Target 29—Control of hazardous wastes
By 1995, all Member States should have eliminated major known health risks associated with the disposal of hazardous wastes.

Target 24—Human settlements and housing
By the year 2000, all people of the Region should have a better opportunity of living in houses and settlements which provide a healthy and safe environment.

Target 25—Working environment
By 1995, people of the Region should be effectively protected against work-related health risks.

Target 26—System based on primary health care
By 1990, all Member States, through effective community representation, should have developed health care systems that are based on primary health care and supported by secondary and tertiary care as outlined at the Alma-Ata Conference.

Target 27—Rational and preferential distribution of resources
By 1990, in all Member States, the infrastructures of the delivery systems should be organised so that resources are distributed according to need, and that services ensure physical and economic accessibility and cultural acceptability to the population.

Target 28—Contents of primary health care
By 1990, the primary health care system of all Member States should provide a wide range of health-promotive, curative, rehabilitative and supportive services to meet the basic health needs of the population and give special attention to high-risk, vulnerable and underserved individuals and groups.

Target 29—Providers of primary health care
By 1990, in all Member States, primary health care systems should be based on cooperation and teamwork between health care personnel, individuals, families and community groups.

Target 30—Coordination of community resources
By 1990, all Member States should have mechanisms by which the services provided by all sectors relating to health are coordinated at the community level in a primary health care system.

Target 31—Ensuring quality of care
By 1990, all Member States should have built effective mechanisms for ensuring quality of patient care within their health care systems.

Target 32—Research strategies
Before 1990, all Member States should have formulated research strategies to stimulate investigations which improve the application and expansion of knowledge needed to support their health for all developments.

Target 33—Policies for health for all
Before 1990, all Member States should ensure that their health policies and strategies are in line with health for all principles and that their legislation and regulations make their implementation effective in all sectors of society.

Target 34—Planning and resource allocation
Before 1990, Member States should have managerial processes for health development geared to the attainment of health for all, actively involving communities and all sectors relevant to health and, accordingly, ensuring preferential allocation of resources to health development priorities.

Target 35—Health information system
Before 1990, Member States should have health information systems capable of supporting their national strategies for health for all.

Target 36—Planning, education and use of health personnel
Before 1990, in all Member States, the planning, training and use of health personnel should be in accordance with health for all policies, with emphasis on the primary health care approach.

Target 37—Education of personnel in other sectors
Before 1990, in all Member States, education should provide personnel in sectors related to health with adequate information on the country's health for all policies and programmes and their practical applications to his own sectors.

Target 38—Appropriate health technology
Before 1990, all Member States should have established a formal mechanism for the systematic assessment of the appropriate use of health technologies and of their effectiveness, efficiency, safety and acceptability, as well as reflecting national health policies and economic restraints.
have brought about a reduction in diarrhoeal disease, these included an improvement in access to water in quantity. Thus, if charging for water were to deter low-income consumers from using it in desirable quantities, it could undermine the important health benefits which investments in water supply seek to achieve.

The present study used the widespread practice of water vending in the squatter areas of Khartoum, Sudan, to measure the impact of price on the water consumption of low-income households. The price charged at the consumer’s door by these water vendors depends on several factors, particularly the distance over which they have to transport the water in their donkey carts, the time they must spend queuing at the borehole to fill their carts, and the price of donkey fodder. Since the water price varies from one area to another, comparable low-income households could be interviewed and observed with a view to making an assessment of the price elasticity of their demand for water for domestic purposes.

SURVEY AREAS

Two survey areas were selected in squatter settlements in Greater Khartoum. They were chosen as communities with low but comparable average incomes, unserved by house connections, largely reliant on water vending. These included a couple of boreholes to the north and west, where long queues of vendors’ carts built up, some households in an adjoining settlement which had private connections, and an irrigation canal to the east. Vendors bought water from the boreholes for LS 0.30 per drum, or LS 0.60 per cart. Water from the boreholes and the pumped supply was sold by vendors in Karton Kassala for LS 0.50 per drum (occasionally LS 0.60 for LS 4.00), and canal water at LS 2.50 to 3.00 per drum in recognition of its poorer quality.

Water was not always so expensive in Karton Kassala. According to local informants, the canal running along the southern edge of the settlement served as a convenient source until July 1986, when it was shut off. Later that year, and shortly before our survey in early 1987, the borehole serving Karton Kassala was also shut down, so households built further house construction. As these two measures progressively reduced the availability of water, obliging vendors to travel farther and wait longer in queues, the price of water rose from LS 1.50 to LS 3.00 and then to LS 5.00 per drum.

Less precision can be attached to our data regarding the quantities of water used for specific purposes. These are not accurate enough for a comparison between the study areas, but are given here to provide an overall picture of the prevailing pattern of water use. In the following discussion, household figures used are those derived from the household interviews.

METHODS

A sample of households was selected in each community, using sampling points marked at random on a map (for Karton Kassala, an aerial photograph) to give an even spread throughout the community. The 5 households nearest to each point were identified on the ground. In Meyo, one of these was chosen at random for interview; in Karton Kassala, all five were interviewed. A detailed interview schedule was followed to ascertain levels of income, household size and other characteristics, water price and the volume of water used during the previous 24 hr. The interviews were conducted in Arabic by local women, who had previously been trained to identify and assess the capacity of the various vessels commonly used for water, and who sought out and interviewed the senior woman in each household. The interviewers had also been trained to collect information on a variety of possible income sources including the brewing of drinks, selling of foodstuffs, selling of fodder, rearing of livestock, and receipts of remittances from absent relatives as well as wage labour.

