the outside world. It does however suggest a relatively lower economic status, as people with good farms are less likely to move. This is confirmed by sample data on sources of household income and presence of status symbols in the next section. In Seseko, the absence of a shop is noticeable.

3. Economic Status of Sample Households

To compare the economic status in the sample villages, two questions were asked on sources of household income (Table 3) and number and type of status symbols (Table 4). Although source of income is not a very valid indicator of income level (adaption of cash crops does not necessarily mean higher income), the significantly positive relationship ($P<0,001$) with number of status symbols make its use as an indicator more acceptable.

Table 3 shows that within Kilosa District, Mhenda, a partially served village, is the richer village of the three, and Kihelezo, which is not to be served, is the poorest, while Madoto, a fully served village takes a middle position.

In Mahenge district, sources of household income in Minepa (fully served) and Kilosa kwa Mpepo (to be served) are very similar, while conditions in Mzelezi (not to be served) are slightly worse.

In Shinyanga district, the sample in the village that is not to be served (Seseko) has a relatively higher economic status than the village that has already been served (Mwaweja). However, this is not reflected by the number of status symbols owned by the sample households (Table 4). In the other villages the number of status symbols owned are a confirmation of the differences found in sources of income.

Source of income	Morogoro Region						Shinyanga Region	
	Kilosa District			Mahenge District			Shinyanga District	
	Mhenda (n=45)	Madoto (n=48)	Kihelezo (n=38)	Kilosa kwa Mpepo (n=18)	Minepa (n=25)	Mzelezi (n=23)	Seseko (n=25)	Mwaweja (n=25)
Subsistance farming only	8.9	62.5	84.2	-	-	13.0	12.0	12.0
Subsistance farming + additional income	75.6	20.8	-	94.4	92.0	78.3	32.0	48.0
Cash crop farming, full-time business	-	2.1	-	-	-	8.7	52.0	28.0
No answer	15.6	14.6	15.8	5.6	8.0	-	4.0	12.0
Total %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 3: Source of income of sample households in 8 selected villages in Mororgoro and Shinyanga Region.

These village data as summarized in Tables 2, 3 and 4 create the impression that villages that have not yet been served are either poorer villages situated in areas with difficult geo-hydrological conditions, or villages with a medium to relatively high economic status and more favourable conditions. Those already served would then be in areas which have a more difficult geo-hydrological condition,

which however still allows the construction of improved supplies. This would be in accordance with the allocation criteria under the domestic water master plan in which villages with a high need are given priority and villages with a relatively low priority for an improved supply are served later on.

Villages that demand costly or different technical solutions risk to remain forever unserved, however (compare also section 4 below, especially on Kihelezo and Seseko). This hypothesis deserves further investigation on the regional programme.

Type of status symbols owned	Morogoro Region						Shinyanga Region	
	Kilosa District			Mabenge District			Shinyanga District	
	Mhenda (n=45)	Madoto (n=48)	Kihelezo ((n=38)	Kilosa kwa Mpepo (n=18)	Minepa (n=25)	Mzelezi (n=23)	Seseko (n=25)	Mwaweja (n=25)
None	15.6	33.3	47.4	29.4	32.0	40.9	64.0	24.0
Radio	71.1	58.3	42.1	58.8	40.0	54.5	8.0	40.0
Bicycle	51.1	54.2	36.8	64.7	60.0	18.1	36.0	60.0
Iron Roof	28.8	18.8	7.9	41.2	12.0	22.7	4.0	4.0
Total % of Ownership[1)]	151.0	131.3	86.8	164.7	112.0	95.3	48.0	104.0

1) Total percentage over 100 as one household can own more than one status symbol.

Table 4: Percentage of households owning different types of status symbols in 8 selected villages in Morogoro and Shinyanga Region.

The economic differences between the village samples suggest, too, that they will also differ in level of environmental hygiene such as a number and quality of latrines and bathing facilities. This is further discussed in chapter VII, section 3.

4. Domestic Water Sources

Mhenda, Madoto, Minepa and Mwaweja all have improved water sources next to the already existing traditional supplies. Mhenda has 5 handpump wells built in early 1981, as well as a seasonal river and numerous traditional wells (unprotected, hand-dug). Of the handpump wells, 2 are not used at all, because of large distance and bad water colour.
Madoto has 7 handpump wells and one public tap of the adjacent sisal estates, plus several traditional wells, rivers and streams. Minepa has its own piped supply with 7 public taps all sited along the main village street. In addition there are numerous traditional dug wells.
Mwaweja has two handpump wells made in early 1976 which fall dry at the peak of the summer season. The village also has a seasonal river and many traditional wells. Some of these do not dry up. In the dry season, women and cattle owners also dig temporary wells in the river bed.

All unserved villages have one or more sources of water supply. Of the three villages that are not yet to be served, two villages (Kihelezo and Seseko) have serious water problems. Kihelezo has a nearby stream and several traditional wells. The village suffers from a shortage of water in the dry season and a problem of flooding in the rainy season. Some of the wells are protected against flooding by barriers made from earth and rocks. This was done on the initiative of a villager who works at the sisal estates where he learned about well protection. At other wells drainage channels have been dug. Earlier attempts to find reliable groundwater sites for the installation of handpump wells have failed in this village[1].

Seseko has many traditional wells and small ponds in the wet season used for both domestic purposes and cattle watering. In the dry season, people must rely on the water reservoir for the water supply of Shinyanga town, at a distance of 7 km. As the women have to carry all water home, they sometimes take their washing there. Bathing also takes place at the source for the same reason. These practices are however forbidden by the town authorities, and cause occasional frictions. Some households use oxen to collect drinking and washing water but the charges asked for services to those who do not own carts make it impossible for the poorer households to make use of this alternative.

The third village, Mzelezi, is situated on a permanent river. In 1976 they got a borehole with dieselpump (though not requested as they are satisfied with the river). The generator was removed three months later, for reasons not known to the villagers[2].

The village that is about to be served, Kilosa kwa Mpepo, has five traditional wells and one protected ringwell built by the Catholic Mission. There are also three rivers and a natural dam. The latter is not used for water collection as the local traditional doctors use it as a dumping place for their medicine. There is an occasional shortage of water in the dry season, necessitating the deepening of the dry wells. Many of the villagers live on their land in the nearby hills during the agricultural season, a factor that will have to be taken into account during well-surveying and siting.

5. Health Education

All villages have some kind of facility nearby. In six villages there are clinics or dispensaries. Kilosa kwa Mpepo has its own dispensary and Mother and Child Health Service (MCH) with 2 Rural Medical Aides, 2 Assistant Nurses and one cleaner. Mhenda also has a dispensary and MCH service which serves 3 villages.

1) The villages did however not know why the survey team pulled out and attributed this to the fact that at the time of the survey the settlement had not yet been officially registered as an ujamaa village.
2) From the District Water Engineer it was later learned that the capacity of the pump was too low for an adequate supply.

Madoto, Mzelezi and Seseko have a rural health centre at walking distance (up to 5 km). Minepa is rather far from any service (the Ifakara Hospital is at 15 km), but it gets a mobile clinic service about once a month.

Health education at the clinics consists of lectures in the morning on different preventive health topics including the transmission of water and sanitation related diseases, construction of latrines, boiling of drinking water and keeping a clean environment. In the afternoon, the health assistants are to pay home visits, but this was only done by the MCH service in Mhenda.

Village Health Workers have been present in 3 villages (Mzelezi, Seseko and Mwaweja) but they left for town in the first two villages, while the VHW in Mwaweja only does curative work.

Besides the regular health education, special cholera prevention campaigns have been carried out in Kihelezo in 1978 and Madoto in 1981. In Minepa, a campaign was going on at the time of the survey organized by the Village Chairman who is a retired Public Health Officer.

Because of the high proportion of radios in 7 of the 8 village samples (Table 4) radio health education may also play a role, depending on listening habits and local availability of batteries.
It was however not investigated if this potential input was reaching the villages concerned.

In none of the study villages had any cooperation or coordination of the existing health education with the water projects taken place.

Photo 1.
Posters on the wall of a local hotel are unlikely to lead by themselves to changes in water collection patterns of women and girls.

IV USE OF SAFE WATER FOR DRINKING

1. Changing to Improved Sources for Collection of Drinking Water

When all or almost all households in the villages with an improved supply use only these sources to collect water for drinking and food preparation in all seasons, the incidence of water-borne diseases would be reduced (see Table 5).

	Disease	Transmission Mechanism
(a)	Faecal-oral diseases cholera dysentery gasto-enteritis typhoid fevers	1. water-borne: transmission by drinking contaminated water 2. water-washed: transmission through lack of cleaning of hands, latrines, eating and cooking utensils, lack of fly-protection etc.
(b)	Intestinal worms (helminths) roundworm (ascaris) whipworm pinworm	
(c)	Skin and eye infections trachoma conjunctivittis scabies skin ulcers	water-washed: transmission reduction (and treatment) by frequent washing/bathing of skin/eyes and hands, for scabies also (hot) washing of clothes and bed clothes
(d)	Louse-borne fevers louse-borne typhus louse-borne relapsing fever	water-washed: transmission reduction though through frequent bathing, washing of clothes and bed clothes.
(e)	Aquatic host infections bilharzia (schistosomiasis) guinea worm	water-based: transmission by bathing, wading or standing in infected water and (for guinea worm) drinking infected water.
(f)	Insect-related diseases yellow fever malaria filariasis river blindness	water-related insect vectors: transmission by mosquitoes or flies breeding in or near water

Table 5: Water-related diseases and their transmission mechanisms[1].

1) Based on: S. Cairncross, et.al, Evaluation for Village Water Supply Planning, Technical Paper no. 15, WHO International Reference Centre for Community Water Supply, The Hague, The Netherlands, February 1980, p. 81-82.

The results of the present study show that a 100% change to the use of safe water sources in all seasons for at least drinking purposes occurred only in one of the 4 villages with an improved water supply (Madoto village, Table 6). This was the case even though one of the 7 handpumps was out of order at the time of the survey[1].

Type of water source and purposes of use	DRY SEASON				WET SEASON			
	Mhenda (n=45)	Madoto (n=48)	Minepa (n=25)	Mwaweja (n=25)	Mhenda (n=45)	Madoto (n=48)	Minepa (n=25)	Mwaweja (n=24)
Improved, all domestic use	20.0	87.5	72.0	16.0	13.3	89.4	68.0	48.0
Improved, drinking and bathing only	-	6.3	-	-	-	4.2	-	-
Improved drinking only	2.2	6.3	-	-	2.2	6.3	-	-
Traditional, all domestic use	77.8	-	28.0	84.0	84.4	-	32.0	52.0
Total %	100.0	100.1	100.0	100.0	100.0	99.9	100.0	100.0

Table 6: Percentages of households collecting water from improved or traditional sources for drinking and other domestic purposes in 4 villages with improved water supplies.

In the three other villages, traditional sources were still widely used for the collection of drinking water. In Minepa village, the piped supply had been out of order for 3 months at the time of the study, so all households were using traditional wells for all purposes, but when asked what sources they used when the taps were working, one third said that they still used the traditional wells for all domestic use, including drinking water.

