[Workshop on Planning for Health and Socio-Economic Benefits in the Water and Sanitation Sector : various papers]

UNICEF, Labouisse Hall
New York, 21-22 April 1993

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WORKSHOP ON PLANNING FOR HEALTH AND SOCIO-ECONOMIC BENEFITS
IN THE WATER AND SANITATION SECTOR

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Improving Cost-Effectiveness of Rural Water Supply and Sanitation Programmes

by

Ashok Nigam and Dick Heyward

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Improving Cost-effectiveness of Rural Water Supply and Sanitation Programmes

by
Ashok Nigam and Dick Heyward[1]

I Introduction

In Africa and Asia, an estimated 1900 million people need improved water supply and 2300 million people need improved sanitation facilities by the year 2000 for universal access to safe water supply and sanitation in these two continents alone. In addition, a number of facilities provided in the 1980s and 1990s will be approaching the end of their useful life and will need rehabilitation over and above the operations and maintenance that needs to be carried out. If developing country actions and the support of the developed countries continues at the same rate as in the 1980s, and even if the cost of these facilities was to remain constant in current prices, the number of unserved people in developing countries would be greater by the year 2000 than today. Accelerated actions using integrated cost-effective approaches and innovative means of financing will be needed if this fate is to be avoided. This paper discusses the scope and areas for improving cost-effectiveness primarily in ***rural*** water supply and sanitation (RWSS) and provides some decision points in this regard for field operations.

Cost-effectiveness means the achievement of objectives with the minimum expenditure of resources. By definition it has two components. First, it implies delivery of services in the least cost and most "efficient" manner raising questions with regard to the delivery mechanisms, appropriate technologies and scope for cost reduction within technologies. Initial investment cost alone is not the criteria in the choice of technology since safe water and sanitation is expected to provide long-term benefits relating to improved health, economic and social conditions. The lack of sufficient resources, however, constrains the choice of technology to the low-cost options. Second, the effectiveness of RWSS must be measured in terms of the sustained benefits. While a number of attempts have been made at quantification of these benefits, it is not always easy. The conclusions reached from some of these attempts can be summarized as:

- Safe water supply and sanitation is a necessary but not sufficient condition for health impact. While there is a significant positive impact on health, it cannot necessarily be expressed in quantitative terms;
- Economic justification for rural water supply can be made in terms of time saved, particularly that of women and young girls. The related benefits cannot be fully stated in financial terms because they include time available for taking care of children, working in fields or house gardens for food production, household work, pursuing literacy and other training or simply rest. In fact, there are a whole range of economic benefits such as the increases in output and productivity which could be achieved if people do not fall ill repeatedly from water-borne diseases.
- RWSS is a mechanism for enhancement of community management and for empowering and promoting women in development.

By their nature these benefits are not susceptible to full valuation which may be considered

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necessary for a quantitative cost-effectiveness exercise. Quantitative estimates of cost-effectiveness by gender or health impact need to consider opportunity costs of labour and shadow wage rates which are fraught with measurement problems. Despite this, the benefits from improved RWSS remain indisputable and much of the debate could usefully focus more on improving cost- effectiveness through technology choice, cost-reduction, delivery mechanism, community involvement and integration with health and education for maximum impact.

A strategy which combines these aspects, and includes the restructuring of internal and external financial resources and institutions in favour of the unserved population, can be key to increasing coverage. Often measures of cost-effectiveness in RWSS look at the number of lives saved or the cost of reducing cases of diarrhea. In fact, the effectiveness of RWSS is much wider as noted earlier and cannot be measured by the provision of low-cost facilities alone. In providing water supply, the impact must be measured at the point of consumption and not at source only since water can be contaminated in transportation and storage reducing its health impact. Also as argued later, in looking at effectiveness the choice is not between the delivery of RWSS against provision of health services because this is not a useful approach in view the significant direct and indirect linkage effects that are created by RWSS. While the health impact is important, it belongs more in the domain of a cost-benefit study.

Some measures of cost-effectiveness would be:

(a) at the technical level, the number of dry wells or the number of non-functioning wells at any particular time;

(b) at the managerial level, the amount of time spent on drilling, and the number of boreholes drilled but not fitted with a handpump. Minimizing the time at both these stages can both increase output and impact;

(c) at the social level, the number of water committees that are working.

In more targeted studies the quality of water supply at the point of consumption and the amount of water used for hygiene could be used as indicators. Similarly for sanitation, the number of people who have latrines and are: (i) using it; and (ii) combining usage with proper hygiene.

Capital Cost of Water Supply and Sanitation

In estimating the total capital cost of provision of water supply and sanitation, the operative consideration is the initial investment cost. These costs have to be borne by someone whether it is the government, communities, donors or households. They represent an initial outlay, subsequent to which there will be recurrent operation and maintenance costs. A number of per capita cost estimates have been carried out for various countries. Table 1 below uses the weighted average *cost at current prices* for individual countries in Africa to estimate the total cost. For Asia the per capita cost is much lower although the absolute population to be covered is higher. This results in a lower total capital cost for Asia than Africa.

TABLE 1

ESTIMATED CAPITAL COST OF PROVIDING RURAL AND PERI-URBAN
WATER SUPPLY AND SANITATION IN AFRICA AND ASIA BY THE YEAR 2000

	AFRICA			ASIA			TOTAL		
	Pop.to be Covered (M)	Per Capita Cost US$	Total US$bn.	Pop.to be covered (M)	Per Cap Cost US$	Total US$bn.	Pop.to be covered (M)	Total US$bn.	Annual Cost US$bn.
Water Supply									
Rural									
Peri-Urban	348	32	11.13	818	6	4.91	1166	16.04	2.0
Total:	130	95	12.35	312	6	1.87	442	14.22	1.8
	478		23.48	1130		6.78	1608		3.8
Sanitation									
Rural	417	10	4.17	1209	4	4.84	1626	9.01	1.1
Peri-Urban	134	25	3.35	305	4	1.22	439	4.57	0.6
Total:	551		7.52	1514		6.06	2065	13.58	1.7

Source: OAU/UNICEF (1992) and estimates by Nigam & Ghosh 1993 for Asia.

The annual capital cost of ***rural and peri-urban*** water supply in Africa and Asia over the eight years to 2000 is estimated at $3.8 billion and sanitation $1.7 billion. In addition, there would be annual recurring costs, which have generally been estimated at about 5 percent of investment costs, amounting to about $190 million for water supply and $85 million for sanitation. The much lower per capita cost in Asia can be attributed to a number of factors, such as generally lower system management cost, availability of trained national staff for delivery of facilities at a fraction of the cost of international staff, local manufacture of raw materials and spare parts, geological conditions and cultural differences in the perception of people regarding the need for facilities, particularly sanitation, generally ascribed to a "way of life". The single major constraint to universalization of water and sanitation programmes in Africa is its capital investment cost. While in Asia investment costs are slowly going down in spite of inflation, the opposite is true in Africa. Unless these basic costs are reduced, through various means discussed below, the goal of universal access will be impossible to achieve. Experience in Asian countries, such as India, has shown that cost-reduction is feasible allowing coverage of a large number of people with the limited resources.

Actions for improving cost-effectiveness must be targeted at both the cost side of the equation to reduce the unit cost of the facilities and at the effectiveness of the delivery mechanisms for maximizing benefits and promoting *sustainability*. Section II discusses the scope for cost-effectiveness through the choice of technology. Section III examines areas and scope for cost reduction in the most dominant rural water supply technology - the handpump - and the more popularized models of sanitation. Section IV looks at cost-effectiveness of RWSS in the context of health and education programmes. Section V summarizes the widely accepted view on the participation of women and the community, particularly for village level operations and maintenance for greater effectiveness. Section VI looks at the short and long-term implications for costs and sustainability as a result of the operations and maintenance costs. Finally, Section VII looks at the role of sector planning, monitoring and accountability for improving cost-effectiveness.

II Choice of Technology

Improving cost-effectiveness through choice of technology is premised on the realistic assumption that most of the population in need of improved facilities will have to be provided with low-cost solutions. While a wide range of options are available, the costs and potential benefits differ for each option.

Equally, measuring benefits from improved facilities is difficult, involving technical, economic, behavioural, nutritional and public health factors. In the case of water supply the scale of benefits has to be measured on the basis of two criteria: the service level and reliability. In the case of sanitation the criteria are: service quality (degree of privacy and cleanliness of the facility) and associated hygiene; and acceptability of the facilities to the community based on cultural factors.

A range of technologies have been developed in both water supply and sanitation which are appropriate for different environments and geological conditions and designed to suit consumers particular needs, cultural preferences, value system and affordability. The market approach would argue that, in any particular setting, the technology chosen should give the highest service level for which users are willing to pay. However, market failures render this neo-classical approach inappropriate for RWSS in many developing countries. The market failures arise out of: (a) the unrealistic assumption that the income distribution in a given setting is optimal; (b) existence of externalities in both economically productive sectors and health; and (c) increasing returns to scale which can only be reaped by a consolidated and co-ordinated large scale operation. Consequently, the modified market approach would argue that technology choice should depend on achieving the maximum sustainable benefits, given the current institutional and community capacity, and affordability. If effective demand, as reflected in willingness to pay, is chosen as the critical criteria, then many people, particularly the poorest, would not be able to obtain improved water supply for a considerable period of time. Nevertheless, affordability by the government and the community is an important decision variable, if some level of improved water supply is to be provided today as opposed to some distant date in the future. The main consideration, therefore, in deciding on the appropriate technology is the highest service level based on present affordability and capacity to deliver. The following factors are important in the choice of technology:

- **Financial resources** for both capital and recurrent costs. For a large part of the rural sector the capital resources may need to come from the government, donors or international agencies. A significant portion of the recurrent costs must, however, be borne by the communities themselves for sustainability and proper use of the facilities as a number of studies have concluded.

- **Aspiration level** of the beneficiary. Aspiration level of the community by definition varies with time and is influenced by financial and non-financial resources and the education of the community. If the beneficiaries do not exhibit a desire for a particular level of service and technology, the effectiveness of the technology will be affected as reflected in its level of usage and operation and maintenance.

- **Organizational resources** including manpower and institutional. Both the government technical services and the communities must be mobilized for effectiveness of the technology chosen and should have the capacity and willingness to provide it.

Regardless of the technology chosen, intervention by the government to provide an improved water source at any given time, must be considered as final. Future improvements can be considered depending

on changes in the communities, affordability, aspiration level, and organization capacity.

Rural Water Supply

A range of technologies can be considered on the basis of the above factors. If the benefits are to be sustained, the community should be able to perform and pay for the regular operations and maintenance of the facilities. Table 2 provides the most recent system and per capita capital cost of different technologies in UNICEF supported programmes in Asia. The usefulness of this data is to some extent limited because it does not distinguish between the cost of new and rehabilitated systems in water supply and the use of possibly different methodologies in cost estimation. Nevertheless, it is indicative of the range of cost variation across countries. Public standpipes and gravity systems are the more expensive technologies considered here. The average cost of a borehole with handpump ranges from $135 in Vietnam to $3350 in China with per capita cost ranging from $1 to $17. These costs are highly sensitive to wage and salary levels, cost of materials, management and the local/import mix.

TABLE 2

COMMUNITY WATER SUPPLY AND SANITATION TECHNOLOGY COSTS IN SOME ASIAN COUNTRIES

	CHINA		VIETNAM		INDONESIA		LAOS		SRI LANKA	
	Avg. Capital Cost per System (US$)	Per Capita Cost (US$)	Avg. Capital Cost per System (US$)	Per Capita Cost per System (US$)	Avg. Capital Cost per System (US$)	Per Capita Cost (US$)	Avg. Capital Cost per System (US$)	Per Capita Cost per System (US$)	Avg. Capital Cost per System (US$)	Per Capita Cost (US$)
WATER SUPPLY										
(New & Rehabilitated Systems)										
Public Standpipes	64,000	27	-	-	4,000	20	-	-	485	5
Borehole with Handpump	3,350	17	135	0.9	550	11	300	2	1,000	10
Protected Dug Wells	8,700	23	104	0.7	50	2	294	2	415	9
Gravity System	N/A	N/A	15,000	3	40,000	16	3,037	4	2,142	15
Protected Springs	-	-	-	-	1,180	4	-	-	500	10
Rainwater Collection	18,700	20	21	3.9	385	27	36	6	-	-
Slow Sand Filters			100	.7						
SANITATION										
(New Systems)										
Pour Flush										
Two Jar Latrines	-	-	15	2.5	25	5	26	4	69	14
	80	10	-	-	-	-	-	-	-	-

Source: UNICEF, Programme Information Data Base, 1992.
Data on cost are preliminary. Although a significant number of water supply facilities provided are new, the cost of some rehabilitated systems was also included in the total cost.

In Africa, the cost of a borehole with handpump varies from $4000 to over $15,000 depending on geological conditions, depth, wage levels etc.. The cost for different technologies is also highly variable as shown by Table 3 for Uganda. The operative decision variable in the in-country choice of technology should be the annualized per capita cost of the system. A number of estimates of annualized costs of various technologies are available. On this basis, and in view of limited resources, the decision on which technology to use in a particular setting could usefully start with an examination of the scope for improving existing systems. Often the improvement in the existing low-cost system such as lining of a hand dug well and covering the well, improving the spring protection etc. can provide adequate quality water supply compared to a more costly borehole with handpump. Thereafter, a step wise approach moving to increasingly more costly technologies based on geological, financial, acceptability

and organizational capability criteria should be considered. This implies that the borehole with handpump is by no means to be advocated as the only medium-term technology.

TABLE 3

RURAL WATER SUPPLY CAPITAL COST FOR DIFFERENT TECHNOLOGIES IN UGANDA
(US$)

TECHNOLOGY	RANGE	MEDIAN COST	POPULATION	PER CAP.COST
New Boreholes	7,000-8,000	7,000	213-320	23-36
Protected Springs	1,200-2,157	1,700	150	11
Dug Wells	4,290-4,500	4,400	150	29
Augured Wells	3,162	3,200	150	21
Rehab Boreholes	3,676-4,500	4,100	213-320	21
Gravity Schemes				60-115

Source: DANIDA (1991)

Within the handpump option, three have come into prominence. The India Mark II (later modified for easier village level maintenance as the Mark III) was developed in India and is in widespread use in a number of African countries and produced in some of them. The Afridev pump developed by UNDP/World Bank, a medium to deep-well pump, has the key feature of the extreme facility with which it is maintained - the village level operations and maintenance (VLOM) capability.[2] The Tara pump of Bangladesh is a direct action pump for shallow wells and is being manufactured in Asia, Europe and Latin America. It is necessary to examine the relative merits of a particular pump based on the hydro-geological conditions, standardization criteria and VLOM features in particular settings before deciding on the appropriate pump to use.

Rural sanitation

The choice of sanitation technology depends on a number of factors such as water availability, ground conditions, the risk of water contamination, population density, the potential for future up-grading; re-use of water and in particular cultural preferences. Significant advances have been made in the development of rural sanitation with the dominance of the Ventilated Improved Pit (VIP) latrine. Further developments in this technology, specifically its fly and odor capabilities, have enabled the consideration of a wide range of adaptation to the VIP latrines. Many of the adaptations depend on the nature of available local materials, differing cultural preferences and levels of affordability. In Africa, the costs of a VIP latrine varies from $15 to $25 per capita. In Nigeria, the VIP latrine has been adapted with the basic structure made of a local thatched material, including the roof, with the major requirement being the vent pipe and gauze. In Ethiopia, the development and use of the SANPLAT latrine has reduced costs to $5 per capita. The SANPLAT is a highly improved latrine slab with elevated foot rests and a drop hole shaped like a key hole. It can be fitted either with a tight lid or vent pipes.

Despite improvements in technology and its adaptation, a major constraint to the widespread use of improved sanitation facilities will be cultural. For example, in some cultures women cannot defecate in the same area as men because the mixing of their feces is regarded as an ill omen. Separate latrines must be provided for men and women which means either two separate latrines near the home or separate communal latrines. Basic education and health and hygiene education will need to be part and parcel of

[2] In Zimbabwe the Blair Pump was designed in 1976 and has been widely used for shallow wells and for wells up to 12 meters. It is a low-cost, easy-to-maintain handpump.

the provision of facilities. This means that considerably more spade work is needed for behavioural change.

III Cost-reduction

The significantly higher per capita cost of service delivery in Africa compared to Asia cannot be explained by wage and salary levels and the cost of imported inputs alone, although these are no doubt important. This section presents an analysis of the cost of water supply through a drilled borehole with handpump. The analysis indicates potential areas for cost-reduction and the expected magnitude of the benefits.

Analysis of rural water supply project costs

The significant variations of in-country and cross-country cost of a borehole with handpump can be seen both from the UNICEF (1990) study and UNDP/World Bank (1991) study of seven West African case studies. In the UNICEF study of four countries, which was based on data gathered and analyzed using consistent methodology, the unit cost of a successful borehole in Sudan varied from $2535 to $4119 (Table 4). In Benin, the estimated cost of a UNICEF supported borehole with handpump was $6260 in comparison to other donor agency costs ranging from $14,400 to $46,486. While the cost of individual boreholes can vary from region to region due to geological and locational factors, the significant variations that are observed suggests that there is considerable room for cost-reduction. The principal reason for the variation in UNICEF and other donor agency costs of a water point is the high cost of expatriate staff involved in other donor agency operations, the tied nature of the assistance provided and the relatively small scale of the operations.

TABLE 4

IN-COUNTRY AND CROSS-COUNTRY
COST OF BOREHOLE WITH HANDPUMP

	PAKISTAN	SUDAN			BENIN					UGANDA
PROGRAMME SUPPORT	UNICEF	North Kordofan UNICEF	South Kordofan UNICEF	Global Kordofan UNICEF	UNICEF	JAPAN	FRANCE ATACORO	FRANCE MONO	FRANCE S.BORGON	UNICEF
Unit Cost/ Successful Borehole	1997	4119	2535	2970	6260	46,486	17,000	15,000	14,400	6,844
Per Capita Cost	10	20.60	12.67	14.85	12.52	60	27.86	24.58	23.75	22.81

Source: UNICEF (1990)

The cost per water point using the borehole with pump in the seven West African case studies varied from $14,000 to $27,000 with a per capita cost variation from $24 to $128 (Table 5). 80% of the costs were directly related to well construction and pump installation; 15% to management and administration and 5% to extension services. Expatriate inputs averaged $3000 per water point and clearly contributed significantly to costs. The study concluded that ".. while the maintenance system

appears to be both replicable and sustainable, the extremely high construction costs limit replicability". (UNDP/World Bank, 1991).

With significant overhead costs, there is scope for economies of scale if the projects are implemented at a faster pace and the distances that rigs have to travel is reduced, allowing for more drilling time which could lead to a lowering of the cost per water point. While this argument is theoretically attractive, the scale of operations in some of the countries is constrained by institutional, political and financial factors and the lack of long-term commitment by donors which prevents cost-reduction through economies of scale to be fully realized. Nevertheless, in view of the scope for significant reduction in costs through increasing the number of boreholes drilled these constraints should be examined and alleviated. Such an analysis should take account of the marginal cost of increasing the number of facilities. While marginal costs may be lower as the scale of the operations increase, they could be higher in remote districts.

Results from both UNICEF (1990) and UNDP/WB (1991) studies and experience from other countries suggest that there is considerable scope for cost-reduction. In Nigeria, the costs have already been reduced by 55% from $20,000 for a deep borehole to $9,000. In Sudan, there was a 66% reduction from $9000 to $3000 and in Ethiopia there is a 64% reduction from $17,000 to $6,000. There are abundant examples from Asia to add further credence to cost-reduction as a major means for improving cost-effectiveness. We turn now analyze the areas in which cost-reduction can be achieved.

TABLE 5

BACKGROUND INFORMATION ON SEVEN WEST AFRICAN CASE STUDIES

PROJECT	Manbsom Burkina Faso	Yatenga Burkina Faso	Aqua Viva Mali	Mali-Sud Mali	Kita Mali	Maritime Togo	Plateau Savane Togo
Principal Donor	Netherlands	EDF	France	Switzerland	IDA/WB	Canada	USA
Project Area (Sq.km.)	80,000	12,300	70,650	39,100	32,250	6,900	17,000 and 8,470
People Served (000'S)	390	331	158	292	160	65	600
Communities Served	600	479	500	487	294	240	850
Cost per Person (US$)	33	44	51	48	68	128	24
Cost per Water Point (US$)	16,500	21,500	14,000	23,500	22,500	27,000	15,500

Source: UNDP/World Bank (1991).

The UNICEF study provides the most detailed and consistent breakdown of the cost components for four countries which is amenable to analysis as shown in Table 6. Material inputs in general make up 30-40% of total costs. Staff costs vary from a low of 20% in Pakistan to a high of 35% in Benin. The balance comprises of depreciation and support costs. The scope for cost reduction in each of these areas is discussed below.

System Management. Control of system management costs can reduce the unit cost of a water point significantly. However, there are limits depending very much upon the technical and management capacity, available in the country and the quality of programme management. Countries which generally have the capacity such as Pakistan, can deliver the output using relatively more local staff instead of

costly expatriate staff. In other countries, particularly where the leakage in staff costs is high, for example, through corruption or inefficiency, or there is insufficient and/or inefficient local system management expertise, the use of expatriate staff is imperative for success until sufficient national capacity is available. While system management costs can be controlled to a certain extent, much of the efforts in the short-run could usefully be directed at ways and means of increasing output using the available manpower resources which could contribute to both an increase in the number of facilities and unit cost reduction. In this context, greater co-ordination between the donor agencies active within the country and their long-term commitment of resources in the provision of rural water supply can contribute to a significant reduction in system management costs.