In order to verify the accuracy of the interview responses, 14 of the 27 households interviewed in Meyo were also observed from 6 a.m. to 6 p.m. over 2 days, and interviewed twice each day regarding the use and storage of water which had been seen to be purchased.

RESULTS

Validity of interview data

Figure 1 shows the results of the interviews and of household observation with regard to total daily water consumption. The agreement is reasonably good, both in terms of the aggregate consumption of the 14 households observed, and that of the individual households. Such discrepancies as appear are within the range of difference between observed water collection and stated water consumption which is likely to arise from overnight storage of water. It is understandable that there should be better agreement between observation and interview data in this case than in other studies of domestic water consumption; it is easier for households which pay for water to remember how much they have purchased than for families to recall the amounts they have used from a free and unlimited supply.

Wage levels in Khartoum are very low; a typical unskilled wage rate in Khartoum at the time of the survey was LS 150/month. Many households in both areas therefore had more than one source of income. Foreseeing some difficulty in collecting reliable information on all these, the interviews included questions relating to the type, size and ownership of the house, and to possession of items such as radios and bicycles, as observable indicators of the socio-economic status of each household. In the event, direct information regarding all sources of income was readily forthcoming from 22 of the 27 households in Meyo and 28 of the 30 in Karton Kassala.

The average household incomes derived from these interviews are similar to those found in other surveys in similar areas of Khartoum [8, 9]; if anything, we found slightly higher average incomes. Moreover, the wage rates quoted by individuals and households were in good agreement with estimates for the corresponding occupations, arrived at by consensus in a number of group discussions with various informants in the communities studied (Table 1). Finally, reported household incomes were associated with the observable proxy indicators of socio-economic status. For example, in Karton Kassala the mean reported income of households which owned a working radio was more than twice that of those which did not. These considerations give us confidence in the general reliability of the household income data, though some degree of error is inevitable in such surveys.

The proxy indicators were therefore not used in the following analysis, except to indicate the approximate comparability of the two areas (Table 2). No households refused to be interviewed.

Comparison between the two areas

The comparison of the two areas with regard to mean household size, income per head, water prices and other income sources, shows that Karton Kassala was more urbanized and had a higher socio-economic status than Meyo. The average household income in Karton Kassala was approx. LS 1000 while in Meyo it was LS 800. The percentage of households with electricity was considerably higher in Karton Kassala, and ownership of a television and a car was much less common in Meyo than in Karton Kassala. Also, the mean water storage capacity per household was significantly higher in Karton Kassala than in Meyo.
and water consumption is shown in Table 3. The average water consumption in Meiyo was 22.4 litres per capita per day (l.c.d.), a fairly typical figure for standpipe users in urban Africa [10]. Remarkably, the mean water consumption in Karton Kassala was 27.0 l.c.d.—no less (but not significantly higher) than the figure for Meiyo where water cost one third the price. Of course, any given household’s consumption—the average number of members in the households surveyed, over the full range of income levels [11]. Thus the relationship between income and water consumption—the income elasticity of demand for water—can be examined without the risk of confounding by the household size. Figure 3 shows the mean total water consumption for the households at each level of income, with the results presented separately for Meiyo and Karton

<table>
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<tr>
<th>Table 3. Comparison of mean household size and income, water prices and water consumptions in Meiyo and Karton Kassala</th>
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<tr>
<td></td>
</tr>
<tr>
<td>Mean household size</td>
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<td>Mean household income per head (LS/month)</td>
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<tr>
<td>Mean water price (LS/litre)</td>
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<td>Mean water consumption (l.c.d)</td>
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<td>Mean % of income spent on water</td>
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Notes: *Averaged by household *Averaged by individual

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<tr>
<th>Table 4. Water consumption by households using water bought at different prices in Karton Kassala</th>
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<td>Source of water</td>
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<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>Bottled or tap only</td>
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<tr>
<td>Bottled and canal</td>
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<td>Canal water only</td>
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Fig. 2. The proportion of water used for each purpose in Meiyo and Karton Kassala.
Among the poorest households, the only major item of expenditure available for sacrifice to meet the cost of water is their food. It is therefore probable that the high cost of water in the squatter areas is a major contributor to the high rates of malnutrition which prevail there [9], and hence that a reduction in this price has a significant impact on the nutritional status of the poor, as well as permitting expenditure on other items such as health care.

It can only be concluded that low-income householders in Khartoum set a high value on their water consumption, and consider that they have reduced it to the bare minimum beyond which they are not prepared to go. Since malnutrition and child mortality are related, it would appear that their children sometimes pay for water with their very lives.

The high value set by the poor on their water consumption can also be seen in terms of the consumer surplus. When the elasticity of demand is effectively nil, as in this case, the consumer surplus is very large indeed. That is to say, the value of water to the low-income residents of Khartoum has been shown here to be greater than the already large amounts which they pay for it, and a substantial proportion of their total income. Wealthier householders with house connections would presumably set at least as a great a value on water as the poor, although they actually pay substantially less for it. The consumer surplus for them is therefore likely to be larger. Such a valuation, if used for appraisal of water supply projects by international funding agencies, would yield cost-benefit ratios or rates of return far more favourable than those obtained hitherto.

There is now an urgent need to examine the degree to which these findings are applicable to other poor urban communities in the developing world, and also to reassess the policies of urban water supply agencies towards the informal market in water vending, as it meets the needs of the poorest, whom they frequently fail to serve.

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REFERENCES