Mhenda has three handpump wells, but one is not used at all because of the bad colour of the water. One well is rarely used (it is 3 km from the village). The third well is used for all purposes but only by a small group of households. In Mwaweja, too, the majority still uses traditional wells.

In total only 76 out of a possible 143 sample households (or 53.1%) had switched to the exclusive use of improved water sources for at least their drinking water.

1) Additional informal discussion with village key-persons and women at improved and traditional sources revealed that in one village section, where for technical reasons no handpump well could be made, some households still used traditional sources for drinking. The switch to safe sources is therefore not exactly 100% but is in any case close to 100%.

2. Seasonal and Non-Exclusive Use of Improved Source for Drinking Water

A second category is the group of seasonal users. It consisted of another 11 households or 7.7% who used an improved source only during the dry season, when their own wells fall dry (Mhenda), or in the wet season, when there is enough water in the handpump wells (Mwaweja). During the other time of the year they use their traditional sources.
A third category identified in the study are the households, that use an improved source in both seasons, but at the same time also go on using a traditional source to collect water for drinking and other purposes (3, or 2.1%).
A reduction of water-borne diseases is only likely in the first category of households who changed completely and continuously to the use of improved sources for drinking water[1].

3. Reasons for Selection of Improved Sources

As shown in Table 7 below, the majority of the households switched to an improved water source because of the close distance in comparison with their traditional sources. This tencendy was the same in all 4 villages with improved water sources. The slightly lower user percentages and lower inportance of distance in the dry season is explained by the drying up of some handpumpwells in Mwaweja village.

A good taste of the water is a second reason for choosing an improved source. However, this was the only or main reason given by only about 15% of those preferring an improved source. For the others, a good taste was a supplementary criterion to low distance. Explicit health reasons were given by only a small minority.

Reason(s) for	Improved Water Source		Traditional Water Source	
Source Selection	Dry Season (n=80)	Wet Season (n=88)	Dry Season (n=63	Wet Season (n=55)
Distance	58.8	60.2	38.1	70.9
Taste	31.3	28.4	3.2	5.5
Privacy	2.5	3.4	58.7	36.4
Abundancy	2.5	2.3	1.6	18.2
Health	7.5	6.8	-	-
Other	1.3	1.1	1.6	3.6
No answer	17.5	15.9	1.6	1.8
Total % [1]	121.4	118.1	104.8	136.4

1) Over 100% as more than one reason could be given per household.

Table 7: Reported reasons for choosing improved or traditional sources for drinking water by 143 households in 4 selected villages in Morogoro and Shinyanga Region.

The main reported reasons for the continued preference for traditional sources in villages with an improved supply are "distance" and especially "privacy" (Table 7). The latter does not refer to any privately-owned sources (except for one case) but to the use of a traditional source by only a limited number of households[2].

1) Although it is possible that already the drinking of safe water only at the onset of the rainy season, when incidences of diarrhoea are highest, makes a difference.
2) Literal translation of Kiswahili text is "few other users".

From the present study it is not clear if this criterion means that the users stay with their traditional sources because of short waiting times, or because sharing a source (nearly all dug wells) with a small group of familiar households is sometimes also seen as a lower health risk[1]. In future studies, a more thorough discussion of reason for accepting one type of source and rejecting the other is therefore adviseable.

The reasons for the small categories of seasonal users were mostly distance: 9 out of 11 people chose the nearest source in the wet and dry season, while 2 people only used the nearby river when the handpump well started giving less water.

4. Source Selection in Villages without Improved Sources

The main reason for selecting a particular type of traditional source in the villages without improved sources were distance only, or a combination of distance and privacy.

In Kihelezo, the nearest source (seasonal river or well) was chosen in the wet season for all domestic purposes, including drinking and cooking.
In the dry season, there is a shortage of water. All households then used the nearest dug well with few users to collect water for all purposes.

In Kilosa kwa Mpepo, the majority of the household used the traditional wells only for drinking and cooking water, and the rivers for washing and bathing. A small category, living near a well uses it to collect all household water.

The permanent river in Mzelezi is used for all purposes in the dry and the wet season for reasons of privacy. Informal discussions with women at the source about quality of river water and water use habits revealed that people had a basic but incomplete understanding of the health risks of river water: drinking water was considered healthy when collected in the early morning, when nobody was yet bathing or watering his cattle in the river. That river water may be polluted by other ways (drainage of wastes into river) or place (villages upstreams) had however not been realized.

In Seseko, traditional wells are used during the wet season for reasons of distance. In the dry season when the wells dry up, all water is collected from the water reservoir of Shinyanga town. Here too, the relative privacy of the household's collection site is the only selection reason given by all sample households.

5. Reported Boiling of Drinking Water

The use of water from unprotected sources for drinking would not matter if this water was always boiled. This is not universally done,

1) This explanation was suggested by informal discussions on the rejection of taps for the more private wells in Minepa: several households thought their well water cleaner than the tap water as the latter comes straight from a river which is used by many people for washing and bathing.

however. Almost half of the households who were using only traditional sources for drinking water (84 out of 173 households, or 48,6%) said that they did not boil this water.

This fairly high reported percentage of non-boiling is quite remarkable, as boiling of drinking water is one of the preventive health measures that are generally promoted in Tanzania, during radio health education campaigns, health education lectures at clinics and dispensaries and anti-cholera campaigns in areas where cases of cholera have occured. People are therefore more likely to give an ideal answer than a true one to a question on boiling practices[1]. The percentage of non-boiling may in reality therefore still be higher.

The main reasons given for non-boiling of drinking water were no time (48.3%), lack of knowledge ("no need to boil, no reason known why water should be boiled", 21.3%) and no custom (19.1%). Other, less important reasons given were lack of firewood (9%) and a flat taste of boiled water (2.2%) (The problem of fuel shortage is taken into account in the promotion of boiling habits by stressing the possibility of using the fire that remains after food preparation to boil drinking water. But since all firewood has to be collected by the women, it is likely that they are already very frugal in its use, and that there is little fire left after cooking the food).

In Mahenge district, a great variation in reported boiling practices was found (Table 8). This difference was highly significant (P 0,001), but the small sample size made it impossible to determine whether these differences are due to practical constraints (time, firewood), attitudes (boiling customs, taste) or lack of knowledge.

Reported water Treatment	Morogoro Region					Shinyanga Region	
	Kilosa District		Mahenge District			Shinyanga District	
	Mhenda (n=35)	Kihelezo (n=38)	Kilosa kwa Mpepo (n=18)	Minepa (n=25)	Mzelezi (n=22)	Seseko (n=24)	Mwaweja (n=12)
Boiled	71.4	75.7	72.2	32.0	4.5	25.0	25.0
Not Boiled	28.6	24.3	27.8	68.0	95.5	75.0	75.0
Total %	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 8: Percentages of households reporting the use of boiled and unboiled drinking water from unprotected sources in 7 selected villages in Morogoro and Shinyanga Region[2].

Remarkable are also the boiling practices and reasons for boiling reported by the 58 households who switched to an improved source for drinking water[3]. Of these households, 22, or 37.9% still said to boil

1) During the interviews, the researcher therefore probed further at a first affirmative answer, asking if drinking water was also boiled in situations of stress, such as peak labour times.
2) In Madoto, all households reported use of safe sources only for the collection of drinking water.
3) Households in Minepa were not included as the piped supply was out of order at the time and villagers were using traditional sources only.

their drinking water and 36 or 61.1% did not do so. The majority of the latter, 23 households (or 63.8%) said they did not boil their water because there was no need for it: the water came from a safe source. The other 13 households gave as reasons however a lack of time or firewood, no custom, bad taste and no knowledge.

Finally, special attention was paid to an environmental health risk not often considere in water use studies: that of serious burns to small children. The present study shows that there is a need to integrate this aspect into any discussions on boiling of unsafe drinking water and village self-improvements: of the 157 households with one or more children under five, 80 or 51.5% were observed to have risky cooking places.

Photo 2.
Unprotected cooking places demand a continuous guard against burns by small children, but in practice this is not always possible. Health education on water boiling should therefore also include discussion on ways in which fire places could be made less risky to children (clayovens, raised stoves, protecting fence etc.).

V WATER CONTAMINATION RISKS FROM HUMAN BEHAVIOUR

1. Pollution at the Source

When safe sources are always used by all or almost all households, at least for the collection of their (unboiled) drinking water, one condition for the reduction of water-related diseases has been fulfilled.

However, the safe water does not always remain safe. A first risk is the contamination of the source itself. With handpump wells, the water may be polluted through seepage and nearby latrines. In the study, conditions around the pumps were observed to be good in 2 of the three villages concerned. In Mwaweja village, a pump caretaker was present who kept the drainage channels open. Also, a soakaway had been made at the end of the gutters.
In Madoto village, sites were well kept by the users but several latrines were observed to be sited near wells. Subsequent water quality tests by the wells project were E-coli positive. This shows not only the importance of proper well siting, but also of communication on this issue with village households living near each well as well as village governments, to avoid that at a later stage any new pit latrines are also sited too close to a well.
In Mhenda village, drainage channels were blocked.

With a piped supply there is less risk of water contamination at the collection point, unless the water in the pipe is not under pressure for 24 hours a day and the water table is high in combination with unhygienic conditions.

However, there is a considerable pollution risk at the intake[1)], e.g. due to cultivation and seasonal settlement by farmers in the catchment area and ongoing bathing, clothes washing and cattle watering. In the present study, such risks existed in Minepa village, but for reliable data water quality tests are necessary.

2. Contamination Risks during Collection

Water collected from a safe source may still be contaminated because of unhygienic conditions or behaviour during collection, storage and drawing.
In the present study, systematic observations on collection hygiene at selected water sources could not be carried out as planned due to a shortage of manpower.
However, in open questions the women interviewed were asked to name all occasions when hands were washed and to describe how this was done. Questions were also asked on type of collection vessels and purposes for which they were used.

Almost all households (89.0%) reported the use of a special vessel (mostly buckets) for water collection. In the other cases the vessel was also used for bathing, clothes washing or cooking. Washing of hands when rinsing the collection vessel is also a common practice: it was reported without stimulus by 79.6% of all sample households. However, inter-village differences were great, especially in Kilosa District[2)] (Table 9).

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1) Assuming no further treatment takes place to make the water safe.
2) Significant at $P<0,005$.

Households using an improved source in Kilosa and Mahenge District mentioned slightly less rinsing and handwashing in describing water collection practices than households using a traditional source (72.9% versus 83.3%). However, this tendency was opposite in Shinyanga District (92.3% versus 47.2%). The conclusion from a study in Mbeya Region "villagers with maji safi tend to ignore health precautions followed by villagers drawing from traditional sources as indicated by rinsing practises" therefore does not apply to every village, at least if practices are truly reported[1].

It was investigated if the lack of (reported) handwashing could be one of the contamination risks for households who were collecting safe water.
Of the 89 households who only used improved sources to collect drinking water, 15 did not report any handwashing at collection. Of these, 3 households said they boiled their drinking water afterwards.