TABLE 6

Inter-country Comparison of Costs of Drilled Borehole with Handpump (Cost figures in US$)

	PAKISTAN	SUDAN	BENIN	UGANDA
Capital Costs				
Staff:	395	1062	2166	2094
Material:	807	1598	1850	2142
Contracts/Consultancy:	359	-	-	-
Depreciation & Support Costs	436	1459	2244	2608
Total (unit cost per borehole)	1997	4119	6260	6844
Cost per capita	10.00	20.60	12.52	22.81
Number of successful boreholes	108	343	122	245
Number of beneficiaries per borehole	200	200	500	300
Average depth (meters)	30	58.87	57.5	66.6
Cost per meter drilled	50	64	109	71
Failure rate (Unsuccessful boreholes/total drilled)	4.4%	28%	17.6%	7.5%
Community Involvement	Poor	Poor	Poor	High
Delivery Mechanism	Govt.Team	Govt.Team	Govt.Team Paid by Community	Local Contractor

Notes: Depreciation costs cover all capital assets such as drilling rigs, compressors, vehicles etc.. Support costs were estimated for government, UNICEF Headquarters, UNIPAC, and UNICEF Regional and Country Offices

Source: UNICEF (1990)

Capacity Building. Long-term cost reduction and sustainability in the sector can only be achieved if national capacity for delivery of these services is enhanced through training, planning and organization. Capacity building at the community, technical and managerial level will be needed for this purpose.

Contracts with Communities. Experience has shown that the "bottom up" approach whereby the community makes a request for assistance to obtain an improved water supply can have a greater impact through ensuring that the facilities are properly operated and maintained. Community feedback can be obtained through discussions with focus groups. Contracts with communities should be established for the provision of the facilities, their operation and maintenance, promoting sanitation and for imparting health and hygiene education.

Survey, Rig Monitoring and Technical Considerations. The largest single cost item in the handpump option, and one which acts as a constraint to expansion, is the drilling operation and drilling success rate. Correct choice of drilling equipment, drilling area, and drilling rig movement can reduce overall costs. Selection of the right equipment depends on the geological conditions and anticipated drilling depths. Proper surveys prior to drilling can contribute significantly to cost reduction. For example, in Nigeria the failure rate in the government programme, due to inadequate surveys, has been particularly high with a number of boreholes running dry after a short period of time. Since drilling costs are the single major component of cost, actions to optimize the use of surveys, rig movement and monitoring can have a major impact.

Experience suggests that improvements can be made in the purely technical and engineering aspects for lowering costs of a borehole with handpump. Some key factors are:

- Diameter of the well - Doubling the diameter of a well will not double the yield of a borehole. Increase in yield depends on: (a) permeability of water bearing formation; (b) draw-down during pumping; and (c) radius of circle of influence. The well diameter should be based on desired yield, type of pumping equipment, physical character of water bearing formation and type of well construction. This would suggest that a 4"-5" diameter well will be appropriate for a handpump. Increasing the diameter adds substantially to costs.

- Depth of a well - Deeper drilling does not necessarily result in higher yield but depends rather on rock formation and the aquifer. Scientific investigations and proper surveys will be needed to indicate the depth of drilling required.

- Equipment selection - Commonly there is an over-specification of the equipment required for drilling "just in case" it is needed. Large equipment not only requires greater capital investment but also means higher running costs as seen from the example of Ethiopia in Table 7. Equipment selection should be based on: (a) diameter of the well to be drilled; (b) average depth to be drilled with some spare capacity; (c) geological formation to be drilled; (d) accessibility to drilling sites i.e. maneuverability. For wider coverage smaller rigs should be preferred with larger rigs for drilling in certain areas only.

TABLE 7

Cost Comparison of Big Rigs vs. Small Rigs in Ethiopia

	Capital Cost US$ (000's)	Depreciation[1] (Daily) US$	Consumables per meter US$	Fuel cost per hour US$
Big Rigs	700	274	81	57
Small Rigs	520	204	43	23

[1] Depreciated over 7 years.

Source: UNICEF/UNDP World Bank, Proceedings of the Second National Handpumps Workshop, Addis Ababa (1992)

- Standardization - Non-standardization of drilling equipment, materials and handpump models increases the spare parts requirements increasing operation cost. The expansion of the rural water supply programme in India and its success were due to a great extent on the use of one type of handpump - India Mark II. It proved easier to develop the local production of hardware and software around this pump. The distribution system could also be built successfully around it with adequate incentives for private sector participation. In Ethiopia, there are more than 22 makes and 33 models of drilling rigs provided by 22 different donors. 8 of these donors purchased 14 varieties of rigs from the same manufacturer with 9 different carriers, 4 types of compressors, 16 engines, 4 mud pumps, 9 hydraulic pumps, 8 hydraulic motors and 4 hydraulic winches. Quite apart from the high cost of service delivery, the sustainability of the programme can suffer due the requirement for several different spare parts for each type of equipment.

- Logistics - The timely availability of materials, particularly imported items, can also help reduce costs. If economies of scale are to be realized and the drilling costs reduced, there should be sufficient advance planning and lead time for obtaining the supplies. Developing countries also need to be provided some form of "certainty" of financial support from donors to enable proper logistical planning. If financial support for programmes is cut or reduced mid-stream, the costs of rural water supply increases considerably. Idle rigs add significantly to costs. In Ethiopia, of 23 rigs in operation between 1987 to 1989 the average number of successful and unsuccessful wells drilled per rig per year was 6.2. Reducing rig downtime, an efficient back up service, operating a shift system so that boreholes are completed without stopping and planning rig movements based on cost and logistical considerations rather than political can also reduce costs.

- Productivity - Low productivity with high systems costs adds to unit costs of a water point. There is often a case for building an incentive system for local staff to increase output. This will have to be carefully designed to fit into the institutional, and wage and salary structure in cases where the water supply is provided by government teams so that it does not, in effect, become an excessive leakage and conflict with the sustainability of the government programme.

Local Production of Materials and Spare Parts. Imported inputs add both to the capital and maintenance costs and are a constraint to sustainability. The scope for medium-term cost-reduction in countries which have the capacity for local production of materials, including spare parts, without sacrificing quality, should be investigated. Malawi and Zimbabwe have both been able to conserve precious foreign exchange by promoting local manufacture. The long term impact on cost-reduction in such a strategy can be significant.

Contracting. The government alone cannot be expected to provide the facilities. Private sector involvement, through contracting will be needed. This means supporting the private sector through incentives and insuring that the conditions and environment exists for their operation. It could include providing an adequate market size to make it attractive for private contractors to invest in expensive drilling rigs and removing administrative bottlenecks. At the same time, the contractors will have to be properly monitored to insure that the process is effective.

Tariff Reduction. In a number of countries, particularly in Africa, it will be necessary and more cost-effective to import materials. The size of the country, its infrastructure and technical capacity can render it inefficient to promote local manufacture at least in the short-run. In these countries the cost of materials can be reduced if the government reduces or eliminates tariffs on imports for this purpose.

Estimate of magnitude of reduction in hardware costs

Any systematic analysis of the scope and extent of cost-reduction possible within technologies will need to be country-specific taking account of the geological, institutional and political factors. These cannot be captured in any global estimates of the extent of reduction possible; suffice to say that a number of areas have been identified for examination. However, we have estimated the scope of cost-reduction due to one factor alone - reduction in the borehole failure rate - in the case of Sudan based on data available in the UNICEF (1990) study. We estimate that if the borehole failure rate in Sudan was reduced from 28% to 10% as shown in Table 6, and after taking account of the additional cost for completing the unsuccessful boreholes, the per capita cost of a borehole could be reduced from $21 to $17 — almost 20% cost-reduction. In addition, if there is a 20% reduction in overall system management, material and overhead costs it would allow a total reduction of 40% in per capita cost reducing the per capita cost of a borehole with handpump from $21 to $13. A 30-40% reduction may not be an unreasonable expectation in many countries in Africa. One way to determine the scope and extent of cost reduction is to examine the costs of similar programmes run by different agencies as well as analyze own programme costs.

Analysis of Rural Sanitation Costs

The cost of sanitation comprises of the cost of facilities and health and hygiene education that must accompany it. Appropriate low-cost sanitation technologies should be promoted along with the provision of materials, interest free or low-interest loans and training. As argued in OAU/UNICEF (1992), the government must not provide the facilities but act as a promoter and facilitator. Households should be expected to pay for most of the costs, although the government could provide loans based on income levels.

Analysis of rural sanitation costs indicate that these can be reduced and community construction promoted through:

Local Production of Materials. Local production of materials should be encouraged. There is also scope for further experimentation in the use of materials for the construction of latrines. Different locally available materials can be tried and supported for the construction of the walls, roof and vent pipes of the VIP latrines.

Networking and distribution system. The government should support the development of a network and distribution system for materials at an affordable price, primarily through the private sector. Such a network could be linked to the provision of training through extension agents.

Sanitation costs have not been monitored to the same extent as water supply. However, if the government supports the provision of low-cost materials, the community could be expected to both adapt the technology and find new ways of reducing costs.

IV RWSS, Health and Education

The cost-effectiveness of RWSS - or even their effectiveness without cost comparisons - depends on the context in which interventions are made. For programming and operational purposes, the most influential elements of the context are health services and education (especially health and hygiene

education).

While there have been studies purportedly showing an expected reduction of disease (morbidity) of some 25% from improved water supply and sanitation (Table 8), these improvements certainly took place where there were health services and schools and perhaps literacy campaigns. Attempts have also been made to compare the effectiveness of RWSS with other interventions - and even the relative cost of a life saved, although the main motivation for RWSS is not this relatively rare occurrence but comfort and convenience.

TABLE 8

Expected Reduction in Morbidity and Mortality from Improved Water Supply and Sanitation

	All Studies	Better Studies
Diarrheal Diseases		
Morbidity:	22%	26%
Mortality:	65%	-
Ascariasis	28%	29%
Guineaworm	76%	78%
Hookworm	4%	-
Schistosomiasis	73%	77%
Trachoma	50%	27%
Overall Impact on Child Mortality	60%	55%

Source: Esrey, et.al. (1990)

Posing these services as options to choose from according to relative cost effectiveness does not seem a useful approach. Rather the programming objective would be to get an appropriate balance between RWSS and health services, with support from the school and other educational/information systems. For example it is obviously a questionable strategy to extend the health system to cure what could be prevented by RWSS, unless the health option has great cost advantages, which is not the case (see below). Moreover the wishes of communities usually concern schools, health centers/posts, and water - they are not so ready to commit themselves to supporting mono-focal interventions. But in about half of developing countries the coverage of health services is significantly wider than access to water, and much wider than access to sanitation.[3]

Contrary to a common misunderstanding, cost comparisons do not justify an unbalanced development of heath and RWSS services. The misunderstanding arises from the fact that it is usually capital costs that are cited for RWSS, while running costs are cited for health services. Naturally RWSS costs appear to be much higher.

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[3] United Nations, Human Development Report, 1992, Table 12. There are some countries in which access to water is wider than to health services so that the total for least developed countries is: 46% access to health services, 46% access to safe water, and 23% access to sanitation. But out of 53 "low human development countries" for which comparisons are given, 28 have greater coverage of health services than access to sanitation.

A comparison of annualized costs[4] shows costs per inhabitant for a district system in low-income Africa as follows:

- district hospital and health centers, some $5
- water (borehole and handpump) some $1-$2.50
- sanitation (VIP latrines) some $1.50

There are some additional costs for management.

With community contributions and user charges supplementing government and donor contributions (for capital costs), it is possible to finance health, water and sanitation in the most cost-effective combination even in least developed countries. In least developed countries, public expenditure on health is some 1% of GNP, which @ $237 per inhabitant gives some $2.4 (Human Development Report 1992). Unfortunately too much of this goes to tertiary hospitals; public expenditure is supplemented or often exceeded by private expenditure, and many district systems depend very much on user charges.

V Community and Women's participation

One primary lesson of the last decade is that the community should feel a sense of ownership of the facilities provided. This can be brought about to a great extent by their participation, particularly that of women, in both the installation, and operations and maintenance (O&M) of the facilities. In addition, the community can be expected to pay for part of the construction either in kind through voluntary labour or materials for constructing the area around the water point. It should also be expected to pay for a significant portion of the operation and maintenance cost. For greater cost-effectiveness, the community, particularly women, must be involved at every stage. Women, the main carriers of water, are both the primary beneficiaries and appreciators of a improved water supply system.

Community management implies the following steps to be taken in service delivery:

- Management and Decision-making by the community Communities must want the improved water supply and be willing to take primary responsibility for it. The traditional "top-down" approach of providing the water point and hoping that it will be used effectively should be replaced by a "bottom-up" approach whereby the community is made aware of the possibility of government support, provided it is willing to bear some financial burden. The communities should be involved at each stage of the process from its design, planning, implementation and operation.

- Establishment of Water Committees Communities should be encouraged to establish a water committee whose function is to ensure proper O&M and the collection and management of funds for that purpose.

- Education and training Water committee members should be trained in the management of the facility and be provided health and hygiene education and encouraged to impart this to other community members.

[4] The life of installations is estimated at 20 years for a borehole, 10 years for a handpump and 4 years for a pit latrine.

- Extension services For community participation to be effective, the government's role should be that of promoter and facilitator in the operation and maintenance of RWSS and in the construction of sanitation facilities. Extension services, in the form of agents living and working within or near communities will need to be provided for this to work.

- Schools It is hard to justify the construction of schools without the provision of safe water and sanitation. Schools provide an ideal environment for imparting health and hygiene education and full advantage should be taken of this opportunity by building in such education in the school curriculum.

VI Operation and maintenance (O&M)

The failure of water supply and sanitation systems once constructed is a serious threat to the provision of the facilities and to their effectiveness. Generally systems fail because of inadequate operations and maintenance, often associated with the use of inappropriate technologies which cannot be sustained by either the communities or the government. This can result in serious deterioration of the assets and is a threat to the sustainability of the programmes. O&M considerations need to be fully factored into the design of the appropriate system. In many developing countries, the coverage of rural water supply is often highly overstated because a number of systems suffer from poor operation and maintenance to the point that they need rehabilitation. In Ethiopia, it is estimated that almost 40% of the systems are not functional, which is a commonly quoted average figure for developing countries with some individual countries in the region of 60-70 percent. Such figures obviously put in question the gross coverage figures often quoted.

A number of reasons are quoted for poor O&M, ranging from poor organizational structures in the responsible agencies, lack of spare parts, inappropriate technology, lack of trained staff, tied aid, insufficient funds, lack of motivation of sector personnel, non-involvement of users and communities, poor initial delivery systems and political interference.

Actions for improving cost-effectiveness through lowering O&M costs start at the design stage. If the design of the system and delivery mechanism is inappropriate for the community and is governed by the consideration of rapidly making up the large deficit rather than sustainability criteria, then there will be larger long-term costs for the community. In the initial design, the provision of the facilities should be oriented so as to make the community feel responsible and be trained to take care of it. The government's role should be that of a promoter and facilitator rather than manager. Secondly, the community should be responsible for the O&M costs. Thirdly, the community should be made aware of the health and hygiene improvements, labour savings and increases in productivity from improved water supply and sanitation so that these can be factored into their willingness to pay for O&M.

The government's role as facilitator should be to ensure:

- adequate design and planning of the facilities with community participation;
- standardization;
- training of community members for O&M;
- provision of O&M support system outside the community to solve more complex problems; and

- supporting the development of a spare parts distribution system at affordable prices.

VII Planning, Monitoring and Accountability

Although discussed at the end of this paper, planning, monitoring and accountability should enter at the very design of RWSS systems. Planning needs to be conducted at the national, provincial and district levels with adequate co-ordination both within the government and with donors, NGOs and the community. It should be conducted at the community level and filter upwards. This process could also be assisted through decentralization of decision making to the district and community level. Often RWSS systems break down and are not repaired for a considerable period of time due to various factors. The role of monitoring should be to show which systems have broken down, for what reasons and what corrective actions are needed. An efficient monitoring system will show the number of non-functioning boreholes and take action to reduce the time between breakdown of the system and its repair. An important element in the effectiveness of RWSS is its reliability. If the systems break down often and is not reliable, the community will revert to its traditional unimproved water supply source.

No RWSS system can be cost-effective unless there is proper management and accountability. The sector requires and receives considerable cash flow which needs to be managed and accounted. Accountability at all levels is fundamental to good management. The village committee should be accountable to the community, the extension worker to the village committee and the district government. Each level of government should in turn be accountable to the higher level and to the population at large. Without a system that monitors and reports on the management of the funds provided and the output, it is likely that money will be wasted.

VIII Conclusions and Recommendations

The targets set for RWSS while ambitious can be strived for if a number of cost-effective measures are undertaken. In some countries in Africa it should be possible to reduce the cost of rural water supply, through a borehole with handpump, by as much as 40 percent. This can represent a significant saving and the total investment required would not be out of bounds of affordability by governments, donors and the community.

To achieve results, this paper points to the need for improving cost-effectiveness through:

- Choice of technology;
- Cost-reducing actions in service delivery, including improved management;
- Provision of health and education for maximum impact;
- Community and women's participation;
- Proper community-based operations and maintenance; and
- Proper planning, monitoring and accountability

The range of benefits from RWSS cannot be fully quantified either financially or in terms of number of lives saved. Cost-effectiveness measures which compare various alternative intervention strategies based on such an outcome alone would omit the broader impact from RWSS. There is ample evidence to make a convincing case for improved RWSS. The challenge must be to improve cost-cost-effectiveness within the RWSS sector through various options.

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COMMUNITY-BASED MEASUREMENT OF IMPACT OF WATER AND SANITATION INITIATIVES

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MEASURING THE IMPACT OF WATSAN INITIATIVES

COMMONSENSE AND SCIENCE

UNICEF has long known that water and sanitation goes beyond making water available or digging latrines. Reaching children with safe water means a lot more than getting better water to where it is lacking and where the diarrhoea is worst. It is a question of behavioural changes -- what people do and what they need to do differently as access improves.

Some years ago, this led to the call for more anthropological research to be more responsive to existing hygiene practices -- what people do with the water, how they use the sanitation facilities, soap, hand washing, cleanliness of eating utensils. Another call went out for the development of social mobilization and social communication techniques to open channels for change of these practices.

Now, science is catching up with common sense. We are directing the measurement of Watsan impact not only at the occurrence of diarrhoea, but also at a number of hygiene practices. Experience is accumulating on measurement of these practices and their relation to health impact. And we have been improving ways of getting this information to where it counts. The issue is <u>who</u> the data are for. There is probably very little new information to circulate at the international level. Debates at this level are usually very well informed. We need to reach those who have most at stake -- the communities and householders (see Figure 1).

LOCAL IMPACT -- National indicators

Part of the "catching up" of science with common sense is the realization that, if we want to prevent the most diarrhoea possible with the resources available, this implies a combination of actions appropriate for local conditions -- and mostly local resources. The actual "recipe" of actions that works best varies from place to place. The mix of water, sanitation and efforts to change hygiene practices may have quite different cost implications and effectiveness under different conditions.

Change in national indicators come from changes in households and individual communities, in addition to social and political influences -- added together. But what makes for changes in each local situation may be a different mix. And what we can deal with in Watsan programmes on the ground are the communities and the households. To make this work optimally, we have to be able to identify what misuse or underuse of clean

water leads to illness, and how we can influence people to adopt different hygiene behaviour.

The task is not to look for new "Eurekas" -- to find new causality chains, although occasionally something innovative turns up. An example of this is the UNICEF-supported research in Luanda, Angola, that identified sharing of a plate at mealtimes to be an easily preventable diarrhoea risk, accounting for 12% of cases among children under the age of three years. More often we work in a spirit of audit, the task being to find out what works best, and to feed that information into planning and social mobilization.

One of our principal tasks, then, is to bring down to size this seemingly formidable task of finding the recipe for each situation. We have found that this is well within UNICEFs reach.

In community-based impact estimation, it may be possible to learn from the spirit behind the early trials in childhood cancer therapy in the 1960s and '70s; improvements of 5% and 10% were aggregated piecemeal, eventually to cure previously fatal afflictions. In water and sanitation, this means picking up the 10% of cases caused by no latrines, the 5% (or perhaps 15%) caused by not washing hands before a meal, and so on. The idea is remorselessly to go after every percentage point, documenting progress and improving on it at each opportunity.

SEVERAL FACTORS CONTRIBUTE TO IMPACT

In his 1990 review of the state-of-the-art of impact assessment in water and sanitation programmes, Cairncross pointed out several important practical issues in impact assessment[1].

To begin with, better access to safe water and sanitation facilities tend to be found in households with lower rates of diarrhoea, for reasons other than water and sanitation. Income, maternal education, nutrition, weaning practices, measles immunization, domestic animals and hygiene consciousness all have an impact of their own. To unravel these factors, we need to know about individual risk -- what each action or attitude might mean for a child -- not only averages over populations (indicators).

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1. Cairncross AM. Health impacts in developing countries: new evidence and new prospects. Journal of the Institution of Water and Environmental Management 1990,4;571-7.

But this is no reason to throw up our hands in resignation. We have found it quite possible to sort out some of these issues in large scale programmes in Africa and Latin America. Carefully designed large studies have been supported by UNICEF in several countries to consider several of these factors simultaneously. We are not the only ones doing this. USAID supported DHS studies have data on synergisms between diarrhoea and water & sanitation. These studies also have to be done in different types of communities within a country -- the picture is different under different geographic and social conditions.

At its simplest level, we are interested to learn whether our water and sanitation inputs -- including efforts to change behaviour -- result in less diarrhoea. We might find, as was the case in Liberia, for example, that a child in a house that does not cover water containers has 60% more diarrhoea risk than one in a house that does.

But we need to be sure that this finding is not explained by one of the other factors that cause or prevent diarrhoea. We could look at the protection among well nourished children separately from malnourished children. If we find it is the same for both groups -- well nourished and malnourished alike -- then, even if malnutrition is itself related to diarrhoea, we know that malnutrition does not explain the "impact" we found from covering water containers.