Reported Handwashing at Water Collection	Morogoro Region						Shinyanga Region	
	Kilosa District			Mahenge District			Shinyanga District	
	Mhenda (n=45)	Madoto (n=48)	Kibelezo (n=38)	Kilosa kwa Mpepo (n=18)	Minepa (n=25)	Mzelezi (n=22)	Seseko (n=24)	Mwaweja (n=25)
Washed	68.9	85.4	97.4	77.8	60.0	63.6	79.2	96.0
Not Washed	31.1	14.6	2.6	22.2	40.0	36.4	20.8	4.0
Total %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 9: Reported handwashing behaviour at water collection in 8 selected villages in Morogoro and Shinyanga Region.

The remaining 12 households all had a risk of contaminating their hands during latrine use, as none of them had water in or near their latrines that they used for handwashing. Some risk is therefore present that safe water is contaminated during collection when the water is touched with unclean hands.

3. Contamination Risks during Storage of Drinking Water

In their evaluation study in Lesotho, Feachem et al stated that "in the lowlands 48% of households stored water in a special storage container and not in the bucket used to collect water. Since these storage containers are seldom, if ever, cleaned out (unlike the buckets used in water collection which are rinsed before each filling) it is not surprising that the water in them should become progressively more contaminated"[2].

In the present study, the following possible riks of contamination during storage were investigated: observed water storage; separate storage of drinking water; reported frequency and intensity of cleaning of storage vessels; observed presence of cover on storage vessels; reported filling practices for storage vessels and observed drawing risks when taking drinking water from the storage vessel.

1) URT/DANIDA/BRALUP/CDR, Water Master Plans for Iringa, Ruvuma and Mbeya Regions, Socio-Economic Studies, Volume 12, Dar es Salaam/Copenhagen, 1982, p. 10.6.
2) R. Feachem etal, Water Health and Development, An Interdisciplinary Evaluation, London, Tri-Med Books Ltd., 1978, p. 120.

For the storage of their drinking water, at least half of the households who stored water (126 out of 236, or 53.4%) used a separate vessel (Table 10). (This practice may be even higher, but due to a fault in the questionnaire, this question was not answered by all households interviewed. Those who did, 126 out of 147 or 86% had a separate vessel for drinking water storage).

Type of storage of drinking water	Covered	Not covered	Unspecified	Total
Same vessel for drinking and other water	1	13	7	21
Separate vessel for drinking water	122	3	1	126
Unspecified	89	-	-	89
Total	212	16	8	236

Table 10: Type of storage of drinking water in a sample of 236[1] households from 8 selected villages in Morogoro and Shinyanga Region.

Contrary to conditions in Lesotho reported cleaning frequency of water storage vessels was high[2]. Only one household in Seseko and one in Mwaweja said they dit not wash their storage vessels at all. Three others only washed them when they were dirty. All other households (241) said they rinsed the vessels at least once a week (35.3%), almost every day (36.9%) or when empty (12.9%). Nine households (3.7%) did not store any water at all and 11.2% could not answer the question.
Differences between the individual villages could not be determined however, as the catgory "when empty" can refer to "once a week" as well as "(almost) daily".

The reported intensity with which vessels are cleaned was found to vary considerably (Table 11). In the three villages in Kilosa District, scouring (with or without sand or ashes) was more usual than in the villages in Mahenge and Shinyanga districts (with the exception of some households in Minepa). But even with this generally better cleaning intensity, significant differences ($P<0.02$) existed between these 3 villages, with Mhenda scoring relatively highest, Kihelezo lowest and Madoto taking a middle position. In Mahenge district, too, differences between the 3 villages were significant at $P<0.005$.

1) Nine households lived so close to a tap that they did not store water at all.
2) Of course, people may say that they regularly clean their storage vessels while in practice never doing so but would they in that case not also report a much more general boiling of drinking water?

Looking at differences between villages and households with improved and traditional sources, the tendency is opposite to the one reported on collection hygiene in section 2: more people in Kilosa and Shinyanga using "maji safi" reported some type of scouring method for the cleaning of their storage vessels than people using traditional sources. In Mahenge district the opposite was the case.

Reported cleaning method	Kilosa District			Mahenge District			Shinyanga District	
	Mbenda (n=45)	Madoto (n=48)	Kihelezo (n=38)	Kilosa kwa Mpepo (n=18)	Mipepa (n=25)	Mzelezi (n=22)	Seseko (n=24)	Mwaweja (n=25)
Rinsing only	11.1	4.2	26.3	61.1	48.0	40.9	66.7[2]	76.0[2]
Scouring[1]	35.6	47.9	52.6	16.7	-	45.5	4.2	12.0
Scouring with sand/ashes	44.4	27.1	18.4	-	44.0	-	20.8	12.0
Water and soap	4.4	-	-	-	4.0	-	-	-
No storage	2.2	14.6		-	4.0	4.5	-	-
No answer	2.2	6.3	2.6	22.2	-	9.1	8.3	-
Total %	99.9	100.1	99.9	100.0	100.0	100.0	100.0	100.0

Table 11: Reported cleaning methods for drinkwater storage vessels in 8 selected villages of Morogoro and Shinyanga Regions.

Filling practices may be another element of risk[3]. Of the total number of households who stored their drinking water (236 households) only 16.7% said they added newly collected water to the old water. The others first finished the old water (33.8%), used the remainders for other purposes, e.g. dish washing (34.9%) or poured out any leftovers (7.2%).

Village-wise, filling practices differed significantly between villages in Kilosa and Mahenge district, especially due to high water re-use practices in Kihelezo and the absence of any reported adding in Mzelezi village. Reported re-use was also high in two other villages with a shortage of water in Seseko and Mwaweja.

To get an indication of the risk of contamination through water drawing practices, the respondent was asked to demonstrate how she took water from the vessel from which drinking water was taken. It was thereby observed if hands could touch water (e.g. dipping a communal cup into the water versus using a long laddle).

1) Using leaves, sisal fibres or natural brush (dried part from ...plant, which makes an excellent scouring sponge).
2) Including 1 household that stored, but never cleaned.
3) On the assumption that water that has been stored longer is more polluted, it was supposed that adding new water to old is a less good practice than collecting new water after the old is finished, poured out or used elsewhere.

The possibility of hands touching water was observed in 132 of the 236 households who stored drinking water, or 55,9%.

Looking especially at those households that use an improved source to collect drinking water, it was found that in all 4 villages concerned, the respondents concerned touched the water no less than those using a traditional source.

4. Contamination Risks from Source to Cup: An Overview

As a final exercise, the reported and observed water use behaviour and conditions of households using only improved water sources were followed from source selection to drawing practices to summarize the risks of ingesting contaminated water.

This data show that the chances of polluting behaviour after choosing a safe source are still quite high: in only one third of the 90 households concerned no risky conditions or behaviour were reported and observed. This tendency was the same in all 4 villages with improved sources. Only in Mhenda was the proportion of households with safe behaviour even lower.

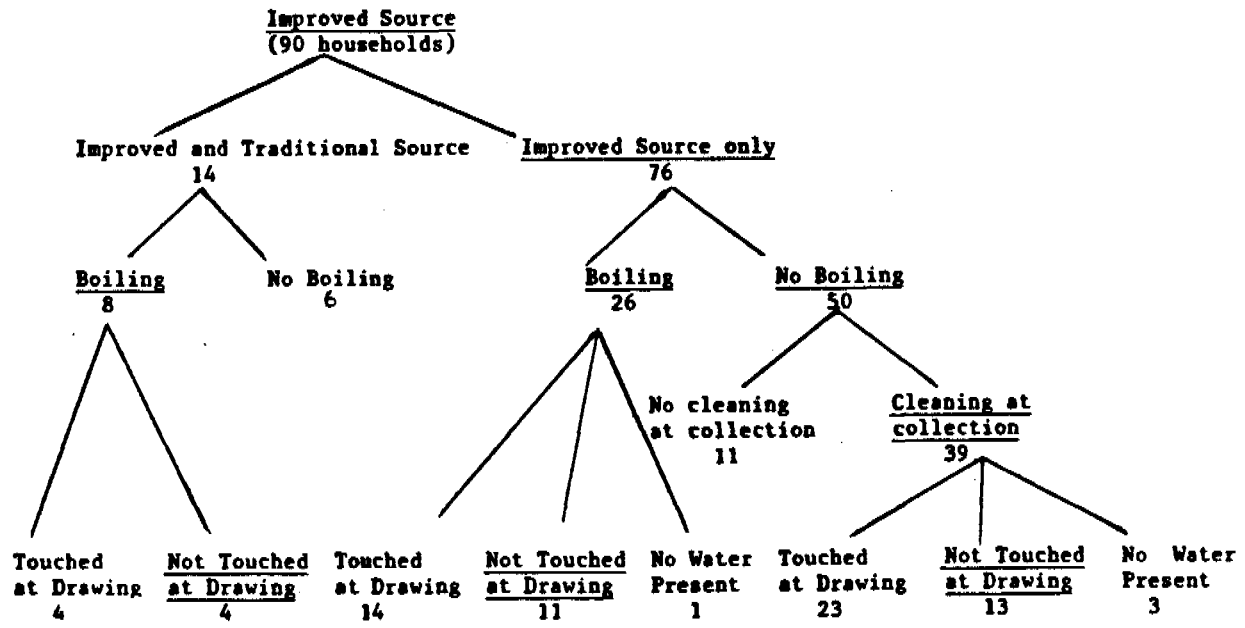

Fig. 1: Risks of water contamination between source and cup for 90 households reporting the use of improved sources for drinking water, (safe water use underlined).

5. E-Coli Tests and Human Behaviour

Water quality testing in Lesotho[1)] and Mbeya region of Tanzania[2)] has shown that contamination of water during collection and storage DOES TAKE PLACE

1) Feachem et al, op.cit.
2) URT/DANIDA/BRALUP/CDR, op. cit. p. 10.2.

actually does take place. However, it would be useful to know more about what behaviour is the most risky and whether relatively minor interventions (handwashing with soap, locally made laddles instead of communal cups) can make a significant difference. In the present study, a trial batch of 38 samples from river and handpump water collection and storage vessels was tested on E-coli, with additional observations on behavioural risks[1].

In doing so, the use of a Millipore set for testing of relative quality at various points between source and cup was found to give specific problems:

(a) Reliability of data on source quality
River water at the source was found to vary greatly in quality from one moment to the next. (from E-coli negative to uncountably positive) An increase in E-coli in the collection vessel of water that originates directly or indirectly from a river does not therefore say anything: this increase can be completely due to a lower water quality of the source of water at the moment of drawing water and not to any contamination introduced by the user. One can only draw conclusions from water found E-coli negative in the vessel at the beginning of the trip back and positive at the end, in combination with observations on washing of hands, touching of water, using twigs and leaves against spilling, distance and vessel size.

(b) Validity of the instrument
In a study in two villages in Mbeya Region[2], Laubjerg found that 9 samples taken within ten minutes from the same batch of water had a number of E-coli varying from 15.000 to 120.000, with 95% of the values falling between 45.286 and 91.603 E-coli/100 ml. Thus, Millipore tests cannot be used to determine a relative increase of contamination at the various points of risk, once some E-coli are found to be present: such an increase may be due to the variation in test scores of the instrument rather than to a varying human behaviour[2].

Because of these limitations and the incompleteness of some of the observations on social factors, only 2 of the 6 samples found to be E-coli positive amoung the 27 samples taken from collection and storage vessels in 14 households could be attributed without doubt to behavioural factors (hands touching during collection, communal cup used for drawing drinking water).

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1) Washing of vessel and hands before collection, amount of water collected, hands touching during transport, leaves and twigs used against spilling, distance to reach home, separate storage of drinking water, presence of cover, amount of water stored and duration of storage, way of drawing water.

2) Unless differences are too large to be only explained by the chance-variation of the instrument.

It is therefore proposed to repeat these tests in a sufficiently large sample, while avoiding the above loopholes by:

(a) limiting the test to households using only a handpumpwell with E-coli free water;
(b) determining the absence of E-coli in the source just before each test household collects water;
(c) observing collection and transport behaviour of each household concerned using a standard list with as much details as possible;
(d) testing collection water on absence or presence of E-coli on arrival;
(e) bringing the storage vessel to the pump and filling it in the way done by the household directly after taking a quality sample of the pumpwater[1];
(f) testing stored water on absence or presence of E-coli after 24 hours, while observing the existing storage and drawing risks.

After analysis the results must of course be reported to the households concerned and their meaning discussed with them. In case of a clear relationship between water contamination and user practices, the changing of these practices can be discussed with the households. If necessary, a few essentials such as soap for handwashing and utensil cleaning and a laddle for water drawing may have to be provided. Thereafter the tests can be repeated to see if less water contamination occurs[2].

Contrast between individual hygiene (bucket washing) and public hygiene (standing water and mud around well).

Photo 3.

1) As an increase in E-coli cannot be determined with sufficient reliability through Millipore tests, the only way to determine storage risks is to make sure that the stored water is free from E-coli at the beginning of the test.
2) The experiences and results of such an experiment might also be very useful for practical health education programmes, e.g. providing material for reportage and in radio health education.

VI ADDITIONAL ROLES OF PERSONAL AND HOUSEHOLD HYGIENE

1. Amounts of Water Collected

In the previous sections, the risks were shown of catching a water-borne disease by drinking unsafe water (from an unsafe source, without boiling and proper handling afterwards, or from a safe source but made unsafe during collection, storage or drawing).

Almost all water-borne diseases are however also transmitted through a lack of washing. Faecal-oral infections (e.g. cholera, dysentery, gastro-enteritis, typhoid fever and most intestinal worms) occur when pathogens from disease carriers are accidently ingested by healthy people. The spread of such infections can be limited by using and regularly cleaning latrines, ensuring safe waste disposal near busstops and when working in the field, washing hands (if possible with soap) after latrine use and child cleaning and before eating and preparing food, helping children to wash hands regularly, regular washing of cooking and eating utensils etc. Other diseases prevented (and sometimes even treated) by plenty of washing are skin and eye infections and some louse-borne fevers (Table 5, P. 11).

The present study showed a significant positive relationship**) between the amount of water collected per person per day and the use of an improved source.
On average, households using a pump or tap collected 22.0 l/c/d, while households using a traditional source collected 14.4 l/c/d. This data suggest that the installation of an improved supply will contribute to a reduction of water-washed diseases through the use of water.

However, it is likely that this positive relationship between improved source and water quantities collected per person per day is for the greater part explained by the also significant positive relationship with bathing and washing at home**) and low distance to the source**).

At handpumpwells in particular clothes washing is discouraged, to avoid unhygienic conditions and source pollution. Also, the households who use an improved source mainly do so because it is nearby. It is therefore not surprising to find that more households using an improved source bathe and wash at home (75.0% and 60.7% repectively) than households using a traditional source (56.2% and 38.9% respectively). It will yet be calculated to what extend these two practices explain the higher amount of water collected.

Other factors that were found to have a significant relationship with the amount of water collected were household size**) (larger families collected more water) and religion: households of a Moslem or mixed Moslem-Christian denomination collected an average of 18.2 l/c/d, while those with Christian religion collected 15.6 l/c/d, and households with a traditional religion 11.6 l/c/d.

*) $P<0.05$
**) $P<0.01$

However, this is probably due more to environmental circumstances than to religious influences: the households with traditional religion nearly all live in two villages with a shortage of water and long collection distances in the dry season. And in only one of the villages with a mixed Moslem-Christian population (Kilosa kwa Mpepo) did Moslem households report a significant higher amount of water collected per person per day than non-Moslem households.

Economic status (sources of household income and number of status symbols owned) was found to be not significantly related to the amount of water collected[1)].

2. Bathing and Handwashing

Daily bathing is a common practice in all villages, whether they have an improved water supply or not: it was reported by between 86% and 100% of the sample households in the different villages.

The only exception is Madoto village, where 21 households or 39.3% reported to bathe twice a week. In 6 households this concerned all members of the households (but 4 of these were households composed of elderly people who carried all bathing water from tap or well to their bath yard) while in 15 households this concerned only the females: males and children bathed every day. Carrying the water for these daily baths to the bathing site behind the house probably takes so much time and energy of the women that they cannot manage to make the same effort again for their personal benefit.

In bathing sites and facilities the villages varied a lot. In Kilosa district, nearly all households had a special secluded area for bathing next to the latrine (94.7 - 95.8%). However, in Mhenda village, over one-third of the women and two-third of the children were also bathing at a water source (a river in most cases, though wells are also used). This saves the women a lot of water carrying, but it also has serious health consequences when the places where bathing is allowed are infested with schistosomiasis (see also p. 41-43). In Madoto and Kihelezo, bathing at the source as reported was less common.

In Mahenge district, all sample households in Minepa had a bathhouse. In Kilosa kwa Mpepo and Mzelezi 27.7% and 4.5% of the households had a special bathing site. In these villages, most people bathed at a river or well, only a few households said to bathe at home.

In the 2 Shinyanga villages, bathing at home was the general practice, with over half of the households in Mwaweja and one-third in Seseko using a special secluded area near the latrine for this purpose.

Handwashing is another important factor in the reduction of water-washed diseases, especially the faecal-oral ones. As an important indication of existing practices the presence of handwashing facilitites in or near the household latrine was observed.

1) The influence of a fourth household characteristic, household composition (number of older girls and adult women) was not investigated.

Table 12 shows that latrine coverage is very good (with the exception of Kilosa kwa Mpepo), whether the village has an improved water supply or not.

Observed latrine facilities	Kilosa District			Mahenge District			Shinyanga District	
	Mhenda (n=45)	Madoto (n=48)	Kibeleso (n=38)	Kilosa kwa Mpepo (n=18)	Mlnepa (n=25)	Mzelezi (n=22)	Seseko (n=24)	Mwaweja (n=25)
No latrine	2.2	4.2	5.3	38.9	-	13.6	-	4.0
No facilities	17.8	10.4	26.3	22.2	40.0	63.6	70.8	44.0
Fly cover only	8.9	29.2	13.1	5.6	12.0	13.6	29.2	24.0
Handwashing only	22.2	8.3	26.3	16.7	24.0	9.1	-	8.0
Both facilities	48.9	47.9	28.9	16.7	24.0	-	-	20.0
No answer	-	-		-	-	-	-	-
Total %	100.0	100.0	99.9	100.1	100.0	99.9	100.0	100.0

Table 12: Observed presence of latrines and latrine facilities (fly cover,handwashing facilities) in 8 selected villages in Morogoro and Shinyanga Region.

However, in all villages there is a need to facilitate and promote handwashing (if possible with soap) after latrine use and to promote the use of fly covers, flies being another transmission mechanism of faecal-oral diseases. Even in the two villages with the best observed conditions (Mhenda and Madoto) less than half of the sample households had water[1] for handwashing and fly covers in their latrines.

Cases of households without latrines were mostly households with older couples and households whose latrine had collapsed or was full and who had not yet built another one. Households with a collapsed or full latrine shared the neighbours' latrine in most cases. Only in Kilosa kwa Mpepo, 4 households did not own a latrine at all, while 2 had not rebuilt after the collapsing of the previous one, and one household was using a public latrine while constructing its own.

An important question in relation with the reduction of faecal-oral disease transmission risks is whether the water observed in or near the latrine is actucally used for handwashing. When the above observations were compared with the handwashing occasions listed earlier in the interview, it was found that in all villages except Mzelezi, the reported washing of hands after latrine use was lower than the observed handwashing facilitites (Table 13). It is therefore likely that much of the observed water in or near the latrines is used only for cleansing[2]. This is further supported by the fact that handwashing facilities were observed significantly more often in Moslem households (who used water for cleansing) and significantly less in households with a traditional religion (who used grass for cleansing). No relationship was found between handwashing and the use of safe water sources.

1) Only in a very few cases soap was also present.
2) Consequently, the handwashing facilities mentioned in Table 12 and elsewhere, will in many cases only be cleansing facilities.

Other occasions when handwashing was fequently reported were before meals and when collecting water. The latter has already been discussed in section V, 2. The former was uniformly mentioned by all village samples (100.0%). For the small sub-category of households with children under one year (35 households), handwashing after cleansing the baby was mentioned by half of the women.

Total number of households with	Morogoro Region						Shinyanga Region		Total
	Kilosa District			Mahenge District			Shinyanga District		
	Mhenda (n=45)	Madoto (n=48)	Kibelezo (n=38)	Kilosa kwa Mpepo (n=18)	Mipepa (n=25)	Mzelezi (n=22)	Seseko (n=24)	Mwaweja (n=25)	
Observed handwashing facilities	32	27	21	6	12	2	-	7	107
Reported cleansing with water	31	19	21	5	12	1	-	4	93
Reported handwashing	17	17	13	3	4	2	-	3	59

Table 13: Number of households with observed handwashing facilities in latrine and reported use of water in 8 selected villages in Morogoro and Shinyanga Region.

From a health point of view, handwashing should preferably be done with soap. In all villages, the availability of soap is a great problem, however. In 7 of the 8 study villages soap is seldom available. Only in Kilosa kwa Mpepo people reported a slightly better availability.

When soap is available, 86 to 100% of the households interviewed do not have any problems in buying the amounts they need. Only in Madoto village, 22 of the 48 households said they could not always afford to buy soap. However, the majority of these households did not belong to the lower income group (subsistance farming, no status symbols owned) so it may in many cases be more a problem of a lack of ready cash than of absolute poverty. Because of the shortage of supply, soap is nearly everywhere reserved for clothes washing, used less extensively for personal hygiene, and seldom for handwashing[1].

3. Household Hygiene

Other possible points of transmission of faecal-oral diseases that were studied in the household survey are: the conditions of the latrines themselves, reported waste disposal practices of small children, and observed protection of food and cooking and eating utensils.

1) More discussion in informal talks about women's knowledge and attitudes about handwashing with soap by all members of the household, in comparison with the values placed on clothes washing and bathing would be useful to see if health education alone might make a difference.

As mentioned above, latrine coverage was very high. But the latrines themselves can become a health risk rather than a health protection when they are soiled and poorly constructed. The absence of a roof in particular will lead to unhygienic conditions during the rainy season, which discourage the use without exception by all household members.

Table 14 shows that latrine conditions, though better in some villages than others can be improved everywhere. Latrines of households using protected water sources did not differ significantly from those who were using traditional sources, so that this transmission risk for faecal-oral diseases remains present when a village has been served. A higher economic status and muslim religion did also not make any significant difference to the observed latrine conditions.