We could then stratify by the other factors that might explain the impact. By looking at each one in turn, we grow increasingly confident that none of these factors explain the protection. When we did this in Liberia, working under quite challenging field conditions Up-Country in 1992, we found that a child in a house with uncovered water containers had 60% higher risk of diarrhoea than a child in a house where they covered the water (Odds ratio 1.62 95%CI 1.4-1.9; RD 11% 95%CI 7%-15%). We were able to establish that this could not be explained by any of several factors:

- Location (urban, peri-urban, plantation, rural)
- Female headed households
- Treatment of water
- Source of water
- Secondary source of water
- Animals in the yard
- Disposal of excreta, and
- Garbage disposal
- Age of the child

Although this list is not exhaustive, the example illustrates how a common-sense principle is applied scientifically. If we find the same protection from covering water in households with latrines and those without, latrines could not possibly explain the effect.

Stratification is a straightforward and robust technique that can be done manually, or with the aid of a simple handheld calculator (although it is much quicker with a computer). There are things to be careful about (see Annex) and things that can be taught, technologies that can be transferred.

This illustrates the feasibility and desirability of an intersectoral measurement scheme, instead of a "Balkanized" series of standalone monitoring schemes -- one for water and sanitation, one for diarrhoea, one for domestic hygiene, and so on. In order to come to any working conclusions, or to be able to feed the data into any sort of dialogue, we have to be as sure as possible that the relation is not an indirect one -- simply because a household with less diarrhoea risk also has more water and better sanitation.

SYNERGISMS

Stratification can be used not only to "rule out" other explanations, based on the principle that if we find the same protection from covering water in households with latrines and those without, latrines could not possibly explain the effect. It is also useful to work out the synergisms that are relevant locally. Understanding synergies is a way to get more impact for our input.

For example, in the Liberia Up-country data, although the presence of domestic animals does not explain the protection that comes from keeping water covered, there is an important difference between children in houses that do and do not keep domestic animals. Although the protection is strong in both (odds ratio 1.33 and 2.0 respectively), it is much stronger in households without animals. This cannot be explained by chance (Chi-square of heterogeneity 3.85, 1df). Other interactions were apparent between covering containers and latrines, garbage disposal and female headed households. Fuller details of these data are included in the Annex.

It is not only the measurement that must be intersectoral, to emphasize synergisms. The messages must go out with this too -- to emphasize actions.

PIGGYBACKING OBJECTIVES -- MEASUREMENT IS THE MESSAGE

In Liberia, two such cycles resulted in data on no less than eleven major indicators of progress toward the Child Goals for the 1990s. These can be turned usefully toward advocacy and fund raising. For almost the same resources as it takes to get a bald indicator -- for example, diarrhoea or handling of water in the household -- we can get

locally specific hard data on some of the factors that lie behind water handling, why people cover water storage or why they do not. For example, we can interact with mothers and communities to find out how they see the problem, what they think can be done and how they think it should be done. And we can aggregate these opinions as part of the measurement exercise.

These are exactly the data we really need for access to clean water to result in health benefit. Taken alongside the capacity building that makes the whole exercise sustainable in the long term, this is no small side effect of monitoring.

The key is that information on impact is not just extracted from the communities and packaged into national and international indicators. It can go to work simultaneously to help solve the problems at community level -- almost as part of the measurement exercise. The information from the community also provides the substrate for discussing, understanding and finding solutions -- in short, for improving the impact.

An example from Mexico illustrates how data are turned back to help communities make decisions and to undertake better informed and affordable actions.

Microregional Planning in Guerrero, Mexico

Risk differences after taking account of some other diarrhoea determinants

	Copalillo	Xochist.	Alcazauca	Coahuayutla	Zirandaro
Chlorination	10%	16%	10%	12%	11%
Source of water	23%	15%	8%	2%	8%
Wash vegetables	6%	12%	4%	9%	11%
Latrines	10%	5%	26%	14%	11%
Pigs	5%	15%	8%	6%	4%
Cost per episode	$9	$3.2	$12	$7	$8

In this process called "Microregional planning", sentinel surveillance has been established as a framework for interaction between the communities, the municipal authorities and the local university. Using a standardized format in all municipalities, data are collected on the most likely determinants of a particular problem, in this case diarrhoea. Other possible explanations are excluded by stratification, to produce the local "recipe". The UNICEF video describing this process is aptly called "the pressure of fact" -- describing the main dynamic. Information from local "actionable" settings is distilled, in this case at municipal level. This is fed back through a series of interactions with the communities involved. The results -- including what the communities think about the data and what they think can be done, can be consolidated to national level. So we get the locally relevant data that can be aggregated to make the bigger picture.

Taking one municipality as an example, Alcazauca, various modes of communication were used to bring these results into the dialogue: local radio stations, community "radio" (tape-recorded broadcasts), pamphlets, sociodramas, posters, community assemblies and interpersonal contacts with community leaders, teachers and health workers. The short term result was that every community in the entire municipality chlorinated their water sources. They also developed a rotating fund for building of latrines, which is currently being implemented.

Also under way is another cycle, this time to study ARIs. The diarrhoea cycle will be repeated later in the year -- one year after the cycle producing the above results -- to look at impact of the intervention.

This is one of the major advantages of this impact assessment framework. It permits the building of capacities for a wide range of issues. The same "machinery" has been brought to bear not just on health and watsan problems, but food security, nutritional surveillance, scorpion stings, pesticide poisoning, poverty tracking and monitoring the household consequences of economic structural adjustment.

Other examples of this local feedback of data comes from Angola, where community meetings and "comics" were used to get the results circulating. Another result was a change of the UNICEF programme in the area.

QUALITY AND QUANTITY -- THE CROSS-DESIGN SYNTHESIS

Some of the factors behind or alongside Watsan impact, like income, are quite tricky to measure. Others require lengthy discussions to understand the factor properly. Estimation of impact, therefore, cannot rest only on simple quantitative household data on who has diarrhoea and who has access to water. This can be resolved by a cross-design synthesis

of qualitative and quantitative methods is needed: a combination of existing data reviews, participatory rapid appraisals (PRAs) and household surveys.

Several other documents and publications deal with the operational aspects of linking these three methods in the process called "sentinel community surveillance" (SCS). An advance of sentinel community surveillance is that the PRAs of local services and general conditions is linked to the household occurrence data. Implementation of this scheme is based on the transfer and decentralization of measurement skills, including capacities to make judgements in design and interpretation of community-based impact assessment.

A well known problem is the reliability of information on impact (diarrhoea or women's work) and exposure (use of the water and sanitation facilities). The definition of whether the child is a case or not can be a problem; the informant might just not know this. But the definition can also be conditioned by education or other factors that themselves are intimately linked to both diarrhoea and WATSAN interventions. This can confuse the picture and emphasizes the need for *comparable quality of data* from different subsectors even in one community.

In practice, this means relying on questions that are most independent of education. For example, we know that mothers with higher education tend to define a case of diarrhoea more readily than those without education. But they also tend to be better off in relation to other determinants of diarrhoea (or women's work). This leads to an "excess" of short duration diarrhoea among the well-to-do. In the short term, we get around this particular problem by limiting the study to children where diarrhoea has lasted several days.

Certain technical expertise is needed to avoid a simplistic approach. But this is not an insurmountable problem. In generalizing the use of these techniques, there is need for some caution against mechanical interpretations and overenthusiasm for "hard results". Caution is part of the technology transfer that needs to go on. As part of its support to this process, the Evaluation Office has invested considerable resources in making these approaches more user friendly (see Annex, 15 criteria).

MEASURING COSTS

We have to be able to ***relate impact to costs***, and not only costs to UNICEF. We need to measure the costs to our partners of what we promote, especially our partners in the household. A UNICEF-supported Watsan programme costs the organization a certain amount, it costs the government and other agencies, and it costs the household. The final solvency of any action will depend on how much each of these partners has to contribute and what they get out of it -- the impact. For example, it might cost the organizers of a

programme roughly the same amount to convince people to boil/chlorinate water as it costs to convince them to keep water containers covered. But the cost to the household is completely different.

Data on this sort of issue is much more meaningful for watsan programmes that simple accounting of coverage or diarrhoea occurrence indicators. We will be able to offer much more meaningful data on the proverbial bang for the buck. At least as important is the way the cost issues build the pressure of fact -- the energy to change things. For example, in Alcazauca, a diarrhoea case costs an average of $12 per child -- and a latrine costs $30 plus labour. In Liberia, each diarrhoea case costs $1.50 and children suffer six to eight of them per year. These data can be fed into the social mobilization efforts to change the diarrhoea risks.

Donors should also be to use this kind of information to direct their resources.

COSTS OF MEASURING

One final question is whether UNICEF can and should dedicate resources to this kind of community-based measurement, when there are so many pressing issues for action. Our experience is that not only can we do it, we should -- and we have a special advantage in doing so as an intersectoral broker. Added to this is the particular character of UNICEF staff as development agents and the institutional strength of UNICEF in social mobilization. Most other agencies come from a sectoral position.

Although all this might seem daunting at first glance, we have the know-how and the fire power to hand. There is no quick fix, but a relatively inexpensive and quite rapid blend of methods has been developed to replace expensive one-off studies and detailed anthropological studies.

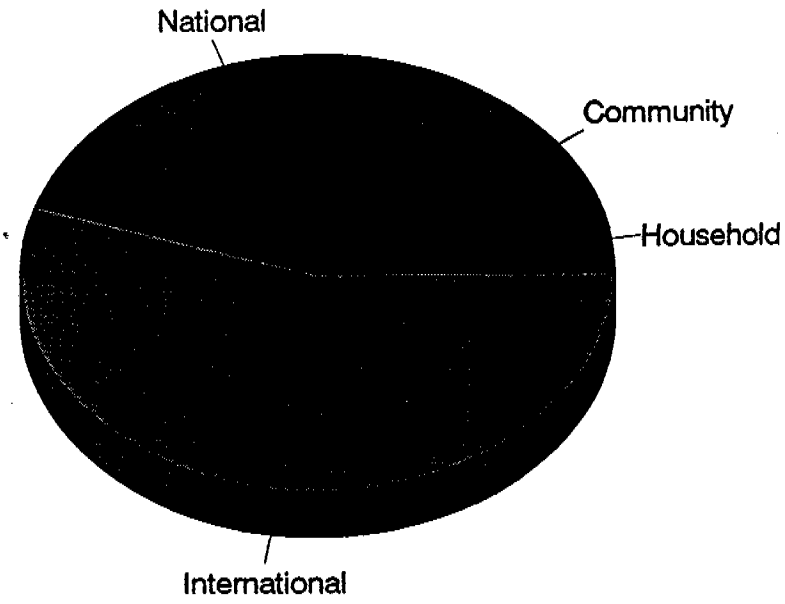
The Mexican results come from a single research cycle lasting about two weeks, staffed by ten people and costing less than $2,000 per municipality. In the five Mexican municipalities where the measurement was done, the household cost (without even counting the costs to the services) came to an average of $8 per episode.

The Liberian results came from a research cycle in Up-Country Liberia where more than 20 nationals were trained. It cost $4,000, excluding UNICEF staff. This gets weighed up against $1.50 per episode paid by the community. Some other countries have spent much more, a first cycle costing as much as $70,000.

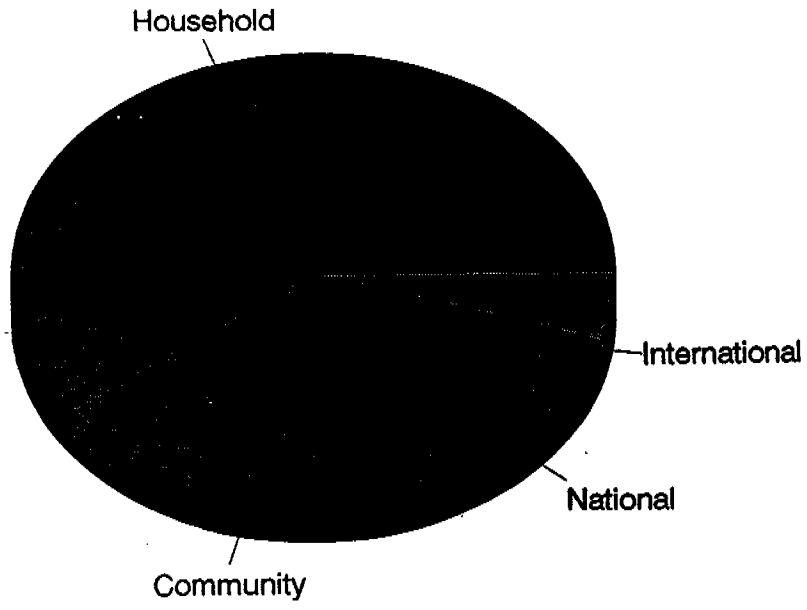
What puts up the costs of this sort of exercise is the initial technical support -- which has to be sustained for some time. This should be factored in as a capacity building exercise -- weighed against costs of other options this builds over time, large numbers exposed

The issue is not can we afford to do this. If we do not do it, how, for example, are we going to push ORT back up again. Scare household resources get drained away treating cases of these often preventable conditions. There is an operational urgency to precipitate choices, but also to develop the measurement infrastructure that will permit this to be done over several years.

Which audiences has research in WATSAN/CDD reached?



Who can do most with the information from research?



ANNEX 1

CHECKLIST FOR EVALUATING EVIDENCE OF WATSAN IMPACT

Short of writing a textbook, it is difficult to deal adequately with all the possible nuances in impact estimation. This checklist of the most common flaws is intended for use in the design stage. It can also be useful for reviewing and interpreting studies and evaluations.

A. SELECTION BIASES

1) Is the reference ("control") group contaminated?
In case-referent studies, the "non-diarrhoea" children may include undiagnosed cases; in longitudinal studies and experimental studies, access to safe water 'spread' beyond the covered population to the presumed unexposed (another example might be in a Watsan educational/promotion programme).

2) Is the index series 'diluted'?
A case-referent study may define as cases children who do not really have diarrhoea; in longitudinal and experimental studies, the worst off people in areas without access may migrate to where conditions are better (for example, rural-urban migration).

3) Is there a Healthy Worker (Healthy Child) Effect?
Sick people tend to stay at home. A record system based at a clinic may miss the most severely ill children who may be too ill to be brought to the health services. Basing impact measurement at the water sources may have the same effect. This reinforces the need for household studies.

4) Are the data sufficiently complete to reflect reality?
The best way to deal with missing data is to have as little as possible. People on whom data are missing may be very different from those on whom data are obtained. The possible effect of missing data can sometimes be assessed through detailed study all of a sample of the missing data subjects, finding out why the data are missing.

B. INFORMATION BIASES

5) Are the exposure data adequate?
A long standing problem in watsan impact is the quality of data on usage -- the fact that improved or new facilities exist does not imply adequate *usage*. It is possible to improve the academic rigor of the investigation (eg, detailed anthropological studies of usage, linked to household /individual occurrence data). Where the exposure is frequent, insufficient detail about the extent of exposure may mask a biological gradient or a threshold.

6) Are the outcome (impact) data adequate?
The reliance on 'hard' data (such as mortality) may mask less dramatic effects of the exposure: reporting a case of diarrhoea may not be sufficiently sensitive to demonstrate impact. Some impacts, like hours of water-carrying saved, are rapidly deployed in other tasks and may not be measurable as "free time".

7) Is there a memory bias?
People who have suffered diarrhoea (or who have lost a family member due to diarrhoea) may remember what they think are the determinants of that illness in a way that is different from other people. This can be got around, in part, by asking about the water and sanitation before asking about the diarrhoea.

8) Was there an observer bias, or participant bias?
Even among the most honest researchers, someone who knows the objective of an evaluation may use a different intonation or say things in a different way. This could precipitate a different response depending on whether the respondent had experienced diarrhoea or if they have some knowledge if appropriate hygiene behaviour.

C. STUDY POWER

9) What size impact can the study exclude?
Detection of a relatively small impact requires a relatively large study. If an impact is not detected in a given study, it may be that the study is simply too small to detect the impact.

10) What is the specificity of the indicators chosen?
"Diarrhoea" includes several conditions, and not all of them related to water and sanitation. It is useful to consider different aetiological entities within this to increase the sensitivity. Duration provides a first subdivision. Most shorter duration episodes (up to, say, 4-5 days) are viral in origin. Those with duration over 14 days tend to be a quite different collection, including malabsorbtion syndromes and parasitic infections.

D. THE ANALYSIS

11) Is the significance test appropriate?
Significance tests indicate confidence about chance findings. They are not necessarily related to *importance* of the impact. For example, a tiny improvement in work time of women (carrying water) could, if investigated in a large study, be highly *significant* but unimportant to the women concerned. The decision about choice of an intervention is hardly ever independent of cost considerations; if anything, one would be concerned about the sustainability, not only whether or not it was significant. Seen in this light, significance tests depend on size of study: they are a DESIGN factor and should not be the sole basis of programme decisions.

Chi-square values are not immediately interpretable by people without specialized information/training: confidence intervals may provide a more meaningful statistical tool.

12) Is the summary measure of impact or occurrence appropriate?
Correlation coefficients should never be taken as evidence for or against impact. Expression of a potential effect of an exposure is most easily understood in terms of risk (relative risk or risk difference).

E. INTERPRETATION OF FINDINGS

13) A biological gradient is not indispensable to demonstrate impact. Although useful supportive evidence, a progressive reduction of diarrhoea risk with increasing coverage does not mean definitively impact, nor is absence of a measured biological gradient a strong argument against impact. Our data on "exposure" are often quite crude.

14) Has time been allowed for?
Related to points 6 and 12 above, the effect may only appear some time after the exposure. Some of the effects of parasitosis are slow and progressive. There is also the issue of seasonality that requires careful consideration. The cyclical process of sentinel community surveillance has proved to be useful for this purpose.

15) Is a confounder masking or producing the effect spuriously, or is an effect-modifier operating?

The only to be sure that the impact is not caused by an indirect relationship -- for example, by different hygiene practices in better educated households that also have better water and sanitation arrangements -- is to take these factors into account. Stratification is an accessible technique under most developing conditions. For example, the protective effect of covering water vessels in the household can be considered separately in households with latrines indoors and those with latrines outdoors. If the effect is the same in the two groups, this argues

A single study hardly ever constitutes definitive proof. Combination of data from different studies can be very fruitful, particularly since all the studies are unlikely to repeat the same biases in exactly the same manner.

The effect of putting a lid on water containers on diarrhoea prevalence

	Lid +	Lid -	
Diarrhoea+	459	408	867
-	1021	559	1580
Totals	1480	967	2447

Liberia rolling situation analysis 1992

x mh, crude analysis: -5.65

RR:.62 CL 95% : 0.52-0.73

RD: 11 CL 95% : 7-15

Indicator: The overall prevalence of diarrhoea is 35 percent. Among households using a lid on their water container the prevalence is 31%. Households not using a lid have a prevalence of 42%

Confounder	Levels of factor				Analysis
Location	Urban	Peri-urb	Plantation	Rural	x mh unbiased: -5.28
	125 21	72 119	15 9	238 254	x ²het 5.23 3df
	215 28	168 118	147 65	474 343	RR: .62 CL: .5-.7
	x.8 r .78	x 4.5r.43	x.68r.74	x3.4r .68	RD: 9% CL: 6-13
Female headed household	Yes	No			x mh unbiased: -5.56
	45 18	414 390			x ²het 5.5 1df
	102 50	919 509			RR: .62 CL: .5-.7
	x.62r 1.2	x 6 r .59			RD: 9% CL: 6-14
Treatment of water	Yes	No	Missing		x mh unbiased: -4.9
	59 1	390 406	10 1		x ²het 3.2 1df
	165 8	831 551	25 0		RR: .64 CL: .5-.75
	x 1 r 2.9	x 5 r .64	x 1.5r -		RD: 9% CL: 6-13
Type of Water	Tap	Handpump	Priv.well	Shared w.	x mh unbiased: -5.5
	35 5	57 55	52 41	163 132	x ²het 9.1 6df
	36 6	183 71	128 56	414 221	RR: .62 CL:.5-.7
	x.23r 1.2	x 4 r .4	x 2.2r .6	x 3 r .66	RD: 11%CL: 7-15
	Swamp	River	Missing		
	27 62	102 109	23 4		
	40 40	192 163	28 2		
	x2.6r .44	x1.3r .79	x 1 r .41		
Source of water on the farm	Good/NF	Bad	Missing		x mh unbiased: -4.0
	169 53	243 299	47 56		x ²het 1.9 2df
	478 114	460 371	83 74		RR: .69 CL: .6-.8
NF= no farm	x 1.5r.76	x 3.8r.66	x r		RD: 8% CL: 4-12
Animals in the yard	Yes	No			x mh unbiased: -6.1
	162 153	295 254			x ²het 3.85 1df
	440 295	570 252			RR: .59 CL: .55-.8
	x 2.5r.71	x 5.9r.51			RD: 11%CL: 8-15
Latrine	Good	Bad	None		x mh unbiased: -4.6
	90 14	113 57	253 334		x ²het 2.3 2df
	203 35	309 104	506 419		RR: .66 CL: .55-.8
	x .3r 1.1	x 2 r .67	x 4.4r.63		RD: 9% CL: 5-13
Garbage disposal	Close	Far	Missing		x mh unbiased: -5.2
	300 303	138 83	21 22		x ²het 2.2 1df
	602 379	349 155	60 25		RR: .64 CL: .55-.75
	x 4.5r.62	x 1.8r.74	x 2.4r.4		RD: 10%CL: 6-14

Conclusion:

Is it worthwhile use of programme resources to encourage and assist the forty percent of households not using lids to do so?

The crude analysis of the individual prevalence of diarrhoea among the children of lid users indicates that they have only 62 percent (RR 0.62) of the risk of getting diarrhoea of those from households not using lids. In the population as a whole the risk difference (RD) tells us that, if there were no other mitigating factors, simply using a lid would reduce the overall prevalence of diarrhoea in the population as a whole from 35 percent to 31 percent.

To what extent can we disentangle cause and effect from association? Lid users are expected, on the whole, to be from better-off households, to be better educated, to have better sources of water, and to be more likely to do other beneficial things like treat their water than are non lid users.

The table looks into several of these possible alternative explanations (or confounding factors). None of the factors explain the effect - powerful evidence of a real effect.