Non-use of latrines was reported in all villages during work in the field, with the digging and covering of a hole an exceptional practice except in Madoto village: 31.2% reported burial in an open question about excreta disposal practices[1].
Schoolage children are another group of non-exclusive users and signs of indiscriminate human waste disposal were observed in all but one of the study villages.

Reported waste disposal of babies and small children who are unable to use the latrine is generally good: three-quarters of the households concerned deposited the excreta in the family's latrine. Only small minorities reported the more risky practices of leaving children's waste in the yard, or throwing these wastes and/or cleansing materials (grass, leaves) in the bush around the house (15.3%, 6.3% and 4.5% of households respectively).

As indicators of food hygiene observations were made on protection of food against flies, presence of a drying frame for houshold utensils and general cleanliness of kitchen area.

Observed conditons of latrine outhouses	Morogoro Region						Shinyanga Region	
	Kilosa District			Mahenge District			Shinyanga District	
	Mhenda (n=45)	Madoto (n=48)	Kihelezo (n=38)	Kilosa kwa Mpepo (n=18)	Mimepa (n=25)	Mzelezi (n=22)	Seseko (n=24)	Mwaweja (n=25)
No own latrine	2.2	4.2	5.3	38.9	-	13.6	-	4.0
Poor and soiled	44.4	56.1	50.0	16.7	20.0	45.5	12.5	4.0
Poor and clean	4.4	6.3	-	5.5	4.0	-	-	-
Good and soiled	26.7	25.0	7.9	11.1	28.0	36.4	45.8	32.0
Good and clean	22.2	8.3	36.8	27.8	48.0	4.5	41.7	60.0
Total %	99.9	99.9	100.0	100.0	100.0	100.0	100.0	100.0

Table 14: Percentages of households with observed statisfactory and unsatisfactory latrine conditions in 8 selected villages in Morogoro and Shinyanga Region.

1) This practice is important to cut off faecal-oral transmission via flies when the fields are near the houses. To cut off the transmission of hookworm, the holes must be ca. 60 cm deep to be fully effective.

As shown in Table 15, covering of cooked food against flies was an almost universal practice. Kitchens were observed to be clean in the majority of households, with the exception of Kilosa kwa Mpepo (33.4%). Noticeable is also that not all households have a drying frame (e.g. made from branches) on which cooking and eating utensils are dried in the sun after washing.
As these frames are easy to construct from natural local materials, this in another improvement to household hygiene that can easily become more general with a sufficient promotion from the various village workers.

	Morogoro Region						Shinyanga Region	
	Kilosa District			Mahenge District			Shinyanga District	
	Mbenda (n=45)	Madoto (n=48)	Kihelezo (n=38)	Kilosa kwa Mpepo (n=18)	Mipepa (n=25)	Mzelezi (n=22)	Seseko (n=24)	Mwaveja (n=25)
Cleansing cooking area	84.4	64.6	79.0	33.4	76.0	68.9	50.3	72.0
Food protection against flies	97.8	89.6	100.0	100.0	100.0	100.0	100.0	92.0
Drying-frame for utensils	53.3	72.9	42.1	44.5	24.0	9.1	29.2	44.0
Total %[1)]	235.5	227.1	221.1	177.9	200.0	178.0	187.5	208.0

Table 15: Percentage of households with observed provisions for food hygiene in 8 selected villages of Morogoro and Shinyanga Region.

Table 15 also shows that the total percentages for food hygiene are higher for the 4 villages with an improved supply. But when the individual scores were compared of households that were using an improved source in these villages with those who continued using a traditional source, the former did not have consistently higher scores. Nor was there any significant relationship with waste disposal: households with better and cleaner latrines did not also have a better kitchen and food hygiene. This shows that households with otherwise low hazards may still risk transmission of faecal-oral diseases at the end of the faecal-oral chain: the preparation and consumption of food.

4. Rodent and Insect Control

Rodents (rats in particular) are more a threat to stored food and thus to nutrition than a major disease transmission risk in the two Regions. Indirectly,[2)] however, nutrition is also associated with water-related disease.

1) More than 100% due to multiple answers.
2) Incidence of diarrhoea is highest at the beginning of the rainy season, when the rain washes faecal matter into unprotected water sources and when resistance of adults but especially young children to diarrhoea is at its lowest. This is caused by food shortages and unbalanced diets at the end of the dry season. The establishment of dry-season vegetable gardens at water sources and the protection of stored food against rodents and insects (from outside, by using closed and raised stores, and from inside, e.g. by mixing stored grains with dried red peppers) can therefore also contribute to a decrease of child diarrhoea.

Rodent control therefore remains of some importance. Two rodent-related indicators of household hygiene that were included in the study are garbage disposal and foodstorage.

Safe foodstorage varied from 0% in 2 villages to 29.2% in Seseko, with an average of 12.2%, so this aspect can be much improved. This also goes for garbage disposal: in 5 out of 8 villages with and without an improved supply, a high percentage of households had no pits and said they threw any refuse in the fields around their house (Table 16).

Method of garbage disposal	Morogoro Region						Shinyanga Region	
	Kilosa District			Mahenge District			Shinyanga District	
	Mbenda (n=45)	Madoto (n=48)	Kihelezo (n=38)	Kilosa kwa Mpepo (n=18)	Mipepa (n=25)	Mzelezi (n=22)	Seseko (n=24)	Mwaweja (n=25)
Pit present	42.2	62.6	52.6	5.6	32.0	18.2	4.2	28.0
Burn	24.4	22.9	2.6	11.1	4.0	-	12.5	52.0
Burry	11.1	2.1	-	5.6	-	-	-	-
Throw in field	15.6	10.4	44.7	77.8	60.0	81.8	83.3	20.0
Throw in river	6.7	2.1	-	-	-	-	-	-
No answer	-	-	-	-	4.0	-	-	-
Total %	100.0	100.1	99.9	100.1	100.0	100.0	100.0	100.0

Table 16: Percentage of households having a pit or reporting other methods of garbage disposal in 8 selected villages in Morogoro and Shinyanga Region.

A final group of diseases related to water and sanitation are those transmitted by insects that breed in or bite near water. The only prevalent disease of this type in the study area was malaria. Effective mosquito control is however very difficult and most of its means (destruction of all breeding sites; protection against bites by netting, wiring, sprays, coils and high sound devices, prophylactic drugs) are out of reach of the majority of rural households. No observations or questions were therefore included on this issue [1]. The only exception was observations on drainage at water sources, as this is a risk of increasing existing breeding sites that the villages can easily avoid.

In Madoto and Mwaweja drainage was observed to be good. In Mwaweja, a soakaway had been made at the end of the gutter and at the other pump the village council allowed the pump caretaker to make a vegetable garden on the communal land, in exchange for his upkeep and occasional repairs (using tractor tools) of the 2 pumps.

In Kihelezo, drainage gutters had been made at some of the traditional wells, on the initiative of a villager who saw this while working at the sisal estates. In the other villages, drainage conditions were not satisfactory.

1) A village campaign for a reduction of breeding sites is of course possible, but especially in relatively humid, low attitude areas they will make little or no difference when carried out in isolation of other control meausures. There are many water-related disease problems that can be tackled by the villages with much better chances of success, and these are therefore stressed in this report.

VII REPORTED INCIDENCE OF WATER-RELATED DISEASES

In the interviews, two questions were asked on disease incidence: an open question on any disease that had affected the various household members during the preceding week, and a closed question on occurrence of particular water-related diseases in the last 6 months[1].

Diseases that were reported most frequently for the preceding week were malaria/fever (118 cases in 82 out of 245 households) and diarrhoea (26 cases in 19 households). Both diseases occurred relatively most in the under-five age categories, with 20% of the 1-5 years' old and 8% of the under-one-years' old affected.

Reported incidence of diarrhoea was found to be significantly (P 0,05) related to type of water source used (Table 17). However, two other findings detract from the likelihood that this relationship is not due to chance. Firstly, the reported incidence of malaria/fever last week, which is far less related to the type of water system than diarrhoea, was found to be even more significantly related (P 0,02) to the source of drinking water used. And secondly reported incidence of diarrhoea and type of drinking water source was no longer significantly related (through some tencendy remains) as soon as the intervening variables of (reported) water boiling and (observed) drawing risks were taken into account (Table 18).

Households reporting	Diarrhoea last week	No diarrhoea last week	Total	Malaria/ fever last week	No Malaria fever last week	Total
Use of improved source	1	61	62	13	49	62
Use of traditional source	18	163	181	69	112	181
Total*	19	224	243	82	161	243

*) No answer: 2

Table 17: Number of households reporting now one or more cases of water-related disease in the preceding week, according to type of water system used[2].

Present samples were too small to account properly for these and other intervening variables, (e.g. presence of other faecal-oral transmission routes) explanatory variables, (e.g. a greater water use per capita) and inter-village variation.

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1) Malaria, cholera, schistosomiasis, serious stomach infections with fever, polio, hepatitis, skin infections and eye infections. Disadvantages of this method are that diseases may not have been recognized, diagnised correctly and/or recalled. For an explanation of why this method was nevertheless choosen, see Chapter 1, section 1.

2) The difference with Fig. 1 on page 21 where 76 users of an improved source are given, is due to the non-functioning of the supply in one of the villages during the time concerned.

Water use Practices		Diarrhoea	No Diarrhoea	Total
Low Risk	Improved Source, No touch	- 4	28 41	73
	Traditional Source Boiled, No touch			
High Risk	Improved Source, Touched	1	39	40
	Traditional Source Not Boiled	9	81	90
	Traditional Source Boiled, Touch	5	32	37
Total*		19	221	240

*) No answer: 5

Table 18: Number of households reporting none, one or more cases of diarrhoea in the preceding week, according to reported/observed water use practices.

For a study on the relation between water and incidence of diarrhoea, it will be necessary (1) to have much larger samples, with low- and high-risk categories (2) to closely define the symptoms of diarrhoea for the respondents and (3) to repeat the interviews on diarrhoea recall over a sufficiently long period[1].
Only then can one find any significant differences between the two populations, and identify also the differences between the individual villages in the sample and between the individual household categories in each village (e.g. those who boil water and those who do not).

Diseases reported most frequently for the last 6 months were malaria (183 cases in 104 households), serious stomach disorders with fever (124 cases in 84 households), schistosomiasis (89 cases in 49 households) and eye infections (57 cases in 30 households).

Looking at the type of water source used by the respondents, malaria was no more reported for the last 6 months by households using an improved source (39 households out of 90 reporting one or more cases of malaria) than by households using a traditional source (65 out of 155).
For serious stomach disorders a significant positive relationship ($P<0,025$) was found between use of traditional water source at least for drinking water and reported incidence of one or more cases of illness in the household (Table 19).

Households reporting	serious stomach disorders	no serious stomach disorders	Total
Use of improved source	21	64	85
Use of traditional source	63	97	160
Total	84	161	245

Table 19: Number of households reporting one or more cases of serious stomach disorders for the last 6 moths and type of drinking water source.

1) For a discussion of sample sizes for diarrhoea incidence study, see Minimum Evaluation Procedure for Water Supply and Sanitation Projects, WHO, Geneva, Second Draft, 1 September 1982.

This relationship was retained (though at P<0,05) when further water use risks (no reported boiling of water from unprotected sources, observed drawing risks of safe water) were taken into account (Table 20). For the individual villages, however, this relationship was only found in 5 out of the 8 village samples, and was non-significant in each case[1].

Water use Practices		Serious Stomach Disorders	No Serious Stomach Disorders	Total
Low Risk	Improved Source, No touch	7	28	35
	Traditional Source Boiled, No touch	13	27	40
High Risk	Improved Source, Touched	14	37	51
	Traditional Source Not Boiled	34	44	78
	Traditional Source Boiled, Touch	16	17	33
Total*		84	153	237

*) No answer: 8

Table 20: Number of households reporting none, one or more cases of serious stomach disorders for the last 6 months, and reported/observed water use practices.

Of schistosomiasis, a total of 89 cases was reported in 49 households. Relatively most cases occurred in three villages with an improved water supply: Madoto (24 cases or 11.4% of the total sample population, Mhenda (34 cases or 13.0%) and Mwaweja (14 cases or 8.9%). This may be related to the existing bathing and laundry habits in these villages[2] as well as regulations on the use of handpumpwells[3].

Bathing and clothes washing at a nearby river instead of at home of course saves much water collection time and effort, especially in the dry season when water is scarcer and waiting times at the pumps are likely to be longer. However, it is just at this time that the rivers become a health risk as the water becomes stagnant and an attractive breeding place for the snails in which the schistosomes develop.

1) The relationship between reported incidence and water quantity, which is as important could not be investigated because no detailed data were collected on total amounts of water used per household per day (many households were washing and bathing at the source).

2) In Madoto as well as Mhenda, 96% of the sample households had a special secluded bathing area in their compounds. In Mwaweja, this was 57%. However, in all three villages women and children did also use the traditional sources (mostly rivers) for bathing. The men almost always used only the special bathing area at home. Clothes washing at the river was always done by 37.8% of the households in Mhenda, 20.8% of the households in Madoto, and 72.0% in Mwaweja. Another 13.3% and 8.3% in the first villages washed clothes there occasionally.

3) For fear of source pollution, the well project tells the villagers not to wash and bathe at the handpump.

Bathing and washing at a handpump or tap may then be a good intermediate solution, because even if this means walking a bit further and waiting for some time, it is still less effort than having to carry all bathe and wash water home.

Until now, the water projects have generally discouraged such practices because washing and bathing at the source also leads to unhygienic conditions and so to greater risks for source pollution and insect breeding.
The present data however points to the necessity of making exceptions to this rule at least in those villages where washing and bathing at the source is preferred by a considerable proportion of households and schistosomiasis risks are present. At the same time, arrangement for the good management of these facilities must be made with their users, to avoid the development of other, new, health risks.

Further specification of the reported cases of schistosomiasis according to age and sexe suggest that besides clothes washing and daily baths, bathing and swimming as recreation is a third, and most important health risk:

(a) the majority of reported cases (83.5%) occurred in the age groups of 6-12 and 12-18;
(b) the majority of children and young adults affected were male (64.5%). Female users were especially affected in the age group of 11 years and older. Given the much greater involvement of girls in household tasks, this may point at infection of girls while washing clothes rather than while swimming[1]. For more certainty on this issue, observations at the risky sources in combination with a morbidity study are necessary.

The installation of bathing and washing facilities will not prevent the transmission through recreation/bathing, so that improvements here will have to come from health education and self-help activities that reduce the degree of infestation of the water sources[2].

1) The number of reported cases among 6-10 year old girls is probably lower because it is easier for boys of that age to notice a symptom of S.Haematobium (blood in urine) than for girls. Also small girls may play less in water than boys.

2) Of course, swimming and bathing by the children can be discouraged as infestation with schistosomes takes place especially with a stay in infected water that lasts longer than ca. 20 minutes, but this means that a much valued means of recreation is taken away from them, especially in the dry season when they enjoy it most.
Alternative village activities that can reduce transmission risks can therefore be tried first, such as stimulation of the flow of water; reduction of vegetation and deepening of water edges; health education on how urination in or defecation near water can infect it: the children (nor anyone else) must therefore not do this themselves and also explain this to their playmates at the source; promotion of early detection and treatment of cases (also with the help of playmates and friends who can spread knowledge of disease symptoms), and experimental introduction of the predator snail Marisa Cornuarietis, which displaces the two snail species that are vectors for schistosomiasis transmission (see A.T. White, Slow Sand Filtration Project, Report on Duty Travel to the rahad Irrigation Scheme, Sudan, IRC, Rijswijk, November 1980, p. 31).

Finally, 57 cases of eye infections were reported for 30 households. The majority of these cases (42%) was concentrated in the age category of under-five. Village-wise, reported incidence was highest in Minepa (11.6% of sample affected), Madoto (5.7%) and Mhenda (5.4%). It is possible that these higher reported incidences are related to lower amounts of water used for washing and bathing in these particular households, but the small number of cases, small sample size and relatively high number of households who did not know how much water they collect per day do not allow any inferences on this issue.

VIII SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

One of the reasons to establish a safe water supply is its beneficial influence on village health. To decide if such an impact has actually occurred from the projects already carried out in Morogoro and Shinyanga Region, health statistics in the project area are however not adequate enough.
A household survey was therefore carried out in a 10% at random household sample in 8 selected villages in 3 districts (Kilosa and Mahenge District in Morogoro Region and Shinyanga District in Shinyanga Region). In each district, one fully served, one partly served and one unserved village was selected[1)].
Purposes of the study were:

- to determine if a positive health impact from the water projects on village health is likely under the existing technical, social and health education procedures;
- to establish a baseline for a supplementary community participation and health education programme in case unsatisfactory conditions were found;
- to collect detailed information about positive and negative local conditions and behaviour to share with the village for a local action programme;
- to determine if a behavioural study can be a useful tool to evaluate the chances of a health impact from a water project and to provide feedback to the programme planners.

1. Summary of findings

The major findings of the study are:

A. Source selection: Health criteria play a secondary role

(1) Villagers only change automatically to the use of an improved supply when new water sources are no less convenient than the ones they used (especially in distance) and when the quality of the water (especially its taste) is acceptable.

(2) When they change they usually do so completely. A small category used improved sources only during part of the year. An even smaller one used traditional and improved sources for drinking water at the same time.

(3) Explicit health reasons only play a limited role, but where they do, they seem to be based on a good understanding of how water is made unsafe (e.g. that untreated river water is also risky when it comes from a tap).

(4) Main reason to prefer a traditional source over an improved one in a village are (1) few other users and (2) low distance. In villages without improved sources, low distance or distance plus few other users mostly determine the choice of a domestic water source. From the study it is

1) The fully-served village in Shinyanga had to be dropped from the survey because part of the material got lost in transfer.

not clear if "few other users" only refers to convenience or also to a lower perceived health risk by sharing a traditional source with only a small number of familiar households.

(5) Health behaviour: where traditional wells are present, they are preferred for drinking water over a nearby river: the latter is mostly used for washing and bathing only. Nevertheless, dug wells were not protected in any way, except for one mission-built ringwell and some wells in Kihelezo: the responsible villager had learned this at the nearby sisal estates. In the one village where only a river was present, people collected drinking water all along its course, but some households collected all drinking water in the early morning as a health prevention.

B. Contamination Risks: Remain present also with an improved supply

(6) Risks of water contamination at the source were observed to be present in 7 of the 8 villages (3 with improved sources, 4 with traditional sources). Where satisfactory source hygiene exists, specific actions have been taken by the village government or an influential and informed villager. Actions included establishment of village regulations on handpump use, employment of a pump caretaker by the village (provided with tools for repairs and given a vegetable plot at one well in compensation for his work) and earthen barriers and draining channels at traditional wells.

(7) Planned observations on water use and preventive health behaviour at the source could not be carried out, but bucket rinsing and handwashing at collection is a common practice, reported without stimulus by 60 to 96% of the village samples. No consistent relationship with the use of "maji safi" was found: it was negative in two Morogoro districts but positive in Shinyanga.
In all individual cases where no handwashing was reported while collecting water from an improved source, a risk of faecal contamination was present (e.g. from poor latrine hygiene) in case this water was touched.

(8) Boiling of drinking water from traditional sources is reported by half of the respondents, but with great differences between the individual villages. Main reasons for non-boiling are no time (48.3%), no need (21.3%) and no custom (19.1%). People using improved water sources either still reported boiling (38%) or say they have no time, firewood etc. (22%). Non-boiling because the water comes from a safe source is reported by 40%. An additional health aspect of water boiling is the risk of burns to young children: in 51.5% of the households with children under five risky cooking conditions were observed.

(9) Overnight storage of water at the house is generally practised. Storage of drinking water was observed to be covered in almost all these households. Reported cleaning

frequency of these vessels is also universally high. Reported cleaning intensity (rinsing only, scrubbing with a natural brush, with or without sand, ashes, or -very rarely-soap) varied considerably between areas and villages. Here also, no consistent relationship existed with the use of safe water: positive in Kilosa and Shinyanga districts, negative in Mahenge. For filling the old water is either finished first, poured out or used elsewhere (e.g. for dishwashing). Only small numbers of households said to add new water to old. The major risk on storage practices seems to be the risky water drawing methods: communal cups are often used and hands were observed to touch water in a demonstration of drawing in 56% of the households. This was the case whether the water stored was originally safe or not.

(10) In only one-third of the households reporting the use of an improved source was no risky behaviour observed and/or reported during the collection, storage and drawing of drinking water.

C. Increased water use for health benefits: Handwashing and latrine practices need improvement

(11) No less or even more important than drinking of safe water is the use of more water than before for personal and household hygiene. In the present study households using a safe water source reported significantly more water collected per person per day. Other factors with a significant positive relationship are low distance to the source, washing and bathing at home, and muslim religion. Economic status was not significantly related. It is yet to be calculated in how far an improved water source as a single factor explains the greater water use of the households concerned.

(12) Daily baths are a common practice, whether the village has an improved supply or not. The only exceptions reported (bathing twice a week) concerned mainly women who bathe in the family's bath house. In other cases, women bathed also or only at the source (mostly river) while the men were only using the family's bath house. This saves the women the heavy water carrying, but increases health risks (see also 20 below).

(13) Handwashing is especially important. It is generally reported (in an open question) before meals. This shows that at least the ideal behaviour is known even when it is not always practiced. Handwashing facilitites in or near latrines were observed in 9 to 70% of the village households. However, this water is used in most cases only for cleansing: in one-third to three-third of the households where water was present in latrines no handwashing after latrine use was reported. The presence and reported use of handwashing facilities in latrines was highest in Kilosa District, but it was not related to the

use of improved water sources. This alternative route for transmission of faecal-oral disease thus also remains present in these households.

(14) From a health point of view, handwashing should preferably be done with soap. Because soap is very hard to get, it is however mostly reserved for clothes washing. The major problem in the availability of soap is not its price but its irregular supply to the villages.

(15) Latrine coverage is generally high, (86.4% to 97.8%), with the exception of one village (Kilosa kwa Mpepo, 61.1%). However, latrine hygiene can be much improved in all villages, whether improved supplies are used or not. Better latrine conditions were only positively related to the number of latrine facilities observed (fly cover, water for cleansing/handwashing or both). Religion and economic status did not make a significant difference.