** Note: Interpretation of the table is hampered by the probable effect of differential response associated with the level of education of the respondent. Better educated mothers have a tendency to overstate prevalence of diarrhoea than populations as a whole. Sub-groups with a large proportion of educated mothers are therefore more likely to report higher prevalences of diarrhoea. This is a plausible explanation for the apparent increased risk of diarrhoea among lid users who treat their water, or who use tap water or who have good latrines. This hypothesis cannot be tested as the educational level of the respondents are not known for this survey.

libwat1.tab

ANNEX 2

Illustrative questionnaire
Measurement of IMR, U5MR, diarrhoea morbidity, women's education, water and sanitation

NB: these illustrative questionnaires need to be reworded to suit local communication requirements. The principle is to ask as few questions as possible. They should be tested, including the data entry and pilot analysis. The objective of this is (1) to encourage quality data capture by seeing how the data will be used and (2) to iron out design flaws and classify possible answers.

Presentation and what the enquiry is about

What is the name of the head of household? *<Code sex>*

What is her/his occupation? *<write>*

How many people live in this household? *<number>*

What is the age and sex of each one, starting with the youngest? *<list: M1, F5, F26, M32, F59, etc>*

What toilet facilities do you use? *<type>*

Where do you get your water for drinking? *<source>*

Is your water storage container covered? *<y/n>*

What do you do with the water before drinking it? *<boil, etc>*

How many of the household members are women between the age of 15 and 45 years? *<number>*

How old is the youngest? *<age>*

Is she able to read and write? *<yes/no>*

How many children has she ever had? *<number>*

How many are alive now, living here or elsewhere? *<number>*

How many of them are under the age of five years? *<if there are no children, move to Q___>*

Starting with the youngest, what is the child's age and sex *<age, sex>*

Has s/he had diarrhoea in the last 2 weeks? *<y/n>* *<if no, move to Q__>*

How many days? *<days>*

Was there blood in the diarrhoea?

Was the child given more/less/same fluids?

Was the child given more/less/same food?

Was ORT *<local identity>* used? *<yes/no>*

After how many days was ORT started? *<days>*

Were antibiotics used? *<yes/no>*

After how many days ? *<days>*

Were local medicine used? *<yes/no>*

After how many days ? *<days>*

How much was spent on the episode? *<cash>*

How much time was spent caring for the child?

<If using anthropometry, MUAC or other>

<Thank you for your help; this information will be very useful; before going, I have one last question>

Has anyone in this household died from diarrhoea in the past year? *<or some notable time point>*

What was his/her age and sex?

Has anyone in this household died from any other cause in the past year?

What was his/her age and sex?

<Thank you again>

Issues Regarding Impact Evaluations of Water and Sanitation Programs

Richard A. Cash, M.D., M.P.H., Harvard Institute for International Development and Harvard School of Public Health

Indicators to measure the impact of water and sanitation programs should be based primarily on program objectives, both short and long term. In many cases, improvements in health, especially diarrheal disease, has been put forward as the principle reason for improving water supplies and sanitation facilities. While improving health in the long term may be the final objective, this can only be realized by significant changes in behavior and improvement in overall health and socioeconomic indicators; that is improved water and sanitation facilities are necessary but not sufficient. The promise, then, here is that the potential impact on diarrhoea in certain environments has been overstated. This has come about because the architects of these programs have not fully understood the epidemiology and/or the risk factors associated with enteric diseases. Furthermore, these factors have not often been assessed with consideration given to the different ecological settings. Health benefits will come from water and sanitation programs, but likely will require multiple interventions and time. In the interim period, process indicators are essential in evaluating these programs.

A. Epidemiology

Enteric organisms are spread through a number of vehicles, one of which is contaminated water. Organisms also can be spread by hand to mouth contamination, by food, and possibly through aerosolized droplets; some diarrhoeas have not been directly associated with specific enteric pathogens (i.e. secondary to malaria, measles, etc.). The number of organisms needed for infection vary from 10^1 to 10^6. The risk of infection following ingestion of organisms will depend on a number of host defense mechanisms including the following: gastric acidity; previous exposure to the organism; presence or absence of intestinal or humoral antibodies (either passively or

actively acquired); intestinal motility; and presence and type of bacteria in the upper small bowel. Studies indicate that the number of organisms ingested not only affects the incidence of disease but the severity of illness. In some programs the level of contamination may be reduced so as to decrease the percent of severe illness but the overall number of cases remains the same (See Figure 1 - i.e. moving from point A to B). A number of studies indicate that the quantity of water is more important than quality in determining the incidence of diarrhoea in many developing country settings.

B. Risk Factors

An analytic framework has been developed by Mosley and Chen (Figure 2) as a means of examining issues of child survival. "The key to the model is the identification of a set of proximate determinants, or intermediate variables that directly influence the risk of morbidity and mortality. All social and economic determinants must operate through these determinants to effect child survival." The proximate determinants are grouped into five categories: maternal factors, environmental contamination, nutrient deficiency, injury, and personal illness factors. The factors that may have the greatest impact on diarrheal disease are those related to environmental contamination and personal illness control (and to a lesser degree nutrient deficiency).

Environmental factors would include the quality and quantity of water; the bacterial contamination of food (which may or may not be affected by the quality of the water); the presence of openly exposed fecal material; and the presence of insects such as flies, etc. Personal illness control factors related to diarrhea would include practices related to the collection and storage of clean water; hand washing practices; place and method of defecation; practices related to handling of children's feces; and early identification and correct treatment of diarrhea.

C. Measuring the Effectiveness of Water and Sanitation Programs

The potential impact of water or sanitation programs on the incidence of diarrhoeas, effected by so many intermediate steps, this assessment problematic. Take the example of a tubewell program where the only stated objective is to reduce the incidence of diarrheal disease. Assuming that drinking water is the only source of infection, the tubewell must be properly constructed and maintained in working order; the pump must be properly primed; the water must be gathered in clean containers and stored under clean conditions; containers that come in contact with the water must be clean; the taste and smell and color of the water must be acceptable so that the water is consumed; and there must be no other sources of contaminated drinking water that are regularly used. As diagramed in Table 1, both the technical aspects, termed health hardware, and behavioral aspects, termed health software, are required. Given this scenario, one might measure the effectiveness of a tubewell program using the indicators in Table 2. A similar program might be developed for the evaluation of sanitation systems.

The time needed to measure the impact of these programs is variable. Process indicators should be measured throughout the program. The time needed to assess health impact is much more problematic, however. The ecological and cultural setting will likely have a major impact. For example, if tubewells represent the only source of water, the education level is high, funds are available to provide well-designed in-house storage facilities, and infant mortality only moderately high, a significant high health impact may be seen in a relatively short period of time. On the other hand, where there are multiple sources of drinking water or water for other household uses, where education levels are low, where extreme poverty exists, and where infant mortality is high, it may take substantially longer to measure a reduction in the incidence and/or severity of diarrhoea.

Table I

Factors Required for an Effective Water and Sanitation Programme	
Health Hardware (Technical)	- Safe and Adequate Water - Safe Water Storage - Safe Faeces Disposal - Safe Food Storage
Health Software (Behavioural)	- Community Beliefs - Community Hygiene - Domestic Hygiene - Personal Hygiene

Table II

Some Effectiveness Indicators for a Tubewell Program

Process Indicators:

1. Number of tubewells built
2. Down-time of tubewells (weeks/year)
3. Spare parts and repair personnel available in the village
4. Water quality and acceptability
5. Distance to tubewell and time needed to fetch water
6. Availability and type of in-home water storage containers
7. Water quantity potentially available - time of day available

Output Indicators:

1. Percent of households using tubewell water
2. Percent of household water consumption provided by tubewell water
3. Percent of water consumed from different sources and for what purpose
4. Bacterial contamination of domestic utensils
5. Hand washing practices
6. KAP survey of water use, especially as related to domestic and personal hygiene, before and after intervention
7. Willingness of consumers to pay for services

Outcome Indicators (Medical):

1. Incidence of bacterial diarrhoeas (V. cholera, S. typhi, E. coli by age
2. Incidence of "severe" diarrhoeas vs. incidence of mild/moderate diarrhoea
3. Diarrhoea-specific mortality rate
4. Incidence of other water-borne diseases (hepatitis A)
5. Incidence of other Water-based diseases (e.g. schistosomiasis, guinea worm)
6. Incidence of water-washed disease (e.g. scabies)
7. Cost effectiveness of water program.

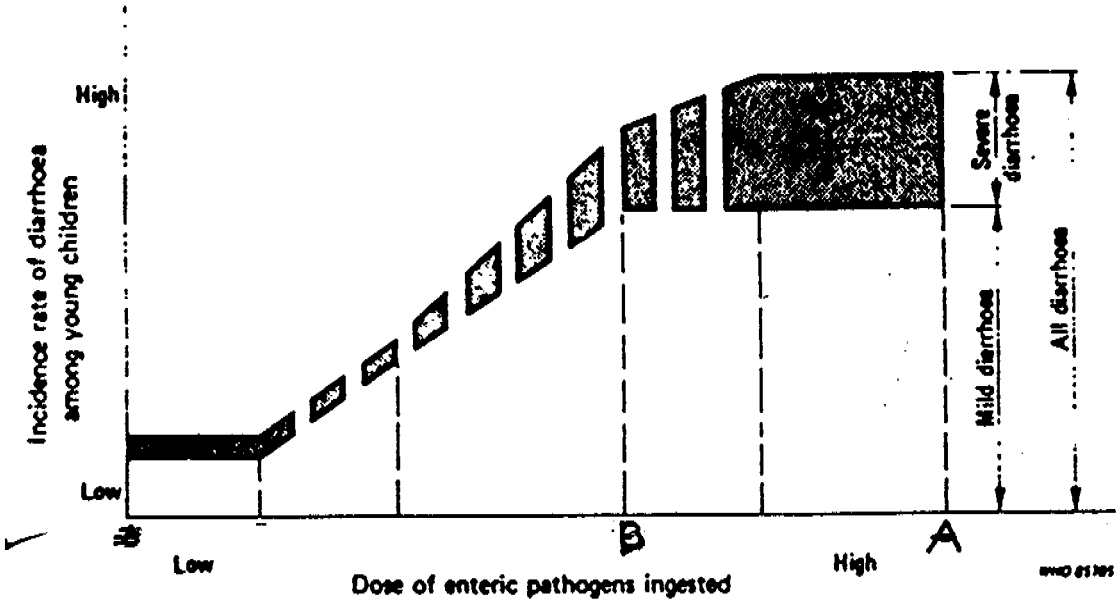
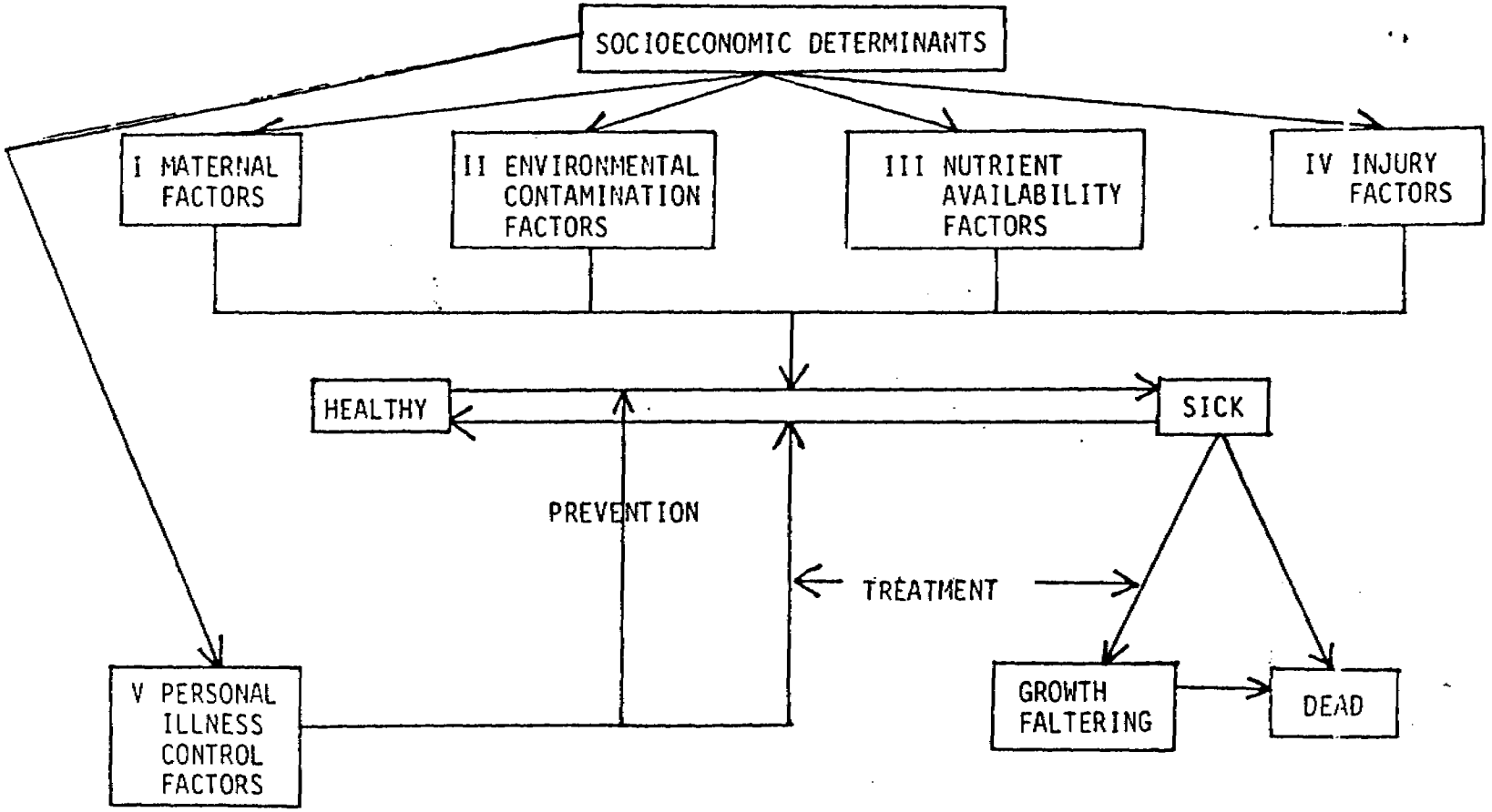


Fig. 1. Dose-response relationship for young children under various levels of exposure to an array of enteric pathogens.

From: Esrey, SA, RG Feachem, and JM Hughes, *"Interventions for Control of Diarrhoeal Diseases Among Young Children," Bull. WHO 63(4) 757-772, 1985*

FIGURE 2


SOCIOECONOMIC DETERMINANTS
I MATERNAL FACTORS
II ENVIRONMENTAL CONTAMINATION FACTORS
III NUTRIENT AVAILABILITY FACTORS
IV INJURY FACTORS
HEALTHY
SICK
PREVENTION
TREATMENT
V PERSONAL ILLNESS CONTROL FACTORS
GROWTH FALTERING
DEAD

TIME ENERGY SAVINGS FROM IMPROVED ACCESSIBILITY TO COMMUNITY WATER SUPPLY

Sponsored by: UNICEF

Conducted by : **The Department of Biochemistry and Nutrition and the Department of Sanitary Engineering**

All India Institute of Hygiene and Public Health

Government of India,
Calcutta, India

and

His Majesty's Government, Nepal

1.0 INTRODUCTION

Water supply and sanitation have economic and social as well as health implications. Information on the impact of water supply and sanitation programmes on health in any setting is essential if sound decisions are to be made in the future. Unfortunately, past planning experience has shown that quantifying health benefits resulting from such interventions is very difficult. The main reason for this is the lack of adequate indicators and methodologies. However, it has been found that the major benefits derived from water and sanitation projects have been the reduction of time and physical labour spent on water collection.

The present project aims at quantifying the time and energy saved, particularly by women, after implementation of the WES programme in the hills and mountainous regions of Nepal. It was anticipated that this would result in direct benefits to health status by saving valuable calories and allow the time saved to be used fruitfully to further socio-economic development as well as bring about improvements in health.

1.1 Objectives

The major objectives of the study were to:

- Quantify of time and energy (calories) saved from improved and ready access to water supply in rural areas.
- Assess socio-economic impact vis-a-vis time savings and its utilization.
- Assess the health and nutritional status in the control (without water) and experimental (with easily accessible water supply) village to compute.
- Investigate water use pattern after improved and ready access to water.
- Collect district-wide information about adverse impact of carrying water on the health of women and children, in the 5 districts, selected for the study.
- Collect information about water collection problems in the most difficult areas in the mountainous regions of North Nepal and estimate calories spent on the same.

1.2 Methodology

Introduction

The study was based on a longitudinal cum cross-sectional assessment of the impact of water supply projects in time and energy savings of the community and other related health benefits.

During the summer months of 1992 a baseline assessment was conducted of a number of villages which did not have easily accessible water source and then having a follow up assessment in the summer months of 1993 in the same villages after water supply schemes have been executed. Simultaneously, a cross-sectional assessment was also carried out in the summer months of 1992 by comparative evaluation between eight villages where people had easy access to water and eight villages without water supply.

Cross-Sectional Assessment (April - May, 1992)

As stated earlier, the study includes a cross-sectional assessment by comparative evaluation of two groups of villages in the central, mid-west and far west during March-April, 1992. These two groups of villages had a population of approximately 10 to 15 thousand and had comparable socio-economic status and hydrogeological features.

- Diarrhoeal/enteric diseases was the highest (40%) amongst children under 5.
- Approximately 60% Nepalese children under 5 years in the villages had height deficit.
- 95% of the children had normal body weight according to height.
- Average energy and protein intakes of the water fetchers were adequate; yet about 60% of them who belonged to the lowest socio-economic strata had deficient energy intake.
- Average intake status of vitamin C, A and Calcium was quite unsatisfactory, which calls for liberal intake of green leafy vegetables/other vegetables/animal foods.
- Iron-bio availability may be effectively reduced.
- Overall energy utilization may not be optimal because of low intake of vitamin B_2.

All together 16 villages (8 in the experimental and 8 in the control groups), were selected in the hill regions of Nepal in the districts of Dadeldura (Far West), Surkhet (Mid-West), and Kavre (Central).

Field data in respect of the body-weight of the water collectors, distance travelled, time required and speed of walk, and ground slope were collected with the help of oxygen consumption data obtained under varying conditions by using an oxylog-machine, standardized mathematical models and nomogram (Fig. 1) were established which were used to compute the actual energy consumption for collection of water in different areas with varying ground slope, speed and body weight.

About 60% children in the age groups of under 5 years and 6 - 14 years showed stunting (less height for age), which indicates chronic under-nutrition. However, 95% of these children had normal body weight according to height. On average, compared to the Harvard standards, about 20% children suffered from Grade III under-nutrition.

Average energy intake per person was about 2526 calories, most of which came from cereals. In general, food consumed was highly imbalanced, deficient in green leafy vegetables, fruits, meat, fish, fats and oils etc. This is also expected to impede full utilization of energy giving proximate principles. Hence, average intake of vitamins like vitamin C, vitamin A, riboflavin etc. was poor. Iron intake was also found to be inadequate which is indicated from high incidence of anaemia (65% in children below 6 years of age and 75% in older children and women) as observed from clinical observations and haemoglobin levels. It is a well known fact that anaemic women have reduced oxygen carrying capacity, which has a direct impact on energy expended on carrying water.

Some of the observations made in this respect are: Average calories being spend per day to fetch water in control villages is 654 k.cal., in pre-project villages (by recall method) is 590 k.cal.

Average time being spend per day to fetch water in control villages is about 6 hours a day, in pre-project villages (by recall method) 5 hours a day and in post-project (experimental) villages about 3 hours a day. Hence the net saving was about 3 hours a day (viz. 50% saving of time).

1.3 Background Information

Water Supply and Sanitation Situation

In 1990, approximately 37% of the total population of Nepal had been provided with water supply, rural coverage being 34% and urban coverage 66%. Sanitation coverage in the rural areas was 5% and in urban areas 47%. The actual population receiving satisfactory services however is lower as projects need rehabilitation.

Problems of Water Collection

In the vast rural areas in the mountains and hills where there is no organised water supply, people face acute hardship in collecting water for domestic use. On average, one family fetches on average 3 to 5 "gagris" (water vessel) a day. Each gagris has a 15 and 20 litre capacity.

A research study conducted in 1987 by IDS under the IDWSSD regional project, reveals that 27 per cent of women were the sole collectors of water in Gajuri and 17 per cent in Fikkal.

Relevance and Justification for Undertaking the Time-Energy Saving Study in Nepal

Foregoing discussions show that under the existing socio-economic situation and health and nutritional status in Nepal, time and energy loss of the people, particularly women and girls, for fetching water, could have critical health implications. A scientific quantifying of the saving of calories by making water easily accessible, could prove to be a more dependable indicator of health and economic benefits of community water supply projects compared to all the existing

indicators. Nepal could be considered among the most appropriate countries for taking up the study, in consideration of the following:

- Additional purchase power for supplementary food intake is beyond their reach. Extra energy spent on water collection could consume one third of the energy intake of these already malnourished women.

- Whatever data is available, on the extent of time and energy spent by people in different parts of the country for collection of water, indicates that bringing water close to the user, could prove to be one of the most cost effective method of restoring energy balance and improving health and nutritional status of the poor and malnourished people, particularly women of rural Nepal.

- A scientific quantifying and evaluation of the situation in Nepal, with extremely difficult and varying topographic conditions would serve as a guideline for other developing countries, where similar problem exists.

2.0. RESEARCH FINDINGS

2.1 Time-Related Results

Time Spent for water collection

In this section a comprehensive analysis is made on the actual time spent per trip for collection of one container of water, average number of trips made in a day for a family and average total time spent for collection of water and to arrive on an average figure indicating the net time saving achieved in the villages where water supply schemes have been implemented. The data on the average time spent per trip, the average number of trips needed for a family per day and the average time spent for collection of water in a day in each of the 3 districts surveyed has been presented in Table - VI-39 and Figures 3 and 4. The mean values of the 3 districts indicate that in the control villages about 46 minutes are spent in making one trip for collection of water and each family requires on an average 7.5 trips per day. Therefore, it is obvious that in these villages nearly 6 hours a day or 25% of the total time (50% of the day time) is spent in collection of water alone. In view of the fact that women are the main water collectors in the rural areas, a loss of 50% of their working time, indeed proves to be quite substantial. A similar picture has been observed in the experimental villages in the pre-project phase where, nearly 5 hours were spent in collecting water. However, in the post-project phase in the experimental villages the average time spent per trip was observed to have been reduced to about 15 minutes. Though it has been observed that the number of trips have increased, due to the obvious reason of improved accessibility, to 12 trips per day, the total time spent was only 3 hours a day.

Maximum time of 9 hours water collection has been observed in the control villages of Kavre

district. On comparing observations of the control and experimental villages, similar trends with respect to time taken for collection of water were observed in each of the 3 districts surveyed. However, the average time spent per trip for collection of water in the Kavre district (central region) was 60 minutes compared to 19 minute in far-west region, both in the control and pre-installation phase of experimental villages. Since time spent is largely dependent on the slope of the terrain, distance traversed and quantity of water available at source, the variation observed with respect to the time taken/required per trip in the districts surveyed may be attributed to these extraneous factors between the areas. For example, in the central district (Kavre), in the majority of cases the slope ranged from 20-30% (i.e. an inclination of 10 deg. to 17 deg. with horizontal), distance traversed ranged between 500-1000 mtrs (70%) as against 5% slopes and within 500 meters distance in the far-west region. The quantum of water available at source in the Kavre district was low as was verbally reported by the villagers. This was further confirmed by the investigators during the survey, in end April, where it was observed that the villagers were literally scraping the water from the bottom of spring wells where depth of water was ankle deep thereby resulting in longer periods of waiting at source.

In the post installation phase of the experimental villages, the average time taken per trip was comparatively higher (30 minutes) in the Kavre district (central) against 12 minutes observed in the far-west district. This was because of very low residual head (pressure) in some of the wards of the experimental villages, which still compelled the villagers to walk to the old or distant source for collection of water.

Time Saved

Table - VI-39 also presents the average time saved per day per family. The combined data of the 3 surveyed districts indicate that the time saved was nearly 2 hours a day when compared between the pre and post project situation in the experimental villages. However, comparison between control and post-project situation revealed that time saved was to the extent of nearly 3 hours a day.

Data on time savings from each of the 3 districts presented an identical trend between control and experimental villages, but in absolute terms the quantum of time savings have varied significantly between different districts with varying topography and terrain. Maximum time saving has been observed in Kavre district in central region which is about 5 hours (comparing control and experimental post project situations). Thus it is interesting to note that in the control villages of Kavre district a person would have to spend almost the entire working hours (9 hours) for water collection and with the installation of water supply projects he is likely to save 50% of that time. However, it must be mentioned that many of the post project data do not reflect the actual benefits likely to accrue to the users when the projects would be fully installed and operation and maintenance practices stabilized. Presently in some of the project villages where schemes have been installed very recently, benefits in terms of per capita consumption and savings in time of collection have not been fully realized, because of some operational problems like low residual pressure. It is expected that a more comprehensive picture will emerge during the longitudinal study next year.

Utilization of Time Saved

Improved access to water is expected to yield direct economic benefits for many rural people. Obtaining water is time consuming and heavy work, taking up a major portion of women's time. Improvement projects have reduced the time substantially. For instance, in a particular study in Mozambique, it was reported that the average time, that a women spent for collecting water was reduced from 120 to 25 minutes a day. Family well-being was thus improved as the time saved could be used to cultivate crops, home gardening, trade in the market. Keeping small livestock, care for children or even rest. In the present study, some interesting observations were made, regarding the utilization of time saved from improved water supply (Table - VI-40 and Figure 5).

Prima-facie observations reveal that although considerable time was saved on account of water collection but the same was not being utilized in the most cost effective ways like trading, cultivation or livestock maintenance. Instead, the main difference was observed in gossiping, sleeping and idle time. Difference in other activities were there but not substantial. Though rest or recreation have indirect health benefits to some extent, but attempts may be made to motivate the villagers to utilize the time savings for some beneficial activities. This calls for an integrated planning for rural development by the local village councils to draw up action plans for starting small scale income generating programmes to engage these women during their free time which might result in effective benefits to the family, to the community and finally for the nation.

2.2 Time-Energy Savings

Energy Saving

The average energy expended in a day for water collection was 654 K. Cal. in control villages, 590 K. Cal. in pre-project villages (by Recall method) and 238 K. Cal. only in post-project (experimental) villages. Hence, the average energy saved per family per day is 416 K. Cal. when compared between control and experimental villages and 632 K. Cal. when compared between the pre and post-project experimental villages using the recall method. The highest saving in energy was observed in the mountainous region of the central zone (Tables VI-36 and 37).

Correlation of Energy Intake with Energy Expenditure

The average energy intake from dietary sources in Nepal is about 2449 K. Cal. per person per day. (Being the average of 2526 K. Cal. in control and 2372 K. Cal. in experimental villages.

Hence, about 20% - 50% of net energy (calorie) intake is expended for collecting water in the control and pre-project experimental villages, while 7% - 12% of the energy intake is expended for water collection in villages where water supply schemes have been implemented. Therefore, the energy saved per person per day after implementation of WES schemes averages out to 13%

to 38%. The savings was however maximum (38%) of the total energy intake per capita in the central mountainous region, while it was about 10% in the terrain/hilly area of the far west region (Table - VI-38).

Time Savings

It was observed that in the control and pre-project experimental villages about 5 - 6 hours a day were spent for water collection alone and on an average 7 - 8 trips were made per day. In the post-project areas the villages spent only about 3 hours a day for water collection though the number of trips increased to 12 per day. Therefore, the saving in time spent for water collection was nearly 50% (Table - VI-39).

Utilization of Time Saved

It was observed that improved access to water supply sources though resulted in savings of both time and energy, the time saved was not yet being utilized for cost effective economic benefits. The main increase in activities was observed to be in sleeping, gossiping and idle time (Table - VI-40).

3.0 SUMMARY OF FINDINGS

Overall, the study shows that provision of water can have a significant impact on the time and energy expended by water carriers and may be significant in conserving important calories in already under-nourished women. However, a longitudinal study is needed to provided conclusive evidence of the total physical, social and economic benefits.

The three major observations resulting from the study were:

1. The average time being spent per household per day fetching water was approximately 6 hours a day in control villages; 5 hours a day in pre-project villages (using recall methods); and 3 hours a day in post-project villages. Therefore the provision of water supply resulted in an average daily household saving of approximately 3 hours a day or 50%.

2. The average calories spent per day to fetch water in control villages was 654 k. cal.; 590 k.cal. in pre-project villages; 238 k. cal. in post-project villages, indicating a daily saving of approximately 350 k. cal. per household.

3. A considerable proportion of the time saved in water collection was spent on rest and talking. Differences in other activities, such as child care, trading and cultivation, were minimal.

The above preliminary results indicate that provision of water may be a very significant input to conserve the calories in already under-nourished woman. However, to assess the exact net

savings by way of both time and energy savings will be examined in the longitudinal survey to be conducted in late 1993.

I R C

International Water and Sanitation Centre

Centre international de l'eau et l'assainissement

Using hygiene behaviour indicators in water, sanitation and hygiene education projects

Discussion paper for the UNICEF workshop on improved sector planning for health and socio-economic benefits, 21-22 April 1993

Prepared by Marieke T. Boot
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It was 2.00 o'clock in the afternoon. Women were gathering for a hygiene education meeting in the house of the village health promoter. I joined as part of the evaluation of a rural water, sanitation and women involvement project in the Republic of Yemen. The promoter welcomed us all and the health educator started to discuss the transmission routes of diarrhoea, using a flannelgraph and cut-out figures of people, animals, houses, water pots, food and faeces. The message was well understood..... One woman got up, angry, shouting: "You are saying we are dirty. But look, look how we have to live", and she left the room.

1. Introduction

The aim of this discussion paper is to share some thoughts on the selection and use of indicators for hygiene behavioural changes for improved sector planning for health benefits from water and sanitation projects.

2. The need to focus on hygiene behaviour*

Health benefits is the major objective of water supply and sanitation projects, at least from the position of governments and donors. Experience has made us aware, however, that provision of new or improved water supply and sanitation facilities alone is not sufficient to meet this aim. Facilities not only have to function properly, they also must be used by all intended users, continuously and in a hygienic way. A handpump unused for whatever reason does not contribute to any health benefits. And the use of a dirty latrine may create rather than reduce health risks.

While potential health benefits can only come about through a hygienic use of water supply and sanitation facilities, additional personal, domestic and environmental hygiene will increase this potential. The safe handling of drinking water before it is consumed, the washing of hands after defecation and before eating, and safe disposal of waste water and solid waste are clear examples in case.

The success of water supply and sanitation projects thus requires a focus on the behaviours of the people with regard to the use and upkeep of facilities, and on additional hygiene practices that help to cut off alternative routes of disease transmission. The need to focus on hygiene behaviour is reflected in a growing integration of hygiene education in water supply and sanitation projects (2), and in an increasing interest in the study of hygiene behaviour for the successful planning, monitoring and evaluation of water supply, sanitation and hygiene education projects (1).

2. Overview of main hygiene behaviours

Hygiene behaviours cover a wide range of actions that promote health. From the viewpoint of the people performing these actions, hygiene behaviour can be broadly divided into five clusters, or so-called 'behavioural domains' (1). These domains are:

A. Disposal of human faeces
B. Use and protection of water sources
C. Water and personal hygiene
D. Food hygiene
E. Domestic and environmental hygiene

An overview of the main behaviours in each domain is presented on the next page. These behaviours - if performed hygienically - are likely to help prevent the transmission of disease. However, there is still much to be learnt about how diseases are transmitted. Evidence from many studies indicate that more often than not a reduction in water and sanitation-related diseases can only be achieved by a combination of a series of hygiene behaviours. Moreover, the significance for health of a specific behavioural change will vary in different communities, depending on the prevailing patterns of disease and existing behaviour.

Behaviour related to food hygiene** is both a wider and a more important domain than usually covered by the water and sanitation sector. Especially weaning food has been identified as a major risk in the cause of diarrhoea and associated malnutrition (4).

Overview of main behaviours which - if performed hygienically - are likely to help prevent the transmission of water and sanitation-related diseases. Source: Boot and Cairncross (Editors) 1993.

A: *Disposal of human faeces*

- choice of place for defecation
- disposal of faeces
- anal cleansing
- disposal of cleansing material
- handwashing
- cleaning of the toilet/latrine
- maintenance of the toilet/latrine
- other activities related to faecal matter
  - use of faeces as fertilizer
  - use of faeces for fish production
  - animals eating faeces

B: Use and protection of water sources

- **choice of water source**
- **water collection**
- **water transport**
- **water use at the source**
- ***wastewater* disposal and drainage**
- **water treatment**
- **water source protection and maintenance**
- **other activities related to water source**
  - **water conservation by prevention of water pollution**
  - **water conservation by prevention of ecological degradation**

C. Water and personal hygiene

- water hygiene in the home
  - water handling
  - water storage
  - water treatment
  - water re-use
  - wastewater disposal
- personal hygiene
  - washing of hands/cleaning of nails
  - washing of face
  - body wash/bathing
  - hygiene after defecation
  - washing and use of clothes, towels and bedding
- personal hygiene during natural events, such as menstruation, birth, death, illness

D. Food hygiene

- **handling practices**
  - **cleaning of kitchen/food preparation area**
  - **handwashing/use of clean hands**
  - **use of clean work-top and kitchen utensils**
  - **use of clean dishcloths/kitchen towels**
  - ***use of safe water***
  - **disposal of wastewater and garbage**
- **preparation practices**
  - **washing of raw food and fruits**
  - **temperature/length of cooking**
  - **temperature/length of re-heating**
  - **speed of cooling**
  - **time of preparation**
- **storage practices**
  - **temperature/length of storage**
  - **location and coverage of stored food**
  - **storage of left-overs**
  - **storage of eating/kitchen utensils**
- **eating and feeding practices**
  - **handwashing/use of clean hands**
  - **use of clean eating utensils**
  - **feeding of babies and small children**
  - **times of eating and feeding**
  - **washing of eating/kitchen utensils**

E. *Domestic and environmental hygiene*

- household hygiene
  - wiping of surfaces
  - sweeping and cleaning of floors/compounds
  - removal of shoes before entering the house
  - cleaning of children's play objects
  - insect control
- environmental hygiene
  - street cleanliness
  - wastewater disposal & drainage
  - solid waste disposal
  - hygiene at public places
- animal management
  - control/corralling of animals
  - safe disposal of animal faeces

Another point coming to the fore is that any particular hygiene behaviour is always complex as it involves many aspects. Hand washing, for example, may be done for various reasons such as cleanliness, beauty or religious purposes; it may be done with or without soap or substitute, in a bowl or under running water, with or without rubbing the hands, with or without drying the hands afterwards with a clean cloth, only occasionally or very often, as a single activity or in the process of other activities such as washing clothes or cleansing after defecation. This implies that when we focus on hygiene behaviour and behavioural change, we are in fact concerned with sets of actions and aspects. The various aspects or dimensions of any particular behaviour are listed in the box below.

Overview of aspects that are involved in any particular hygiene behaviour. Source: Boot and Cairncross (Editors) 1993.

***Box 6:* Dimensions of behaviour**

1. **Applicability of particular behaviour**
   - Is the behaviour applicable?
   - Is the behaviour performed?

2. **Features of particular behaviour**
   - What behaviour?
   - Who (age, sex, marital status, education, occupation religion, socio-economic aspects)?
   - In what sequence?
   - When (what occasion, time of day and year)?
   - How much (quantity)?
   - How well (quality or degree)?
   - How long (duration)?
   - How strongly (intensity)?
   - How often (frequency)?
   - Where (location)?
   - Combined with other behaviours (before and/or after)?

3. **Determinants of particular behaviour**
   - Physical environment
   - Economic conditions
   - Cultural beliefs and practices
   - Household structure/organization
   - Community social structure/organization
   - Personal interest

4. **Motivation for particular behaviour**
   - Why (purpose/reasons)?
   - Perceived costs and benefits
   - Antecedents and consequences of behaviour

3. Risks of focusing on hygiene behaviour changes

The increasing focus on hygiene behaviour in water supply and sanitation projects is a major step forward. At the same time it also bears some risks, and this seems especially to be the case when an emphasis is put on the need for behavioural changes to have a positive impact on health.

The risk of blaming people

One of the risks is putting the blame with the people, or willy-nilly giving the people the impression that they are getting the blame. The example at the beginning of this paper is an illustration in case. Few people put themselves at risk by choice. Rather, physical, socio-economic and cultural influences often present major constraints. Obvious examples are lack of sanitary facilities, and lack of time and money to comply with desired behaviours. Reducing these constraints will allow people to adopt hygiene behaviours until then beyond their means (1 & 2).

The risk of an unbalanced gender focus

Another risk is that of putting the burden with women, especially mothers. The fact that women are usually responsible for water use, hygiene and education of children has also made them the primary target group for hygienic education and behavioural change. This exclusive focus on women and children ignores the fact that men need to support and adopt improved hygiene practices as well, and that the responsibility for health and hygiene should not be placed on the women alone. Focusing only on women's family tasks and responsibilities further bypasses the authority of women in matters related to water supply, sanitation and hygiene and the need to involve them in the project's decision making (5).

The risk of neglecting other important factors

Focusing on behavioural change also may cause a neglect of other important factors for project success. These factors often concern pre-conditions for adoption of hygienic behaviour and behavioural change. For example, water supply, sanitation and hygiene education are more successful when the three components are integrated and build on each other's strengths. The results of a recent mail survey by IRC on factors influencing the success of hygiene education programmes underlines this. Many hygiene educators indicated that their efforts were more successful when educational activities were part of and combined with activities for hardware improvements (report in preparation). Other important factors influencing project success are community participation (both men and women) in project planning, choice of technology and level of service, and siting and management of facilities. A recent state-of-the-art publication on women

involvement provides new evidence that women's involvement in local planning and management has resulted in a better distribution and use of facilities, in better financing and in better hygiene. Where women were not involved, poor women in particular did not get access to improved services (5).

The risk of a top-down project approach
Focusing on success through behavioural change also creates the risk of embarking on a top-down project approach based on a bio-medical model of what our behavioural goals should be. Priorities for the target groups often differ from project priorities in two respects. Whereas the project's main objective is health benefits, people's aim is to make life easier through greater convenience from an improved water supply, greater privacy and safety from latrines, and the time and energy savings from reduced hardships in water collection and waste disposal. Moreover, ideas about which health problems and behavioural changes are more important or should be given preference may be different for projects and community groups. Projects tend to base their choice primarily on their perceptions (and sometimes misperceptions) of which hygiene behaviours have maximum potential of reducing disease transmission. Community groups, however, face many more considerations, including daily life realities and aspirations, and perceived costs and benefits of a particular behavioural change.

4. Selecting and using behavioural indicators:

Continuing the line of thought above, in selecting and using behavioural indicators for the planning and measurement of health benefits in the water supply and sanitation sector the following considerations may be kept in mind:

a. **use behavioural change indicators with care**
In order to prevent unwanted and unnecessary risks it is probably only feasible to talk about indicators for behavioural changes within the specific area of hygiene education. It is a bit beyond this paper, but even within the area of hygiene education the term "behavioural changes" should be used with care, not only because we should prevent blaming people, but also because a change is not always an improvement and it is important to look into the direction of the change. Green et al. provide a valuable discussion on this (10,2).

b. **make a participatory, well-considered choice**
It is always important to focus on a limited set of behaviours. As there are many hygiene behaviours and the implementation of a single hygiene behaviour is seldom

sufficient to cut off disease transmission, a clever selection of behavioural indicators is needed based on project goals, community priorities and local circumstances. Examples of useful tools to guide selection are the 'minimum complex' of hygiene behaviours for the prevention of diarrhoeal diseases identified during the May 1992 WHO Informal Consultation (report in preparation) and the system of Hazard Analysis Critical Control Point (3).

When we have selected the behavioural indicators for planning and measuring project success in terms of potential health benefits, the next question is how to collect the information. It is important to arrive at simple methods of assessment such as self-reporting and spot checks. For example, when our indicator for success is the safe storage of drinking water, we may use spot checks to see whether water pots are covered or not as a quick method of assessment. Or, for hand washing after toilet use we may consider spot checks for presence of soap or ash and water at or near the latrine as an easy indication of hand washing. What data should be collected and how can only be established after an exploratory study (1).

Growing attention is being given to participatory selection and use of indicators, and especially PROWWESS and IIED have taken a lead role in active develoment and promotion. In view of the crucial importance of community participation (both men and women) for project success in terms of effectiviness and sustainability (not to mention the other values of community participation) it goes beyond saying that these developments should be strongly further supported. A new proposed project by WHO/UNDP World Bank Water and Sanitation Programme on participatory methods to study hygiene behaviours is an important example in case.

c. **make indicators gender-and-group specific**

Indicators always should be gender-specific and sensitive to socio-economic and cultural differences. Indicators, also behavioural indicators, easily give the false impression of being neutral, whereas in fact they hide differences between men and women and between various groups of people. A community consists of men and women. Also, a community is never homogeneous, and water and sanitation are never neutral issues. If no differentiation is made, women may be left out or overburdened and the poorer and other disadvantaged groups may easily be overlooked and neglected (9, 12).

d. **also cover non-behavioural indicators**
While it is of crucial importance to focus on behavioural aspects, they should be embedded in overall planning, implementation and evaluation. In terms of indicators we could think of three types, covering both behaviours and conditions:

i. related to project characteristics and pre-conditions for project success (eg. integration of the water supply, sanitation and hygiene education components; community (m/f) participation and management. Other elements not covered by this paper may need to be added such as human resources development);
ii. related to the effective use and upkeep of the facilities (eg general, consistent, exlusive and controlled use of facilities; care for facilities by cleaning, preventive maintenance, quick repair);
iii. related to additional hygiene measures to cut of alternative routes of disease transmission (eg. separate pot for drinking water, washing of hands, safe disposal of little children's faeces, feeding infants recently cooked food).

A number of organizations and professionals have given valuable thoughts to indicators for one or more of these subjects, and it would be worthwhile to review and learn from them. UNICEF has done a lot, other examples are by Deepa Narayan/PROWWESS (6,7), GTZ (8), Christine van Wijk-Sijbesma/IRC/INSTRAW/UNDTCD/ILO (9), Schultzberg/WHO (10), and Brown and Hurtado/WASH).

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* Hygiene behaviour is defined as a wide range of actions that promote health (1).

** Food hygiene is the term most frequently used in the water and sanitation sector, though nutrition and food specialists prefer to describe it as food safety. It is defined as all conditions and measures that are necessary during the production, processing, storage, distribution, and preparation of food to ensure that it is safe, sound, wholesome, and fit for human consumption (3).

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SUPPORTING MATERIAL

FROM
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Health Impacts in Developing Countries: New Evidence and New Prospects

By A. M. CAIRNCROSS, PhD, MICE *(Member)**

ABSTRACT

This review of recent studies of the health impact of water supply and sanitation programmes in developing countries shows that they share many findings, and some methodological problems, with older studies of the subject. Considerable health impacts can occur under appropriate conditions, and it is suggested that the greatest impact can be produced by targeting water and sanitation facilities to those whose existing water sources are furthest away, or whose environment is most faecally polluted.

Another finding is that health benefits stem from the changes in hygiene behaviour which water and sanitation make possible. The measurement of such behavioural changes is a subject in need of development. Nevertheless, it is likely to be easier, more reliable, and more useful to water and sanitation programme managers as an operational evaluation tool than any attempt to measure the health benefits directly.

Key words: Diarrhoea; epidemiology; hygiene; sanitation; water supply.