(16) Non-use of latrines was reported especially when working in the field (with only a few respondents reporting the use of their tools for burial) and by school-age children. In all but one of the villages signs of non-use were observed. Reported waste disposal of babies and small children is generally good.

(17) As indications of transmission risks at the end of the faecal-oral route, kitchen hygiene, food protection against flies and presence of a drying frame for food utensils were observed. Observed kitchen hygiene was fair to good with the exception of Kilosa kwa Mpepo. This village on the other hand had the third highest score for drying frames. Food protection against flies was generally high (90-100%). Better food hygiene was however not related to the use of an improved water source. Nor was good food hygiene positively related with good latrine conditions.

(18) For rodent control, safe food storage (from 0-29%) and garbage disposal (thrown in the field by 10 to 83%) can be much improved. Poor drainage around water sources may increase mosquito breeding places. Drainage around public water points (traditional and improved) was good in 2 villages and partly so in one village, resulting from a combination of user education by the well project and subsequent village action in 2 villages and private initiative by an informed villager in the third.

D. Reported Incidence of Disease: Some impact only on serious stomach disorders with fever

(19) Reported incidence of water-related diseases has a low reliability: diseases may not be recognized, recalled and/or properly diagnosed. Nevertheless, the few data collected show a higher reported incidence of stomach disorders in households with unsafe water use and other high risk factors.

(20) Schistosomiasis on the other hand was reported most frequently in three villages with an improved supply. Further specification of the cases according to sexe and age show that boys of 6-18 years are mostly affected, followed by girls and women of 11 and older. This points at (a) the easier recognition of S. Haematobium by boys and (b) swimming in unsafe water as a major transmission mechanism. A second, less important transmission mechanism may be clothes washing and bathing at the source by older girls and women, who thus reduce the heavy water-carrying (see also 12 above).

2. General conclusions

From the above findings, the following general conclusions can be drawn:

(1) With the existing procedures of technical water projects and health education, no overall improvement of village health is likely as:
   (a) no general use is achieved in every project village;
   (b) contamination risks exist especially at the source and in drawing of stored drinking water, while in villages with an improved supply there are also less precautions taken during collection (bucket rinsing and handwashing) or storage (vessel cleaning methods);
   (c) existing risks of schistosomiasis are not reduced due to project regulations on pump use and to swimming;
   (d) other routes along which faecal-oral diseases are also transmitted are found to be no less present in households using improved water supplies.

(2) An important reason for the lack of general use are the existing procedures applied to determine the number and siting of water points:
   (a) political constraints: In Shinyanga in particular, there has been a tendency to spread available funds as widely as possible by providing a few handpump wells to many villages, rather than serving fewer selected villages completely[1];
   (b) technical constraints: number and siting of handpump wells in particular can be limited by the varying availability of reliable and good-quality groundwater. This hampers adherence to national design criteria on number and distance to public water points;
   (c) participation constraints: the future users (or their representatives, including especially women) are not systematically involved in the siting procedures.

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1) See also: H. Ausi, Rural Water Supplies and Regional Development, A Case Study of Shinyanga Wells Programme in Bariadi District, Shinyanga Region; MDS Thesis, Institute of Social Studies, The Hague, December 1979, and I. Andersson, Wells and Handpumps In Shinyanga Region, Tanzania, Level of Service from Small-Scale Water Supplies, BRALUP Research Paper No. 77, Dar es Salaam, November 1982.

Villagers often have useful knowledge about their own environment[1] and can assist in choosing optimal sites for a general use within the given technical and financial situation;

(d) educational constraints: when for technical reasons no optimal siting can be achieved, the health consequences are not discussed with the villagers (women) concerned.

(3) In some respects (latrine coverage, storage of drinking water) the level of environmental hygiene was observed to be high. However, the existing health education activities have not yet sufficiently reduced other risks in the transmission of water-related diseases. This may have to do with the type of health education given:

(a) lectures at the clinic or dispencary taken place from the actual points of risk in the village and compounds, so that demonstration and discussion of risky behaviour is difficult; also the patients among a clinic audience are likely to be preoccupied with their immediate complaints;

(b) cholera campaigns imply a short-term mass action at a time when everyone is greatly motivated by the cholera threat. With the passage of time and the disappearance of the cholera, its effects diminish, however;

(c) the water projects do not cooperate with the existing health staff, schoolteachers, women leaders etc., to ensure that the health education already given in the village concentrates on water and hygiene at least during the time of the project.
Also little or no explanation of the health aspects of the project is given during the technical work in the field.

(4) Three types of health education seem necessary:

(a) Initial and general education on the potential benefits for everyone's health (women, children and men) of water supplies and latrines that are safe, function continiously and are properly used by everybody in the village;
This education should reach in particular the men as financial decision makers and the village government and (sub)committees for water and health (as they will be involved in local planning and maintenance);

(b) Subsequent detailed education on the various points of risk that can be cut off through the right type of behaviour. In this education, the women and older children will be particularly involved as they are the ones who are most concerned with household hygiene and can assist best in identifying and solving the risks in their own environment;

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1) In Mwaweja, for instance, the two handpump wells dry up while some traditional wells still have water. Also it occurs that taps or wells are sited in technically or culturally unacceptable places (flooding risks, burial grounds, etc.).

(c) Training of local key-persons such as the village water subcommittee, village caretakers and schoolteachers, so that they, together with the health staff at ward level can organize periodic evaluations and follow-up once the water project has been completed.

(5) A survey of village and household hygiene conditions and behaviour is useful for the water project and health agencies to see if there is a need to adapt the existing procedures and programme contents for a maximal chance of public health benefits.

Other means to obtain useful feedback are systematic observations at improved and traditional sources combined with some questions, in-depth interviews with key-informants for the various village groupings, user-group interviews and participant observation[1].

Important is the combination of maximal systematic observations for a high reliability of the data with additional discussion of these observations with the people themselves. This one can make sure that the observed behaviour and conditions are interpreted correctly and learn more about the underlying reasons. Where no observations are possible, a further discussion of initial survey findings can also be helpful[2].

It may even be possible to organize the survey as a village self-survey, with the assistance of village committee, local health staff and the village primary school or women'group[2]. In any case results of any survey should be reported back to the village and discussed in detail with its representatives to see what action the village itself can and will take and what the project can/will do (See also Annex 2).

(6) The negative relationship found between reported incidence of serious stomach disorders over the last 6 months and safe source selection and water use practices of individual households supports the hypothesis that safe water facilities and utilization practices contribute to a lower incidence of water-related diseases. For really reliable conclusions and insight in the relative importance of each behavioural factor, a special study is however necessary (see also Chapter VII).

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1) See also M. Simpson-Hébert, Methods for Gathering Socio-Cultural Data for Water Supply and Sanitation Projects, TAG Technical Note No. 1, World Bank, 1983.

2) Compare for instance the work of the International Child-to-Child Programme of the Institute of Child Health, London. Such a survey may of course not be fully representative, but can still give a good idea and stimulate village action better.

3. Specific Conclusions

(1) For practical reasons the study was limited to hygiene conditions and behaviour[1] and did not include health knowledge.
Nevertheless, the data on source selection[2], boiling[3] and protection of drinking water and cooked food indicate that a basic health awareness exists in rural villages.
It can however be doubted, from the same data on source selection and boiling[3] and other findings on water drawing, handwashing etc. if there is a general, complete and practical understanding of the ways in which water-related diseases can be transmitted. This is a question which should be studied more closely.

(2) In local health education programmes, a more systematic approach to all subsequent points of risks in transmission of locally prevalent water related disease is necessary. For this purpose water or health committees can be helped to identify the particular risks in their village[4] and in designing and implementing a local action plan.

(3) A general propagation of the boiling of drinking water does not have an optimale effect. The present data indicate a need to identify special target groups for the promotion of boiling practices[5]. Also the data indicate a need to increase the practical understanding of when and why boiling is important; to help the women work out how extra time and firewood can be avoided by fitting water boiling into the regular meal preparation activitites; and to create a boiling custom by stimulating group decisions of these target groups.
An additional point of discussion should be the risks of serious burns to small children from unsafe cooking conditions.

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1) To learn if people have a complete and practical understanding of the relationships between water, sanitation, and the local disease informal, in-depth interviews are necessary.
2) Use of improved source for cooking and drinking water, river for bathing and washing; preference of "private" traditional well over untreated tap water from "public" river; no boiling of handpump water since water is safe.
3) See especially source selection in Mzelezi (p. 37) and reasons for non-boiling of handpumpwater (p. 39).
4) E.g. through observations and discussions at local water sources, an environmental village walk, informal discussions with women and older children, a village self-survey in cooperation with the local school.
5) Villages where no improved sources are available; households who live far from a safe source and close to a traditional one; households who use tap water of an unreliable quality; and a campaign to either boil drinking water from a traditional source or use another safe supply point in areas where the improved source is out of order.

(4) In village action programmes supplementing water projects, special attention can be paid to improvements of existing environmental health conditions with local resources, such as roofing of latrine out-houses; long handled fly-covers and water dippers; water and if possible soap for handwashing in or near the latrine; drying frames for household utensils; protected food storage; cooking devices that save fuel and are safe to children; dry season vegetable gardens for child nutrition, a village seedbed for fruit and other trees at a public handpump etc.
However, such improvements will only be useful for village health if they are generally adopted with the matching health behaviour.

(5) Bathing and washing facilities at one or more water points may be necessary in villages where washing and bathing at the source is common and where (a) a high risk of schistosomiasis is present or (b) distances to the source are relatively far and prevalence of skin and eye diseases is high. In the former case, only transmission of schistosomiasis through swimming will then remain to be solved. In the latter case, these facilities may reduce skin and eye infections through greater water use.

(6) A regular supply of soap to rural villages is not just a basic domestic need but in combination with the stimulation of handwashing, a basic health factor for women, children and men. This warrants a higher priority to the allocation of soap to the village shops.

4. Relevancy for Planners and Fieldstaff in Water, Health and Community Development

From the above findings and conclusions, several inferences may be drawn that concern the organizations involved in domestic water supply, preventive health and village development:

A. Implications for technical projects

(1) Where possible, technical teams (MAJI, RCU, donor projects) should site all improved waterpoints as far as or nearer than the traditional sources that people use to collect drinking water from in the dry and wet season. Also it must be checked if the taste of the water (and any other quality criterion applied by the people) is acceptable to the users.

In practice, these recommendations are not always applicable, e.g. when the village has many traditional sources or siting at a close distance is technically or financially impossible.
The following steps are then recommended:
(a) Discussion of health aspects of siting of water sources with village officials and other key-persons such as school teachers and women leaders[1];

1) Suggested topics are safe and unsafe sources; general and continuous use and pollution risks to handpump wells from seepage and latrines.

(b) Tour of village with leaders, noting settlement pattern, existing sources in use for various purposes and village expansion areas;
(c) Establishment, as soon as possible, of a special village water sub-committee (VWSC) that can represent the village in the local planning and can organize village self-help, local maintenance, health action and water-related local development;
(d) Decision on optimal sites in consultation with VWSC;
(e) Approval of selected sites by the villagers (e.g. in a general meeting or quarter meetings organized by the VWSC).