INTRODUCTION

Attempts to measure the health impact of water supplies and sanitation have a long and chequered history. Many of them have been made by amateur epidemiologists at the behest of the agencies financing the construction of the facilities, and with insufficient planning and rigour. Even some studies supervised by eminent specialists have produced almost useless or meaningless results, after taking years to complete and costing substantial sums of money. This unhappy experience led a panel of experts, convened in 1975 by the World Bank, to conclude that the Bank should not undertake any long-term longitudinal studies of the question[1].

A more sanguine mood prevailed, however, at the international workshop convened in 1983 at Cox's Bazaar, Bangladesh, on 'Measuring the health impact of water and sanitation programmes'. Agencies such as the United Nation's Children's Fund (UNICEF), the World Health Organization and the International Development Research Centre supported the meeting, which gave rise to a set of methodological guidelines[2] and a document[3] explaining how a new technique (the case-control method) could be used to measure impact on diarrhoeal disease, in less time and at lower cost than with conventional methods.

Since that time, new evidence has accumulated. About a dozen studies focusing on diarrhoeal disease have been carried out by reputable research groups, which have endeavoured to incorporate in their methodology the lessons learned at Cox's Bazaar. The results are summarized in Appendix 1. As the Water Decade draws to its close, the time is opportune for *(a)* a review of the results of this activity, *(b)* a synthesis of the lessons to be learned from them so far, and *(c)* careful consideration of their implications for future work.

A review of the published and unpublished results of this new generation of health-impact studies suggests two important conclusions. First, health-impact studies are not an operational tool for project evaluation or 'fine tuning' of interventions. The results are not only unpredictable; they are sometimes so surprising that they offer no firm interpretation. In particular, the short-duration studies sometimes advocated as an operational tool are those which offer least information to assist the interpretation of their results. If no health impact is detected by such a study, the design is too basic, and the sample is too small, to permit any further analysis to discover why this might be so.

Second, notwithstanding the unpredictability of the results of these studies, taken as a whole they provide firm evidence that water supplies, excreta disposal, and hygiene education can have a significant impact on diarrhoeal disease, similar to that indicated by Esrey *et al*[4] on the basis of the older literature. The overall picture suggested by the recent studies is not very different from that offered by the older ones. Most of the studies suggest that access to water, increased water usage, and improvements in hygiene may have a greater impact on diarrhoea than water quality and excreta disposal.

However, any such conclusion can only be a personal assessment of the literature, because considerable (sometimes insuperable) methodological problems beset anyone seeking to conduct such a study[5,6] and can cast doubt on the results. One of

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these problems is 'confounding' at the household level, which deserves more thorough consideration than it has received so far. It arises because of the way most health-impact studies are designed.

A MAJOR PROBLEM

Briefly, there are two main approaches to the design of an epidemiological study to measure the impact of water and sanitation on disease: (i) quasi-experimental, and (ii) observational (Fig. 1).

In 'quasi-experimental' studies, the health of two groups of people is studied, one group being provided with water supply and/or sanitation facilities. This is not a true experiment, because it is not possible to allocate people to the groups at random - as is carried out when evaluating drugs and other medical interventions. Apart from any ethical misgivings it might arouse, in most circumstances the strategy is not politically feasible. Moreover, it is often impractical to observe the two groups before the facilities are installed.

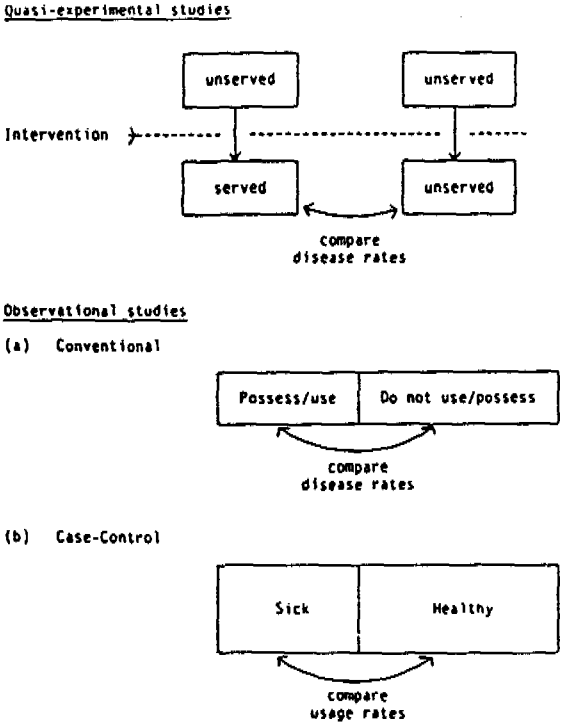

Fig. 1. Types of epidemiological study to measure health impact of water supplies and sanitation

This means that most studies essentially belong to the other type, i.e. 'observational'. The researcher simply observes the health of groups who have and who have not benefited already from water or sanitation facilities, and tries to eliminate any bias due to the way they have been allocated.

Observational studies are of two basic types: *(a)* conventional, and *(b)* case-control. The 'conventional' observational study compares the groups served and not served by the facilities, with regard to their disease rates. The 'case-control' study is the exact opposite of this approach. A group of people who suffer from the disease in question (cases) is compared wth a group of comparable people who do not (controls). The investigators compare the proportion of individuals in each group who are served by the facilities, and from this they can deduce the relative odds of becoming sick among those who are served and not served; in other words, the health impact.

These two types of observational study are mirror images of one another, and both have several problems in common. A major question relates to how the facilities have been allocated among the population. In the case of water supply the allocation is often made to whole communities at a time, e.g. a whole village when a hand pump is installed, and is dictated by administrative or technical convenience, political patronage or other factors only loosely associated with health. In the case of sanitation, however, and in some cases the use of a protected water source, the allocation depends on a decision taken at the level of the individual household.

Serious problems arise because the households which are most likely to invest in a latrine, or to prefer a protected source of water, are probably atypical in other respects. The occupiers of the household may be wealthier than average, their members more educated, or simply more aware of the benefits of hygiene; various studies have shown that this is the case. Wealth, education and hygiene consciousness are also associated with a lower incidence of disease. Hence those using water and sanitation facilities will tend to have less disease, whether or not the facilities have any protective effect. This phenomenon is known as 'confounding'. Statistical techniques exist to 'control' for confounding, with a view to eliminating its effect; however, they are effective only if the confounding factor is accurately measured for each household. In practice, wealth is usually assessed from one or more 'proxy' variables, such as the possession of a metal roof, a watch or bicycle, and education in terms of years of schooling of the adults in the household. Hygiene consciousness, as expressed in hygiene practices, is measured crudely or not at all.

Esrey and Habicht[7] found that sanitation seemed to have a greater impact on diarrhoea incidence than water-supply improvements. It is possible that this apparent finding simply reflects the degree to which studies of the health impact of sanitation have been bedevilled by confounding at the household level, and have only partially succeeded in its control.

Many of the studies where water-quality improvements seemed to reduce diarrhoea, even when conducted by eminently competent researchers, are also open to suspicion.

TARGETING FOR HEALTH IMPACT

It is probably not very productive for anyone other than academic researchers to agonize any longer about such methodological problems and whether an impact on diarrhoea exists at all. Some studies have shown conclusively that it does. Most studies, if less conclusive, tend to support the view that water and sanitation can reduce the incidence of diarrhoea by about 25%[4]. Moreover, water supplies and sanitation can have a powerful impact on other infections. Water supplies can almost eliminate Guinea worm[8] and substantially reduce the prevalence of trachoma[9] and schistosomiasis[10]. Excreta disposal is a prime control measure for intestinal parasitic worms, and most studies of the impact of water and sanitation on the parasitic diseases have underestimated its public-health importance[11].

It is perhaps more constructive to ask under what conditions the greatest benefit to health may be obtained. Some researchers have focused on whether the groups which are likely to benefit most are in a particular socio-economic group[12], or have a particular set of infant feeding practices[13] or level of education[14]. However, the policy implications of such studies are obscure. It would often be administratively impossible, and usually politically unacceptable, to target water and sanitation investments explicitly at such groups.

There is another approach to targeting which is clearly politically equitable but has largely been neglected in the health-impact literature, most of which considers water supply and sanitation as interventions defined by the level of service provided. These interventions can only be fully defined with respect to the conditions prevailing before they were implemented. Piped water in a household which previously used a hand pump in the backyard is unlikely to have the same impact as in one which collected its water from a muddy puddle 1 km away. Where previously-existing water and sanitation conditions are least hygienic, provision at a given level of service is likely to have the greatest impact. Few would dispute that it is equitable to target such environmental improvements on those whose environmental conditions are worst; for example, those whose water sources are furthest away or whose environment is most faecally polluted.

Such target groups are also most likely to feel a need for water and sanitation and therefore most likely to pay for it[15]. They are also most likely to respond to them by improvements in their hygiene. While the evidence from health-impact studies is hard to interpret in this respect, it is clear that in most of those where a significant health impact was found, the provision of water supply or sanitation had been accompanied by improvements in hygiene.

MEASUREMENT OF HYGIENE

'Hygiene' in this context refers to practices such as the washing of hands, food and utensils, or the disposal of children's stools. It may be promoted by better access to water and sanitation or by hygiene education, and improvements in hygiene may be reflected in increased water consumption. It appears that the most significant impacts on disease incidence stem from the behavioural changes which constitute hygiene improvements, and which interventions in the water sector seek to bring about. If no such change in behaviour results from improved water supply or sanitation, the only health benefits which are likely to occur are those stemming from improved water quality; in many settings these are relatively minor or even negligible.

Unless more is known about the conditions for these behavioural changes to occur, it is not possible to know how a health benefit can be expected. However (and this is a third conclusion to be drawn from the recent health-impact studies), all of them had difficulty in measuring the simple behavioural factors such as household water consumption. In some studies these factors were neglected because of an emphasis on water quality. In others an effort was made to examine them, but the study team lacked the necessary expertise or resources. In several, only a simple questionnaire was used, and the results showed too many discrepancies for detailed analysis to be considered worthwhile.

However, the objective study of human behaviour is not impossible, as a wealth of anthropological literature can testify. The problem is that the necessary techniques are not well known in the water and sanitation sector, and no coherent attempt has been made to adapt them to the needs of the sector.

A set of guidelines for the study of hygiene practices would provide practical tools for the operational evaluation of water and sanitation projects. A study of behavioural factors can be carried out more quickly, and much more cheaply, than a health-impact study, and its results would offer far greater power to diagnose problems in an existing programme. For example, a finding that health impact is small does not indicate how the impact can be increased; on the other hand, a finding that, say, latrines are not widely used will suggest measures to improve the situation. In fact, the guidelines envisaged would greatly facilitate implementation of the Minimum Evaluation Procedure for Water Supply and Sanitation Projects[16].

Operational tools for the assessment of changes in hygiene practices would be particularly valuable for the evaluation of hygiene education programmes. Little is known about the relative cost effectiveness of the various possible approaches to hygiene education, and without objective (preferably standardized) methods to measure the impact on the behaviour of each approach, an understanding of this subject is unlikely to improve. Methodological guidance on the measurement of intervening factors would be invaluable to researchers planning any future health-impact studies. It would help them to design their investigations in such a way as to permit a better examination of the pathways by which water and sanitation may influence health. Future interventions can then be designed to maximize their health benefits, although this, it must be stressed, is not a short-term goal.

CONCLUSIONS

1. Reconsideration of the evidence, old and new, on the health impacts of water supply and sanitation programmes in developing countries offers new prospects for programme design and evaluation, by which those impacts can be increased.
2. By considering the existing conditions of water collection and excreta disposal, the provision of water supplies and sanitation facilities can be targeted to the groups which are likely to benefit most from them. These groups are also most likely to be willing to pay for them. On the other hand, it is now clear that these impacts stem from changes in hygiene behaviour.
3. Measurement of the changes will improve the ability to evaluate water, sanitation and hygiene education programmes to make them more effective. However, reliable methods for studying such behaviour has proved elusive, and the assistance of anthropologists is needed to develop better techniques.

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APPENDIX 1

Summary of Recent Health Impact Studies

LOCATION, SECTOR (SOURCE)	TYPE OF STUDY	PROBLEMS	CONCLUSIONS
Mirzapur, Bangladesh: Rural WS, Sanitation and health education[17]	Longitudinal, children under 5	Difficult to distinguish between effects of different interventions.	Combined package of WSS and health education resulted in significant decrease in diarrhoea and dysentery; relative proportion of children suffering from diarrhoea at any one time fell by 46% in intervention area. Closeness to handpump and use of latrine for disposing of children's faeces also significant.
Mohale's Hoek, Lesotho: Rural sanitation[18]	Case control, children under 5	Water use not studied in detail. Private water source associated with 38% reduction in diarrhoea, but this may be largely a socio-economic effect. Surprisingly, significant improvement in children's height-for-age associated with latrine ownership arouses suspicion that results may be due to latrine owners being unrepresentative of population.	Latrine ownership appears to be associated with 24% reduction in children's diarrhoeas, but this is not quite statistically significant at 5% level. Impact of water supply seems likely to be connected with increased use and better hygiene, rather than improvements in water quality. Preliminary analysis of data showed no apparent difference between VIP, pit and bucket latrines, in respect of health impact.
Kurunegala, Sri Lanka: Rural WS[19]	Case control, children under 5	Apparent impact varies widely between the 5 hospitals at which cases and controls were recruited, ranging between 90% reduction in diarrhoea incidence and no significant reduction at all.	No association between childhood diarrhoea and sanitation, access to water or quantity of water used. Quality of water used has an impact: use of protected sources resulted in about 35% reduction in the risk of diarrhoea on average, even among people claiming to boil their water. Hygienic disposal of children's faeces was also associated with 34% less diarrhoea.

LOCATION, SECTOR (SOURCE)	TYPE OF STUDY	PROBLEMS	CONCLUSIONS
Porto Alegre and Pelotas, Brazil: Urban WS[20]	Case control, infant mortality	Small sample size leads to few statistically significant results after correcting for confounding factors. No measurement of factors such as water consumption or quality.	Infants in houses sharing a tap with neighbours are 50% more likely to die of diarrhoea (even after adjusting for confounding factors) than those from houses with in-house piped water (but this result is not statistically significant). Infants from houses using a public standpipe or well are 4.8 times more likely to die of diarrhoea than those from houses with in-house piped water (significant at the 1% level).
Villa Carlos, Fonseca, Nicaragua: Rural WS[21]	Case control, children under 5	Relationships between distance to source and water consumption not studied, despite finding that distance linked to diarrhoea incidence.	Wide variations in level of faecal contamination. Relationship with proximity to water source (especially during dry season) detected, and just significant.
West Zomba, Malawi: Rural WS[22]	Longitudinal, children under 5	Problems in implementing the intervention to be evaluated.	Inconclusive.
East Zomba, Malawi: Rural WS[23]	Case control, children under 5	Sample too small to provide significant results. Distance to both improved and traditional water sources almost the same so water consumption (as reported) did not vary much.	No significant association was found between risk of diarrhoea and type of water source or presence of latrine. Improved water supply and possession of a latrine might reduce diarrhoea risk by 23% but this conclusion is not statistically significant due to small sample size (15% probability it arose by chance).
Cebu, Philippines: Urban WS[24]	Case control, children under 2	Sample too small to provide significant results. No direct measurement of water consumption.	No consistent relationship was found between type or quality of water supply, presence of a latrine and risk of diarrhoea (note that adjustments were made for effects of boiling and proper storage of water).
Imo State, Nigeria: Rural WS, sanitation, health education[25]	Longitudinal study: mainly diarrhoea in children under 6; nutrition in children under 3; and Guinea worm for entire population	Emergence of a new spring in the control area confounded water source comparisons. Improved water supply still not very accessible (median distance 500 m). KAP changes also detected in control area, probably due to exposure to project monitoring.	No consistent reduction in diarrhoea was found, nor any relationship between water source quality and diarrhoea (adults had higher incidence of diarrhoea with improved water quality). Time spent collecting water was linked to diarrhoea incidence: if the collection time was 2 h children aged between 0–4 are 2.9 times more likely to have diarrhoea in any week (for children aged 5–14, 2.0 times). Distance to a borehole is also important: children aged 0–4 from houses more than 250 m from a borehole were 23% more likely to have diarrhoea (but this is not statistically significant).

LOCATION, SECTOR (SOURCE)	TYPE OF STUDY	PROBLEMS	CONCLUSIONS
Lesotho: Rural WS[26,27]	Longitudinal, children under 3	Detection of impact required comparison of households within the improved villages, contrary to the original intention of conducting a randomized controlled trial.	Children in villages without improved water supply grew better and did not have more diarrhoea than in those which had one. They did however, have less Giardia and *E. coli*. In the improved villages, growth rates (but also diarrhoea rates) were higher among exclusive users of the improved supplies. Giardia infection rates were lower and diarrhoea rates among infants higher, among those using more water *per capita*.
Teknaf, Bangladesh: Rural WS and health education[28]	Longitudinal, children under 2	Lack of baseline data prevents distinction between impact of hygiene education and possible difference between areas. Hygiene observed for only one day, not in peak diarrhoea season.	Provision of 1 handpump to 4–6 households plus hygiene education associated with 17% less diarrhoea. Within both intervention and control areas, diarrhoea rates were significantly lower when good hygiene practices were observed: – no faeces in yard – hands washed before serving food – ash/mud used for handwashing after defaecation – use of handpump water for washing. These practices were reportedly more than 9% more common (the last two over 27% more common) in the intervention area.
Bakau, Gambia: Urban WS	Retrospective child mortality under 3	Probable confounding at household level.	Risk of death in households using public taps twice as high as for those with yard connection.

A copy of the discussion to this paper, and a copy of the full version of the proceedings of the Symposium, may be obtained from the Institution's Headquarters.

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WORKING TOWARD A JOINT STRATEGY FOR HYGIENE EDUCATION IN WATER SUPPLY AND SANITATION IN THE 1990s

Within water and sanitation programmes, providing clean, accessible water and sanitary latrines are not sufficient to realize health benefits. Changes in hygiene behaviours, which ensure that new facilities are properly used, are also frequently required. Thus, hygiene education is recognized as an essential part of water supply and sanitation projects that seek to improve the health status of a population. The paper proposes that WHO and UNICEF collaborate on joint activities at the country level as a basis for the development of a joint strategy for hygiene education for the 1990s. Specific joint actions are recommended for WHO and UNICEF to promote hygiene education in country programmes.

CONTENTS

1. HYGIENE EDUCATION - AN ESSENTIAL ELEMENT OF WATER AND SANITATION PROGRAMMES

It is widely recognized that providing clean, accessible water and sanitary latrines are not sufficient, in most settings, to realize health benefits of these improvements. Changes in hygiene behaviours, which ensure that new facilities are properly used, are also frequently required. Consumers, however, often do not have the information on what behavioural changes would bring the greatest health benefits. Also, many are not able, for a variety of reasons, to accomplish a new behaviour, such as using soap or washing hands more often, due to economic, cultural or other constraints. For these reasons, hygiene education is recognized as an essential part of all water supply and sanitation projects that seek to improve the health status of a population.

Reaching and encouraging people to change their behaviour are fundamental factors in the success or failure of any social development programme. An effective hygiene education programme combined with a strong communications strategy is the key. It is often forgotten that it is easy to change technology but not to change behaviour.

2. POTENTIAL HEALTH IMPACT OF IMPROVED HYGIENE EDUCATION PROGRAMMES

Each year over three million children under the age of five die from diarrhoeal diseases. Many other diseases are associated with unsafe and insufficient water, poor sanitation, and personal hygiene practices and a lack of understanding by individuals of what they can do to avoid such diseases.

Most episodes of diarrhoeal diseases can be prevented through changes in child care practices, many of which are related to personal and domestic hygiene. Periodic outbreaks of cholera in Latin America and Africa confirms that adults and older children also can be put at great risk of diarrhoeal disease. Most cholera episodes can be prevented through changes in hygiene behaviour linked to improvements to the infrastructure of water supply and sanitation systems. Even in the absence of infrastructural changes, dramatic decreases in the incidence of cholera can occur through hygiene education, as has been reported from Latin America.

Success in controlling the incidence of other water and sanitation related diseases is even more closely tied to hygiene education. For example, health education for the eradication of guinea worm is viewed as an essential element. Schistosomiasis programmes are increasingly dependent upon health education, even after years of efforts with biological, chemical and engineering controls. The prevention of worm infections, skin and eye diseases rely heavily upon improved personal hygiene, while the prevention of mosquito-borne diseases draws heavily upon improvements in domestic hygiene.

3. DESIGN OF SUITABLE PROGRAMMES

In the design of health education programmes, it is important to use an adaptive and flexible approach aimed at reinforcing positive practices already present in the community. In order to do this, socio-cultural research on local environmental health habits can provide the necessary information for the design of suitable programmes. Efforts should be made to discover what is the extent of present health and hygiene practices.

Village leaders and others knowledgeable on matters of health or water technology can play an important role in hygiene education programmes. Information obtained from them can be used to build upon positive ideas, practices and involvement of the appropriate local people in order to introduce new concepts into the village.

In the design of suitable programmes, emphasis should be upon the changing of behaviour rather than the provision of health knowledge. For example, it is the act of using a latrine or constructing a compost pit, for example, which is important for the programme outcomes. The individual's knowledge and beliefs about health factors may be related to desirable behaviour change but may not in themselves lead to changes in health. By being aware of present beliefs and behaviours within the community, changes can be more easily introduced.

Practical examples of how improvements are made can be a more effective method of introducing new ideas. The construction of demonstration latrines at a health post or government office often may be more effective in convincing people to build latrines than mass media campaigns.

4. WHO AND UNICEF ACTIVITIES IN HYGIENE EDUCATION

4.1 WHO Activities

Improving personal and domestic hygiene has been one of the strategies of the WHO Programme for the Control of Diarrhoeal Diseases (CDD) since 1987. Among other things, it has initiated a scientific research programme to identify what behavioural interventions should have the greatest impact on the prevention of diarrhoeal diseases and what methods or approaches are more successful in bringing about behavioural change.

In 1991, the Community Water Supply and Sanitation (CWS) unit initiated a programme on hygiene education for water supply and sanitation projects and began collaborating with the CDD programme, the Health Education programme, and the Health Learning Materials programme on the basic issues of behavioural change.

In May 1991, the CWS unit and CDD programme held an international informal consultation to review what is known about the impact of various hygiene-related behaviours

on diarrhoeal disease and what methods could be used to influence and change corresponding human responses. The consultation concluded that there is a small set of hygiene behaviours that are most likely to lead to reduced morbidity if adopted in poor communities, as follows:

- Sanitary disposal of faeces (with emphasis on faeces of young children and babies, and of people with diarrhoea);
- handwashing (after defecation, after handling babies' faeces, before preparing food, and before feeding and eating).
- maintain drinking water free from faecal contamination (in the home and at the source).
- feeding small children with recently cooked or recooked food.

It was further concluded that programmes should place immediate priority upon public health communications, participatory community-based methods and school health education.

4.2 UNICEF Activities

UNICEF supports water, sanitation and hygiene education programmes in 97 countries with approximately 170 field staff. In 1991, UNICEF assisted national governments in providing improved water supplies to 22.5 million people and sanitation services to 6 million. The UNICEF Water and Sanitation Workplan for 1990-1995 stresses the importance of strengthening the hygiene education and communication components of all water and sanitation programmes. The focus of UNICEF-assisted water and sanitation programmes has changed significantly over the past ten years, moving away from high cost engineering to low-cost community managed systems and from technical to a combination of socio-technical orientation. In order to strengthen sector staff for this approach, UNICEF has developed a water and sanitation training package including eight modules. Hygiene education/communications and community participation are two of the most important modules included in the training.

In 1993, UNICEF intends to hold an informal meeting on planning water and sanitation programmes for improved health, economic and social benefits. Specific focus will be given to hygiene behavioural changes and indicators for measurement. UNICEF also intends to conduct in 1993 a global evaluation of the sanitation and hygiene education components of UNICEF-assisted sector programmes. Both of these meetings will be used in the development of improved strategies for field level implementation.

5. ON-GOING AREAS OF UNICEF AND WHO COOPERATION IN WATER AND SANITATION

Three recent events resulted in stronger UNICEF and WHO cooperation in health-related areas of water supply and sanitation. First, 1990 marked the end of the International

Drinking Water Supply and Sanitation Decade. Owing to the limited achievements of the Decade and the fact that it did not reach its goal of universal access to water and sanitation, the two organizations decided to collaborate more closely on follow-up activities to the Decade.

Second, the World Summit for Children held in September 1990 called for all UN agencies to collaborate more closely to achieve:

- reduction of the 1990 under-5 child mortality rates by one-third or to a level of 70 per 1,000 live births, whichever is the greater reduction; and
- universal access to safe drinking water and to sanitary means of excreta disposal by the year 2000 combined with health education;

Third, the outbreak of cholera in 1991 in Latin America, later spreading to Africa and other parts of the world, signaled the need for the two organizations to marshall their efforts jointly to achieve greater impact.

Prompted by these three events, UNICEF and WHO decided to collaborate in three specific areas related to water, sanitation and health. These are:

a) The control of diarrhoeal disease.
b) Cholera control in national programmes and the joint raising of funds to support the activities of both organizations.
c) The Joint Monitoring Programme for Water Supply and Sanitation.

In April 1990, the diarrhoeal disease control programmes of WHO and UNICEF met to develop a joint CDD strategy for the 1990s. The WHO programme conducts research to provide scientific guidance for the control strategies and development of tools for programme implementation. In its support to national programmes, it collaborates closely with UNICEF at global level and through its extensive network of country level field offices.

Similarly, in the joint WHO-UNICEF effort on cholera control, the two organizations play complementary roles. UNICEF again assists in strengthening country programmes through its field staff and raises funds for both organizations, while WHO provides direction on the scientific aspects of cholera control and develops the necessary technical and management guidelines.

The WHO-UNICEF Joint Monitoring Programme for Water Supply and Sanitation is intended to strengthen government capability in collecting and utilizing relevant data on sector coverage, management and funding in rural, urban and urban marginal areas to enhance macro-planning and advocacy of the sector. WHO is developing the information management system while UNICEF is responsible for training at the field level and channeling feedback to WHO.

Using the experience gained in these examples of cooperation, the complementary strengths of WHO and UNICEF in the water supply and sanitation sector now should be developed into a joint hygiene education strategy. UNICEF-WHO cooperation on hygiene education was discussed at both the 1990 and 1991 JCHP meetings.

The 1990 Report of the UNICEF-WHO Intersecretariat Meeting, held in November 1990, states that: "UNICEF would particularly welcome a more active WHO role with respect to control of diarrhoeal diseases, health impact, and health/hygiene education (the latter having the best potential for WHO and UNICEF cooperation) and on promotion of sanitation, especially the use of sanitary latrines." (IS/UNICEF-WHO/90.16, P.5).

In 1991 JCHP recommended that joint activities between UNICEF and WHO should include:

> "Strengthening hygiene-related components of water and sanitation interventions through:
>
> a) school programmes that combine hygiene education, curriculum development and the provision of proper water supply and sanitation facilities;
> b) community programmes on health/hygiene education for adults and out-of-school children; and
> c) promoting community-oriented programmes, with special emphasis on the role of women, with a view toward their full involvement in the planning and management of water supply and sanitation activities." (Report of the UNICEF-WHO Joint Committee on Health Policy, 28th Session, January 1991, JCHP28/91/21, P.20)

Despite the above statements, no specific joint activities have been initiated to date in the area of hygiene education. It is proposed that this meeting of the JCHP help to make past resolutions a reality. To undertake an effective cooperative programme to strengthen country level capability, WHO and UNICEF should develop a joint strategy on hygiene education for the 1990s. This strategy should incorporate at least the following elements:

a) The eight countries on which UNICEF and WHO have agreed to collaborate for the control of diarrhoeal diseases.
b) Inclusion in the UNICEF child survival indicators of several new household-level indicators for use by district workers.
c) Addition of these several indicators to the WHO/UNICEF Joint Monitoring Programme.
d) Identification of guiding principles for WHO/UNICEF action for hygiene education based upon a continuous examination of what is known and what actions are effective for behavioural change.

6. PROPOSED JOINT ACTIVITIES BETWEEN WHO AND UNICEF IN HYGIENE EDUCATION

It is proposed that WHO and UNICEF jointly select five to six suitable countries to carry out the following activities during 1993-94.

6.1 Research activities

The importance of good research in planning hygiene education programmes is not always well recognized. WHO and UNICEF should review in selected pilot countries the following elements for hygiene education planning:

- major target audiences
- existing knowledge, attitudes and practices
- likely constraints to changes in hygiene behaviours
- existing channels of communication and potential communication resources, including mass-media, front line workers, school teachers, water and sanitation facilitators, NGOs, community leaders and community groups, including formal and informal women's groups.
- existing hygiene and health education resources.
- training requirements of health workers, water and sanitation engineers, community workers, village women, etc.
- opportunities for integrated communications efforts.

6.2 Development of Strategies

The development of a joint strategy should be the underpinning for all WHO-UNICEF cooperation in the 1990s. However, cooperative actions should not wait until completion of the strategy but should be vigorously pursued on the basis of existing activities and current opportunities. For example, UNICEF and WHO are currently collaborating in hygiene education on an informal basis in the following countries:

In Zambia, on the formation of a health education curriculum in connection with a World Bank project for the rehabilitation of the national education system. Much of the emphasis of the new curriculum will be on hygiene education for the control of cholera and other diarrhoeal diseases.

In Mozambique, where hygiene education materials developed by UNICEF will be incorporated into a new hygiene education programme for peri-urban areas to be developed by the National Low Cost Sanitation Programme and the Ministry of Health with technical assistance from WHO.

In Botswana, where a recent WHO mission enlisted the support of the local UNICEF office to assist in the formulation of a strategy for the delivery of hygiene education to help create demand for the rural sanitation programme.

It is recommended that the programmes responsible for hygiene education in UNICEF and WHO work together in 1993 to develop operational strategies that can be tested in selected countries prior to developing a strategy for the 1990s.

6.3 Training

UNICEF and WHO should work together to develop a training curriculum for hygiene education and communications for field level government and non-government staff. The basis for this collaboration can be UNICEF staff training materials supplemented by new training materials developed for district/village level field workers.

6.4 Using Existing Education Systems

All formal and non-formal opportunities should be reviewed with special attention given to the content of non-formal education courses for women and children. Additional attention should be given to the formal health and hygiene education training given to teachers and health workers as this is often poor.

UNICEF should cooperate with the WHO programmes in Control of Diarrhoeal Diseases (CDD) and Community Water Supply and Sanitation (CWS) which are in the process of developing a WHO strategy for future cooperation in school health education.

It is also recommended that UNICEF and WHO establish immediate cooperation in the area of improving school sanitation facilities and the teaching of hygiene to school children. UNICEF should consider collaborating with WHO and the International Water and Sanitation Centre (The Hague) in the sponsorship of a workshop on school sanitation and hygiene education in Latin America in early 1993.

6.5 Development of Mass Media/Materials

Assistance should be given by WHO and UNICEF for the development of appropriate messages and mass media materials in hygiene education at the country level. The messages should take into consideration the existing knowledge and priorities of the target audiences and, where possible, build on existing positive behaviours.

6.6 Organizational Capacity Building

To ensure a working structure for integrated hygiene education activities, WHO and UNICEF must work to support agencies at country level that provide coordination in hygiene education. Where necessary, such agencies must be strengthened through training, materials support, and policy guidance.

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Reviews/Analyses

Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma

S.A. Esrey,[1] J.B. Potash,[2] L. Roberts,[3] & C. Shiff[4]

A total of 144 studies were analysed to examine the impact of improved water supply and sanitation facilities on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. These diseases were selected because they are widespread and illustrate the variety of mechanisms through which improved water and sanitation can protect people. Disease-specific median reduction levels were calculated for all studies, and separately for the more methodologically rigorous ones. For the latter studies, the median reduction in morbidity for diarrhoea, trachoma, and ascariasis induced by water supplies and/or sanitation was 26%, 27%, and 29%, respectively; the median reduction for schistosomiasis and dracunculiasis was higher, at 77% and 78%, respectively. All studies of hookworm infection were flawed apart from one, which reported a 4% reduction in incidence.

For hookworm infection, ascariasis, and schistosomiasis, the reduction in disease severity, as measured in egg counts, was greater than that in incidence or prevalence. Child mortality fell by 55%, which suggests that water and sanitation have a substantial impact on child survival.

Water for personal and domestic hygiene was important in reducing the rates of ascariasis, diarrhoea, schistosomiasis, and trachoma. Sanitation facilities decreased diarrhoea morbidity and mortality and the severity of hookworm infection. Better water quality reduced the incidence of dracunculiasis, but its role in diarrhoeal disease control was less important than that of sanitation and hygiene.

Introduction

Water and sanitation have been the subjects of considerable recent attention as a result of the declaration by the United Nations General Assembly that the 1980s were the International Drinking-Water, Supply and Sanitation Decade (IDWSSD). A major objective of this was to improve the health of populations that received the interventions. Most of the research on the health impacts of water and sanitation projects has focused on the incidences of diarrhoeal diseases, malnutrition, and mortality of young children, and evidence accumulated during the decade indicates that these rates have been reduced (*22*, *25*). Although it is generally believed that the rates of other diseases will decrease following improvements in water and sanitation, there have been no systematic reviews of this.

The present article reviews the health impact of water and sanitation interventions on the following: ascariasis (*Ascaris lumbricoides*), diarrhoeal diseases (including measures of nutritional status and child survival), dracunculiasis (*Dracunculus medinensis*), hookworm infection (*Ancylostoma duodenale* and *Necator americanus*), schistosomiasis (*Schistosoma haematobium* and *S. mansoni*), and trachoma (*Chlamydia trachomatis*). These diseases were chosen because they are widespread in developing countries, or because they constitute serious problems where they exist, or both (Table 1). All developing countries are affected by diarrhoeal diseases and ascariasis; the

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Table 1: **Incidence and effects of selected diseases in developing countries (excluding China)**

	Estimated number of:	
	Cases per year ($\times 10^6$)	Deaths per year
Ascariasis[a]	900	20 000
Diarrhoeal diseases[b]	875	4.6 million
Dracunculiasis[c]	4	—[f]
Hookworm infection	800	—[f]
Schistosomiasis[d]	200	—[f]
Trachoma[e]	500	—[g]

[a–e] See ref. *96*, *80*, *97*, *57*, and *18*, respectively.
[f] Usually causes debilitation rather than death.
[g] The major disability is blindness (8 million).

other four diseases are somewhat more restricted in their range, although they are all prevalent in some developing countries, except dracunculiasis, which only occurs in parts of Africa and Asia.

These diseases also illustrate the variety of mechanisms through which improved water and sanitation can promote health (Table 2). Four basic aspects were considered: sanitation (i.e., human excreta disposal), water quality, personal hygiene, and domestic hygiene. Personal hygiene refers to water used for cleaning the body, including water for the face, hands, and eyes, domestic hygiene refers to water used to keep the home clean (e.g., food, utensils, and floors). Each disease is affected by one or more of these interventions. For example, providing safe, potable sources of drinking-water will probably prevent transmission of dracunculiasis, while using larger quantities of water for personal hygiene will probably interrupt the spread of trachoma. The incidence, prevalence, and/or severity of all these diseases are reduced by water and sanitation interventions.

Table 2: **Illustration of the potential relation between water and sanitation interventions and morbidity from selected diseases[a]**

	Intervention			
	Improved drinking-water	Water for domestic hygiene	Water for personal hygiene	Human excreta disposal
Ascariasis	+	++	—	++
Diarrhoeal diseases	+	++	++	++
Dracunculiasis	++	—	—	—
Hookworm infection	—	—	—	++
Schistosomiasis	—	++	++	++
Trachoma	—	+	++	—

[a] Interventions marked with one or two pluses have an impact on a particular disease: an intervention marked "++" will have a stronger impact than one marked "+"; "—" = the intervention has little or no impact on reducing disease rates. For a particular disease, a package of interventions with pluses is expected to produce a larger impact than any one intervention alone.

Methods

Computer searches of articles on each of the diseases considered were carried out using the MEDLINE and MEDLINE 500 systems, which cover the period from 1966 and 1986, respectively. For schistosomiasis, an additional computer search was performed on CAB Abstracts (period, 1984–89). For hookworm infection and ascariasis, Index Medicus was searched for 1976–86, and the Science Citation Index for 1970–84. Because a thorough review of diarrhoeal diseases was published in 1986 (*22*), only studies published since then were sought. For trachoma, additional references were provided by a recent review (*72*).

References cited in the articles identified, but which were not located in the computer search, were also sought. Only studies published in English in peer-review journals were used; this methodology excluded technical reports, mimeographs, and agency documents. An exception was made for studies carried out by Miller et al.,[a,b] because although they had been published in peer-review journals, the unpublished documents upon which they were based contained more information. Finally, the review was restricted to studies that presented data on the effect of water and sanitation conditions on one of the six diseases.

Specific criteria that we have reported previously were used to identify the rigorous studies from the large number reviewed (*22*). First, studies were divided into those that reported a statistically significant positive association between the provision of improved water or sanitation and better health and those that did not. Studies were excluded from the rigorous category if they had a single major flaw or several known or suspected minor flaws that could have biased their results. Each disease is treated in turn, with the discussion focusing on the rigorous studies.

The median reductions in morbidity (i.e., incidence and prevalence) and a range of reductions attributable to improved water and sanitation were

[a] Miller, F.D. et al. *Human intestinal parasitic infections and environmental health factors in rural Egyptian communities.* (EPA Research Reporting Series EPA-600/1-80-024), 1980.
[b] Miller, F.D. et al. *Schistosomiasis in rural Egypt: a report of U.S.-Egyptian River Nile and Lake Nasser research project.* (EPA Research Reporting Series EPA-600/1-78-070), 1978.

calculated for each disease, based on all the studies reviewed. The same calculations were also made for only the rigorous studies, the results from which more accurately represent the reductions that may be achieved by water and sanitation interventions. The results reported in some studies did not permit determination of the median reduction in morbidity, and such studies were not included in the calculations. The average reduction for each disease category was expressed as the median value for all the studies considered, and not as the mean, because medians are not influenced by extreme values, while means are.

The definitions of morbidity reported in the articles reviewed included incidence, point and period prevalence, infection, and indicators of severity (e.g., duration). As far as possible, changes in incidence and prevalence have been used in the present review, but the discussion of specific studies also includes changes in infection and severity of disease.

Results

Ascariasis

For ascariasis, nine studies that reported a positive effect for water supply or sanitation were reviewed (*3*, *15*, *31*, *37*, *63*, *66*, *76*, *77*)[c] together with five negative studies (*28*, *44*, *78*, *85*, *89*). Three studies (*63*, *66*)[c] examined differences in excreta disposal facilities, and five (*3*, *15*, *37*, *76*, *77*) investigated various combinations of water supply and sanitation conditions. All five negative studies reported on excreta disposal facilities, while only one study (*37*) investigated the influence of water supplies alone. One study (*31*) reported both positive and negative findings; for ascariasis, significant differences were found among users of different types of excreta disposal facilities. The median reduction in morbidity estimated from all studies was 28%, while that for only the rigorous studies (*3*, *37*, *76*, *77*) was 29% (Table 3).

Water supplies with sanitation. The four rigorous studies (*3*, *37*, *76*, *77*), all of which reported positive effects, investigated the combination of water supplies and excreta disposal facilities. The rate of morbidity reduction was dependent on the level of service provided, and indoor facilities were associated with larger reductions than public facilities. In the USA the prevalence of *Ascaris* spp. among all age groups was reduced by 71% for people with flush toilets and indoor plumbing compared with a group that had lavatories but no well-water (*77*). In Saint Lucia the prevalence of *Ascaris* spp. was reduced by 31% for a cohort of children with household water and latrines compared with a control group without such facilities (*37*). In Iran the provision of a courtyard latrine

[c] See footnote *a*, p. 610.

Table 3: Expected reduction in morbidity and mortality from improved water and sanitation for selected diseases[a]

	All studies[b]		Rigorous studies[b]	
	n[c]	Median reduction (%)	*n*[c]	Median reduction (%)
Ascariasis[d]	11	28 (0–83)[e]	4	29 (15–83)
Diarrhoeal diseases				
Morbidity	49	22 (0–100)	19	26 (0–68)
Mortality	3	65 (43–79)	—	— —
Dracunculiasis	7	76 (37–98)	2	78 (75–81)
Hookworm infection[d]	9	4 (0–100)	1	4 —
Schistosomiasis[d]	4	73 (59–87)	3	77 (59–87)
Trachoma	13	50 (0–91)	7	27 (0–79)
Child mortality[f]	9	60 (0–82)	6	55 (20–82)

[a] The reduction for each individual study was calculated, if possible, directly from the data reported, usually prevalences. However, this was not possible for studies that reported results as odds ratios or graphically. To convert the odds radios, we used prevalences, if they were known; for the data in graphical form, estimates of the reductions were made. If a study reported the results from more than one comparison, the largest reduction in disease was used to highlight the benefits of water and sanitation under optimal conditions. The results from studies that reported reductions that were not statistically significant were used. If studies showed an increase in disease, this was taken to be a reduction of zero; because medians were used, this did not affect the results.

[b] For every disease category, all available studies that met the criteria described in "Methods" are summarized.

[c] The number of studies may not equal the number of studies reviewed. For some studies, reductions could not be calculated because data were not available or prevalences could not be determined from the odds ratios.

[d] Although the presence of eggs in stools was used as an indicator of the prevalence of ascariasis, hookworm infection and schistosomiasis, data for the reduction in egg count (an indicator of the severity of these diseases) were not used in the calculations.

[e] Figures in parentheses are the range.

[f] Results from several studies were excluded from the child mortality calculations. One study (*13*) used the same data as two others (*23*, *33*), and so these three were grouped as one study. Another study (*4*) did not isolate the effect of water and sanitation on mortality; and reduction levels could not be estimated from another study (*98*).

and public standpipes was associated with a reduction of 16% in the prevalence of ascariasis compared with a control group with no such facilities (*76*).

In two studies in Iran the reduction in the severity of ascariasis was greater than that of its prevalence (*3*, *76*). In one of these studies the baseline infection rates and egg counts in four villages that had a household latrine and a community water supply were compared with the infection rates and egg counts in three control villages (*3*). After 3–4 years, the prevalence of infection with *Ascaris* spp. in the group with latrines and water supply had decreased by 28% and the egg counts by 60%. For the control group, the prevalence of infection and the egg counts decreased by 19% and 29%, respectively. In the second study, courtyard latrines and public standpipes reduced egg counts by 62% over a 1–2-year period, but the prevalence of ascariasis dropped by only 16% (*76*).

Water supplies. The effect of water supplies on infection with *Ascaris* spp. was compared in two studies (*37*, *77*). In the USA the reduction in the prevalence of infection was 37% for a group that had lavatories and indoor plumbing, and 12% for those with lavatories and a yard well, in both cases relative to a control group that had only lavatories, but no well-water (*77*). In Saint Lucia the provision of household piped water supplies produced a 30% reduction in ascariasis over a 2-year period among children under 3 years of age (*37*).

Water and sanitation plus chemotherapy. The reduction in ascariasis was greater if chemotherapy was used in conjunction with water and sanitation than if only water and sanitation were provided. In the study in Iran described above (*3*), four villages were supplied with a household latrine and a community water supply plus chemotherapy, four others with only chemotherapy, and three villages remained as a control group. For the group with latrines, water, and chemotherapy, the prevalence of *Ascaris* spp. among all age groups decreased by 79% and egg counts by 88%, while the corresponding reductions for the chemotherapy-only group were 84% and 90%. These were considerably greater than the reductions for the group with only water and sanitation (28% and 60%, respectively). The reductions in the prevalence of ascariasis and in egg counts for the control group over the 3–4-year study period were 19% and 29%, respectively.