Ideally, every village quarter should have its own approved water point. If this is technically or economically impossible, a compromise can be made, e.g. two quarters agreeing to share one point, or several handpumps sited in one area but assigned to and accepted by different village quarters.

(2) The criterion of a good water taste may cause special problems with handpump wells, as sometimes the salinity of the water increases after the well has been made. In areas where this risk exists, the villagers must be made aware of this so that they can take appropriate action[1] and no negative effect on water use follows.

(3) The study also illustrates the importance of providing no less water points than the design criteria describes. With handpump wells in particular, this is not always done, for technical or political reasons. A few pumps will however lead to non-general use (as was the case in 2 of the study villages) while a general use as a result of more health education may lead to queuing, excessive wear and tear and more breakdown. In both cases, the possibility of achieving the desired health impact is greatly impeded.

(4) For an optimal health impact, the technical teams should also:
(a) check with the local dispensary or clinic whether prevalence of schistosomiasis and/or skin and eye infections is high;
(b) relate this data to existing bathing and laundry habits and water collection distances (with large distances, less water is used);

1) For the users: discuss possibilities of going to another pump for at least their drinking water or boil all drinking water from an unprotected source.
For the village: inform the water agency and make arrangements for the optimal sharing of the other pumps if necessary.
For the village water (sub) committee and health staff: concentrate discussions on source selection and water treatment for some time on households near the rejected source.
For the water agency: check the eligibility of the village for another well or a different type of supply.

(c) on the basis of these findings, discuss with the VWSC if there is a need for additional washing and bathing facilities at one or more public water points; if yes, discuss how the village will be involved in financing, construction and maintenance of these facilities;
(d) involve the future users (women!) in the detailed design when a general agreement has been reached[1].

(5) Although health education is not a specific task of technical fieldteams, they can give significant support to the work of the local health staff and VWSC by explaining the health benefits and conditions for their realization to the villagers during their stay in the village[2].

(6) Another essential contribution of the technical teams to the health impact is training of selected villagers for the most basic maintenance and repair, the upkeep of the sites and some aspects of user education.
This can contribute to less frequent and shorter breakdown periods in which people may use unsafe water again. As women are the ones most directly affected by the domestic water situation, they are also likely to feel greatly responsible for the new supply. So, where possible, at least one of the trainees in each village should therefore be a reliable and suitable woman.

(7) In a technical domestic water supply programme evaluation should not be carried out only after the programme has been completed or is in its final stage. For an optimal health impact it can be very useful to check already in the first group of completed villages if under the applied procedures the supplies are optimally used and other disease transmission routes also blocked. At a slightly later stage, the continued functioning of the supplies can also be evaluated. This will allow timely adaptation of the existing procedures at a minimum of costs. In the various training programmes for health and maintenance evaluation needs also to be included.

B. Implications for programme planners

(8) A particular issue for an optimal health impact is the blockage of other transmission routes, in particular through the improvement of latrine conditions and use in the regions. A UNICEF-supported pilot project with ventilated improved pit (VIP) latrines in Iringa region has so far been

1) For this purpose, a scaled model can be used, or a visit paid to a nearby village where such a provision has already been made.
2) During well-drilling, for instance, many spectators will gather. A short explanation and request to inform others may help to spread understanding of, and appreciation for the work being done.

very promising. Similar projects will also be started in Mbeya and Rukwa regions and probably in Mtwara and Lindi regions.

However, for a nation-wide coverage, several issues remain to be solved[1]:

(a) a subsidy on non-local materials[2];
(b) assistance to transport of local materials (firewood, sand);
(c) avoidance of ecological side effects (increased deforestation);
(d) procurement of non-local materials (imported and non-imported);
(f) support to promotion, community organisation and health education;
(g) consideration of effects on women (convenient siting of latrines for women and children; consequences of burned-brick making on women's firewood collection).

For a wide-scale coverage in a shorter period it could therefore be considered to add a third alternative to the permanent and semi-permanent VIP-latrines: the improvement of existing pit-latrines with movable latrine slabs. This would be less costly[3] and complex, yet facilitate the solving of the major problems of difficult cleaning and risk of collapse from frequent wetting (leaky or no roofs; water used for cleansing and handwashing; disposal of other waste water in latrine). Only where flooding is a problem special latrines will have to be built. The problem of periodic pit digging can be reduced by using a village-owned hand-auger. The problem of smell would in this case not be solved as it is with the VIP latrine. This is no health risk as such, but it may keep people from always using a latrine[4]. For health risks from flies and mosquitoes, a cover is needed in both types of latrine[5].
Further consultation on this matter is necessary with the organisations involved in rural sanitation in Tazania: the Division of Environmental Sanitation and the Health

1) See A.M. Wright, Low-Cost Sanitation in Tanzania, Report on Mission to United Republic of Tanzania, October 23 to November 15, 1981, TAG/UNDP/ GLO/78/006, March 1982.
2) In 1981, this was Tsh.298 per latrine, when burned bricks are used for pit lining; for a cement-lined pit a higher subsidy may be neccesary, but it greatly reduces demands on firewood. Just these great demands on firewood has made SIDA decide not to support local burned-brick making industries.
3) Non-local materals ca. Tsh. 40 per slab; for auger-drilled pits lining will however be needed.
4) Although bad smell is one of the felt problems of pit latrines, it is not clear in how far this influences latrine use.
5) An additional spin-off of the VIP latrine is the use of the new building techniques learned for other village constructions (A.M. Wright, personal communication).

Education Unit in the Ministry of Health, the Low-Cost Sanitation Unit in the Ministry of Lands, Housing and Urban Development, UNDP's Technical Advisory Group for Sanitation and UNICEF.

(9) Another planning issue for a greater health impact is the facilitation of a regular supply and low price of soap for rural villages. Alternatively, it may be considered to strengthen local soap production, as part of the Community Development Programme, developing where possible local alternatives for essential ingredients (e.g. banana leave ash for caustic soda).

(10) With regard to Community Development, the study shows that it is important to create a special village organization which includes several women and explicitely takes on the local responsibilities for the domestic water supply in all project phases. Its members will have to be trained on their technical, health communication and management tasks in cooperation with the local health staff and technical teams. In addition, the CD workers can assist in solving any problems between the technical project and the village, and stimulate the committee to carry out regular evaluations of villages maintenance. water-use and hygiene.

(11) A directive from the Ministry of Health on the gearing of local health education to village water supply projects would facilitate the cooperation between the water projects and the local health staff. On its side, the project team should contact the local health staff as soon as the project is initiated in their villages, for mutual cooperation and coordination.

(12) A similar directive can be given on gearing of school health education to a local water supply project for practical lessons and field work.

(13) For the actual village health education, it is suggested that the local health staff assists the village water sub-committee to:
   (a) identify the main transmission risks of water-related diseases in their village (through joint observations, informal interviews, etc.)
   (b) draw up and implement a local health education and action plan; and
   (c) evaluate its short- and long-term effects.

In addition, the health staff can greatly support local action by organizing demonstrations and discussions of environmental health risks at the various places of risk and with the various target groups[1].

1) E.g. on source selection and water boiling with women near traditional sources, on bilharzia risks and village action with schoolchildren, teachers and water committee, on latrine improvements with male heads of households etc.

(14) Short training courses are an important key to a more integrated, locally-specific, systematic and two-way health education:
   (a) refresher courses for local health staff on latest subject matter, participatory health education methods and evaluations;
   (b) training of selected villagers (Village Pump Caretakers, members of VWSC) in subject matters and discussion technics for health education as part of village-level training;
   (c) Orientation of technical teams on health issues and communication with villagers during fieldwork.

(15) For the sake of villages where no immediate water projects are possible, this training can include basic self-improvements to traditional sources (coordination MAJI-RCU-CDTF?).

(16) The high proportion of households with radios sustains the suggestion for a special radio group listening campaign on water and sanitation, that was made in an earlier report (Annex 1, no. 2). Financial support from one of the bilateral water project donors for such a campaign is warranted by the extensive and successful experiences with such campaigns in Tanzania. Alternatively, it can be considered to include a special series on water and sanitation in a served and an unserved village in the existing radio health education programme[1].

(17) Special issues for further research on water and environmental health behaviour are:
   (a) the degree to which villagers understand the various relationships between local conditions and behaviour and water and sanitation-related diseases;
   (b) the long-term effect of a participatory and integrated form of health education on water and sanitation, in comparison with the existing type of health education;
   (c) impact of various water use practices on quality of collected and stored water (see Chapter V, section 5).

(18) In general, water projects could have a greater impact on village development when technical agencies (MAJI, RCU, donor projects) work closer together with existing research institutes and departments, such as the Institute for Resource Assessment and the Department of Community Health in the University of Dar es Salaam, Centre for Educational Development in Health; African Medical and Research Foundation and Planning and Research Division of the Community Development Department in PMO. In their turn, the social scientists will in their research and recommendations have to take into account the technical and economic realities of water projects (e.g. production targets and cost aspects).

1) Essential for a good impact is of course that radio batteries are available and affordable and that the health education programme has a large and faithful audience. These questions are not answered in the present study.

LIST OF PROJECT DOCUMENTS

1. IRC, Project Profile for the Development of a Community Participation Component in the Tanzanian Rural Water Supply Programme, Rijswijk, November 1980, 18 pp.

2. White, A.T., Project for the Development of a Community Participation Component in the Tanzanian Rural Water Supply Programme, Draft Interim Report, URT/MAJI/DGIS/IRC, September 1981, 117 pp.

3. BRALUP/IRC, Village Water Supply and Community Participation in Tanzania, Report of a National Workshop held in Dar es Salaam, Tanzania, July 14-16, 1981, Dar es Salaam/Rijswijk, July 1982, 136 pp.

4. Kirimbai, M.; van Wijk, C., Project for the Development of a Community Participation Component in the Tanzanian Rural Water Supply Programme, Profile for Field-Testing and Application of Results, MAJI/PMO/DGIS/IRC, July 1982, 18 pp.

5. Van Wijk, C., Maintenance and Repair Systems for Handpump Wells, An Appraisal Study, (Draft) IRC, Rijswijk, February 1983, 39 pp.

6. PMO/IRC, Project for the Development of a Community Participation Component in the Tanzanian Rural Water Supply Programme: Preliminary Report, Dodoma/Rijswijk, March 1983, 49 pp.

Present Follow-up in Study Villages

The initial results of the survey were reported back to the villagers in a general meeting, as part of the general community participation project. As a result of this and other discussions and observations of the villagers with the CD fieldworkers and local health staff, village water sub-committees have been established in each village. With the assistance of the health and CD workers, these committees have planned local health education and action programmes in each village. (The contents and activities of these local programmes will be described in the final report). The programmes are monitored by the CD workers.
The short-term impact of these programmes is presently evaluated in 2 of the study villages (Mhenda and Kihelezo). Due to a shortage of manpower and funds, the study can not be repeated in the other villages, nor is it presently possible to study the so-important long-term effects. It is however hoped that such follow-up will yet be possible. The regional health authorities, the Health Education Unit of the Ministry of Health and the Department of Community Health of the University of Dar es Salaam are greatly interested in such a follow-up and would actively participate.