Diarrhoeal diseases

We have updated a previous review of 67 studies on diarrhoeal morbidity, nutritional status, and mortality (*22*) by including 17 more recent studies (*1*, *6*, *7*, *23*, *24*, *26*, *27*, *33*, *39*, *51*, *52*, *65*, *81–83*, *95*, *103*). The median reduction in diarrhoeal morbidity calculated from all the studies was 22%, and from the rigorous studies only, 26% (Table 3).

Water and sanitation. Eleven studies examined the combined effect of water and sanitation without considering the effect of each separately; the median reduction determined from the seven that provided appropriate data was 20% (Table 4). Two studies reported on specific pathogens, one on nutrition, and one on mortality. Of the 11 studies, seven were flawed (three of which reported positive impacts). In two of the rigorous studies, an average of 30% reduction in diarrhoea was associated with improved water and sanitation conditions (*47*, *73*). A third study reported fewer malnourished children from families with a sewage system and a household bath than from families with latrines and no bath (*16*). In Malawi, the combination of water and sanitation was associated with a lower prevalence of diarrhoea, but the results were not statistically significant because of small sample sizes (*103*). Only one of the 11 studies examined mortality: among infants in Malaysia, the addition of toilets and water versus no facility was associated with an 82% reduction in infant mortality, particularly if the child was not breast-fed (*33*).

Sanitation. The impact of sanitation was examined in 30 studies (12 of which were flawed), and 21 reported health improvements. Overall, a 22% reduction in morbidity was calculated for 11 of the 30 studies, whereas the reduction determined using data from

Table 4: Expected reduction in diarrhoeal disease morbidity from improvements in one or more components of water and sanitation

	All studies		Rigorous studies	
	n	Reduction (%)	*n*	Reduction (%)
Water and sanitation	7[a]/11[b]	20	2[a]/3[b]	30
Sanitation	11/30	22	5/18	36
Water quality and quantity	22/43	16	2/22	17
Water quality	7/16	17	4/7	15
Water quantity	7/15	27	5/10	20
Hygiene	6/6	33	6/6	33

[a] The number of studies for which morbidity reduction calculations could be made.
[b] The total number of studies that related the type of facility to diarrhoeal morbidity, nutrition, and mortality studies.

five of 18 rigorous studies was 36% (Table 4). Of the remaining rigorous studies, two reported on nutritional status and 11 on mortality. Of the studies that compared the relative importance of water and sanitation, most reported that sanitation had a greater impact on child health, based on mortality, growth, and morbidity indicators. Some mortality studies reported that the method of disposing of excreta determined the magnitude of the health impact. Mortality was reduced to a greater extent by flush toilets than by pit latrines (*2*, *34*, *98*), which nevertheless were associated with mortality reductions compared with no sanitation facilities at all. Sanitation has also been reported to produce a differential health impact depending on the presence or absence of other risk factors. For example, sanitation was most effective in reducing mortality among nonbreast-fed infants (*13*) and infants of illiterate mothers (*23*) than among breast-fed infants or literate mothers.

Water quality and quantity. In most of the studies reviewed, it was difficult to determine whether the differences in health conditions were due to increased amounts of water, improvements in its quality, or both; these studies have therefore been grouped together. Of the 43 studies that compared groups with different types of water supplies, 24 reported a positive impact, and for the 22 studies for which morbidity calculations could be made, a median reduction of 16% was calculated (Table 4). Of the remaining studies, four reported on pathogens, four on nutritional status, 11 on mortality, while two had insufficient information. Fourteen of the studies were rigorous. Only two of the 22 morbidity studies were rigorous (median reduction, 17%). Nine of the rigorous studies reported on mortality and three on nutritional status. Of these, a modest benefit for particular, but not all, age groups was found. In the studies that reported a health benefit, the water supply was piped into or near the home, whereas in those that reported no benefit, the improved water supplies were protected wells (*2*), tubewells (*74*), and standpipes (*27*, *51*, *52*, *69*, *98*).

Water quality. Sixteen studies (10 of which reported positive effects) examined the health impacts of pure versus contaminated water supplies. Of the seven studies for which calculations could be made, a median reduction in the prevalence of diarrhoea of 17% was found (Table 4). Four of the other nine studies reported on pathogens, two on nutritional status, two on diarrhoeal mortality, while one had insufficient information. In several of the studies, impacts were found only for certain age groups. Among the seven rigorous studies, a median reduction of 15% in diarrhoeal disease morbidity was found for the four studies for which this could be calculated. Of these, one reported little or no association between the quality of drinking-water and the occurrence of diarrhoea in children (*39*), another reported an 8% reduction in the prevalence of *Shigella* spp. (*87*), while two found some association with child nutritional status, but not with diarrhoea (*24*, *55*). Because diarrhoea has many causes, drinking-water constitutes only one of many sources of infection. In areas where environmental faecal contamination is high, little or no health impact from water improvement can be expected. For example, studies in Lesotho (*30*) and Guatemala (*79*) failed to detect reductions in the prevalence of diarrhoea following improvements in water quality. Also, a recent study in Brazil (*95*) found no association between water quality and diarrhoea mortality, as did an earlier study in India (*104*).

Water quantity. Of the 15 studies that examined the effect of increased amounts of water specifically and independently of water quality, all but one reported a positive impact. The median reduction for seven studies for which this could be calculated was 27% (Table 4). Of the other eight studies, five reported on pathogens and three on nutritional status. Of the 10 rigorous studies, a median reduction of 20% was found for the five for which this could be calculated. Health benefits were greater for children whose families used more water than for those whose families used less, but, in some instances, the differences were small or significant only for selected age groups. In Ethiopia, the prevalence of diarrhoea among under-2-year-olds from families with higher water usage rates per person was less than that among comparable children from families with lower rates (*32*). In Lesotho, use of smaller amounts of water was associated with higher rates of infection with *Giardia lamblia* (*26*). In both of these studies, the amount of water used was more important than its source. No studies relating water quantity and mortality were identified.

Hygiene. Only six studies were found that reported on the impact of hygiene interventions on diarrhoeal morbidity (*1*, *6*, *12*, *45*, *82*, *93*). All were rigorous, and the median reduction was 33% (Table 4).

Several studies focused specifically on handwashing. In Burma, a 30% reduction in diarrhoea was reported when mothers and children were provided with soap and encouraged to wash their hands after defecation and before preparing meals (*6*). In day-care centres in the USA (*12*), a handwashing regimen reduced the incidence of diarrhoea by 48% compared with a control group; and in Bangladesh

(*45*), a 35% reduction in the incidence of diarrhoea caused by *Shigella* spp. occurred following an intervention to promote handwashing.

Other studies have examined not only handwashing, but combinations of handwashing and other hygienic behaviours. For example, an educational intervention in Bangladesh (*82*) emphasized proper handwashing before preparing food, defecating away from the house at a proper site, and suitable disposal of waste and faeces; the investigators reported a 26% reduction in the incidence of diarrhoea. Another study in Bangladesh provided hand pumps and health education to promote personal and domestic hygiene (*1*); a greater than 40% reduction in the incidence of diarrhoea was found among groups with good hygiene practices (irrespective of whether or not they received the intervention), compared with individuals with poor practices. The reduction attributable to the intervention itself was 17%. In Guatemala the incidence of diarrhoea was reduced by 14% following a programme to promote health awareness and hygienic behaviour (*93*).

Dracunculiasis

Seven studies (*11*, *21*, *36*, *41*, *54*, *75*, *94*), two of which were rigorous (*21*, *36*), examined the impact of improved water supplies on the prevalence of dracunculiasis. All reported a positive impact, with similar median reductions being reported for all studies combined and for the rigorous studies only (76% and 78%, respectively).

Water source. The two rigorous studies (*21*, *36*), both of which were from Africa, compared the use of borehole water and of water from unimproved sources. In Nigeria (*21*), the impact of a UNICEF-assisted rural water project that provided boreholes and hand pumps, along with health education, was evaluated. Prior to the intervention 8600 subjects, and 3 years after its installation, over 10 000, were examined. The study comprised 20 serviced and five unserviced communities. Use of borehole water reduced the incidence of dracunculiasis by 81%. The greatest reduction in the prevalence occurred in those villages where the boreholes were conveniently sited and close by, but the effect was less if the wells were distant. The impact was also less dramatic in villages where the water was unpalatable or the supply erratic.

A study in Uganda reported data from a pre-intervention survey (*36*). Over 2000 people were interviewed in the north-west of the country to determine the relationship between water use and disease. The results were analysed by season because the attack rate of dracunculiasis peaked twice during the year. During the rainy season the attack rate among borehole users was one-tenth of that among non-users, while during the dry season it was two-fifths that of non-users.

Seasonal transmission. A number of studies on dracunculiasis have investigated the seasonal nature of its transmission. In West Africa, attack rates correlated positively with periods of below-average rainfall or the dry season, when the copepod vectors reached their highest density in ponds that were drying up (*9*, *20*). In Nigeria, the prevalence of the disease remained high if the piped-water supply was intermittent or unreliable during the dry season (*40*). The problem of unreliable tube-wells or boreholes which fail, particularly during the dry season, is frequently cited as an important factor that contributes to transmission of dracunculiasis (*11*, *84*).

Hookworm infection

Eleven studies (*3*, *15*, *17*, *31*, *44*, *63*, *77*, *78*, *86*, *89*)[a] were reviewed that related hookworm infection to excreta disposal facilities, with or without water supplies. Five studies reported positive findings, two involving water supply and sanitation (*15*, *77*) and three sanitation only (*17*, *44*, *89*). Only one study, which examined the influence of sanitation facilities in conjunction with chemotherapy, was considered to be rigorous (*3*). The median reduction in the prevalence of the disease calculated from all studies was 4%, which was the same as that calculated from the rigorous study alone (*3*).

Excreta disposal. In the study in Iran referred to under ascariasis (*3*), villages where sanitation improvements were carried out had a 4% decrease in the prevalence of hookworm infection, while there was a 26% reduction in egg counts among those infected. For the group that received the sanitation and chemotherapy intervention, the reduction in prevalence of infection was 69%, while the egg count was reduced by 88%; for the chemotherapy-only group, the reductions were 73% and 87%, respectively; and for the control group, 11% and 12%. However, each cohort began with a different prevalence of hookworm infection, e.g., at the outset 77% of the sanitation cohort and 44% of the control group were infected.

Schistosomiasis

Twelve studies were found that examined water and sanitation facilities and rates of schistosomiasis (*8*,

[a] See footnote *a*, p. 610.

29, 38, 43, 46, 49, 50, 53, 59, 64, 86)*. All four of the rigorous studies examined the degree of protective efficacy of water supplies (*8, 43, 50, 59*). Extensive water supply and washing facilities were provided to the study populations. One study also examined the effect of water supply and the provision of latrines (*8*). For all studies combined, the median reduction in morbidity was 69%, and for the rigorous studies only, 77% (Table 3).

Water supplies. The presence of piped-water in the home (*43, 50*) was associated with larger reductions in the prevalence of schistosomiasis than that produced by community water supplies (*59*). In Saint Lucia over a 5-year period following the provision of household piped-water and community washing and showering facilities, the overall prevalence of schistosomiasis was reduced by 27% and that among children aged under 10 years of age, by 59% (*43*). In south-east Brazil, children aged 5–14 years were 2.3 times more likely to be infected if they had no piped-water in their home (*50*).

In Zimbabwe the prevalence of *S. mansoni* among schoolchildren who lived on communal lands without a piped-water supply was 4.8% and of *S. haematobium*, 4.4% (*59*). Among children who lived on the same lands, but with piped water, the prevalence of *S. mansoni* and *S. haematobium* was 0.8% and 0.4%, respectively.

In Brazil the severity of schistosomiasis was reduced more than was its prevalence (*50*). Children aged 5–14 years were 7.3 times more likely to have splenomegaly (an indication of severe schistosomiasis) if they had no piped water in their home. Malaria, which can also cause splenomegaly, was not a confounder, because its prevalence in the study area was low. The risk of severe infection (7.3) was much greater than the risk of the prevalence of schistosomiasis (2.3).

Sanitation and water supplies. One study in north-east Brazil reported the prevalence of *S. mansoni* before and after a water, sanitation, and health education campaign (*8*). In the treatment villages, latrines were built for each house, and communal taps, laundry facilities, showers, latrines, and hand pumps were installed. Over a 7-year period, children under 14 years of age exhibited a net drop in the prevalence of schistosomiasis, and this was 77% greater in the treatment than in the control villages.

Water contact. One of the primary mechanisms through which improved water supplies have an impact on schistosomiasis is by reducing human contact with infected water. A distinction should therefore be made between possession of an improved water supply and having contact with pathogen-laden water. In Saint Lucia (*42, 43*) and south-east Brazil (*50*), access to improved supplies that included laundry and shower facilities was associated with reduced contact with infected waters and thus reduced infection. In Saint Lucia, this led to an 82% reduction in the frequency that people had contact with infected water and a 96% reduction in water-contact time. In Kenya, the installation of boreholes, without laundry or shower facilities, failed to reduce the reliance on high-risk marshes and ponds for bathing (*46*).

Water supplies and chemotherapy. Reinfection can rapidly diminish or negate health improvements brought about by community-wide schistosomiasis programmes devoted exclusively to drug therapy (*10, 101*). Drug treatment combined with improved sources of water produces a greater reduction in the prevalence of schistosomiasis than that resulting from provision of water facilities alone (*43, 60, 64, 68*). Programmes that adopt a multifaceted approach have repeatedly been successful (*64, 67, 90*), and the provision of adequate water supplies to those who have been treated with drugs can prevent reinfection (*43*). For example, in Saint Lucia oxamniquine caused a precipitous drop in the rates for infection with schistosomiasis and a 4-year follow-up provided no evidence for reinfection (*43*).

Trachoma

Sixteen studies on the role of water, sanitation, and/or hygiene in the reduction of trachoma were reviewed. Thirteen reported positive effects (*5, 14, 19, 35, 56, 58, 61, 62, 71, 88, 91, 92, 99*) and three, negative (*48, 70, 102*). Five of the rigorous studies were positive (*5, 61, 91, 92, 99*) and two, negative (*48, 102*). The median reduction in trachoma calculated for all studies was 50% and for the rigorous studies only, 27%.

Distance and time to water source. Four studies (*5, 61, 92, 99*) reported a 30% median reduction in trachoma that was associated with shorter distances or time to water sources. In China (Province of Taiwan) the prevalence of trachoma among people with household water connections was 45% less than among those whose water source was over 500 m away (*5*); and in India those who had a water supply within 200 m exhibited 30% less trachoma than those who obtained water from a more distant source (*61*). In Malawi there was 26% less trachoma among

* See footnote *b*, p. 610.

children whose water was less than 5 minutes away than among those who required a trip of more than 1 hour to obtain water (*92*). In the United Republic of Tanzania, 26% fewer households had trachoma that affected all the children if the source of water was less than 30 minutes away, compared to a water source that was more than 2 hours distant (*99*). Two other studies (one in Morocco (*48*) and one in Mexico (*91*)) failed to find such an association between the prevalence of trachoma and distance to water supply.

Distance to water has been taken to be a proxy for the amount of water used, but the above-mentioned Tanzanian study did not find a direct association between the distance to water and the amount of water brought into the household (*99*). Also in the study in Morocco there was no correlation between distance to the source and the per capita use of water (*48*). Similarly, several studies of diarrhoeal diseases have reported no significant association between improved water or distance to water and the amount of water used (*27, 51, 100*).

Personal hygiene. In India people with good hygiene practices had 79% less trachoma than those whose practices were poor (*61*). In Mexico a study of the relationship between the prevalence of trachoma and a variety of possible risk factors reported a significant association only for the frequency of face-washing (*91*). Children who washed their faces seven or more times a week had 69% less trachoma than those who washed their faces less frequently; however, the importance of this aspect of personal hygiene was not confirmed in a follow-up investigation in Mexico near the original study site (*102*). The different findings in these two studies might be accounted for by the different conditions: in villages included in the follow-up study, almost twice as many children washed their faces frequently as did those in the original villages.

In the United Republic of Tanzania observations of hygiene practices indicated that a child was 1.7 times more likely to have trachoma if all the children in the family had unclean faces (*99*). Also, distance to water was related to the proportion of children with unclean faces. There were 14% fewer households where all the children had unclean faces when the source of water was less than 30 minutes away, compared with more than 2 hours away.

Conclusions

The results of this review indicate that improvements in one or more components of water supply and sanitation can substantially reduce the rates of morbidity and severity of ascariasis, diarrhoeal diseases, dracunculiasis, hookworm infection, schistosomiasis, and trachoma. Despite the mix of both positive and negative studies, the overwhelming evidence is in favour of positive impacts, with the exception of hookworm infection, for which the impact was negligible. The reduction in morbidity from the rigorous studies ranged from 26% for diarrhoea, 27% for trachoma, and 29% for ascariasis to 77% for schistosomiasis and 78% for dracunculiasis. For the rigorous studies the median reduction in diarrhoea-specific mortality was 65% and in overall child mortality, 55%, which suggests the important role that water and sanitation play in enhancing child survival.

Studies that reported reductions for one disease (or even more than one) most probably underestimated the total effect of water and sanitation in improving health. This was particularly true if several diseases that are affected by water and sanitation were prevalent simultaneously in the intervention area. Even though studies often report on only one indicator of health for a selected age group, other health indicators may also be changing for other age groups.

In addition to reducing the incidence or prevalence of disease, improvements in water and sanitation can be expected to affect other aspects of health. When infection rates are reduced by chemotherapy, as was the case for some parasitic diseases, water and sanitation facilities prevented infection rates from increasing again to pretreatment levels. Furthermore, the severity of infection was often reduced more than that of the incidence or prevalence. For example, the reductions in egg counts for ascariasis, schistosomiasis, and hookworm infection were greater than those in the incidence or prevalence of these diseases. In addition, reductions in childhood diarrhoea and overall mortality rates were greater than for diarrhoea incidence or prevalence, which suggests that the severity of diarrhoea was reduced more than its incidence.

The expected reductions in disease rates provide a guide. The studies reviewed were of variable quality, and therefore reductions may be smaller or larger depending on several factors; for example, the success with which an intervention was installed, the overall health status of the recipients, and the presence or absence of environmental factors that can also reduce transmission of disease agents. If the interventions do not work, break down, remain underused, or do not change behaviour sufficiently, they will probably result in small impacts at best. No study, irrespective of how well it is conducted, can produce substantial impacts under such conditions. On the other hand, considerable impacts will probably result if the intervention was successfully imple-

mented, properly utilized, and the population disease rates were high enough for benefits to be measured.

Results published since 1986 on diarrhoeal diseases concur with previous findings (*25*), and the rigorous studies conducted in the last few years show a greater reduction in disease: while this may reflect better studies, it may also indicate better-conceived interventions. Interventions to improve excreta disposal and water quantity, which are associated with better hygiene practices, produce greater impacts than improvements in water quality. This is particularly so in highly contaminated environments where diarrhoea rates are high. Because the use of more water is not automatic following the installation of water supplies, hygiene education is a necessary part of the intervention.

The following recommendations can therefore be made:

- to achieve broad health impact, greater attention should be given to safe excreta disposal and proper use of water for personal and domestic hygiene rather than to drinking-water quality;
- sanitation facilities should be installed at the same time as water facilities when faecal-related diseases are prevalent;
- access to the water supply should be as close to the home as possible, in order to foster the use of larger amounts of water for hygiene practices;
- water supply and health programmes should emphasize hygiene education to encourage the use of more water for personal and domestic hygiene;
- sanitation facilities should be culturally appropriate to ensure their use;
- use of facilities is essential during critical seasonal transmission periods for diseases such as dracunculiasis; and
- water and sanitation programmes should complement those in other sectors (e.g., chemotherapy) to reduce disease rates.

Issues for future research

Despite the accumulation of knowledge during the IDWSSD, questions remain about the health benefits associated with water and sanitation. Many of these issues could be examined using well-established epidemiological methods (*22*) in areas where water and sanitation systems are working and used by the recipients. Rigorous studies should focus on the following issues:

- the maximum travel distance/time that will result in appropriate use of an improved water supply under a variety of socioeconomic and environmental conditions;
- the minimum quantities of water that are necessary to produce positive health impacts under a variety of environmental conditions (e.g. periurban, rural, etc.);
- the hygienic behaviours most conducive to better health;
- appropriate methods for introducing and reinforcing behavioural change;
- the conditions under which water and sanitation facilities are likely to be sustained;
- the possibility of increasing the amount of water used and of changing behaviours in the absence of interventions to install piped supplies;
- the conditions (including environmental, cultural, and level of development) under which installation of water and sanitation facilities are likely to produce the greatest health benefits; and
- the health indicators that are most susceptible to change and most related to disease.

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Résumé

Amélioration de l'approvisionnement en eau et de l'assainissement: conséquences sur l'ascaridiase, la diarrhée, la dracunculose, l'ankylostomiase, la schistosomiase et le trachome

On analyse ici les résultats de 144 études portant sur l'impact de l'amélioration de l'approvisionnement en eau et des installations d'assainissement sur l'ascaridiase, les maladies diarrhéiques, la *dracunculose*, l'*ankylostomiase*, la schistosomiase et le trachome. On a choisi ces affections parce qu'elles sont très répandues, constituent des risques graves pour la santé et illustrentbien la diversité des mécanismes par lesquels l'amélioration de l'approvisionnement en

eau et de l'assainissement peut protéger les populations. On a calculé pour l'ensemble des études la diminution médiane du nombre de cas de chaque maladie qu'elle entraîne et l'on a tiré des études les plus rigoureuses sur le plan méthodologique une deuxième valeur de la diminution médiane.

Les résultats montrent que l'approvisionnement en eau et l'assainissement entrainent une amélioration de la santé des populations concernées. En ce qui concerne la diarrhée, le trachome et l'ascaridiase, la diminution médiane de la morbidité (c'est-à-dire de l'incidence et de la prévalence) a été respectivement de 26%, 27% et 29% dans les études rigoureuses. La diminution correspondante pour la schistosomiase et la dracunculose a été plus importante, à savoir 77% et 78%, respectivement. Toutes les études sur l'ankylostomiase ont été défectueuses, à l'exception d'une seule dans laquelle on a trouvé une diminution de 4% de la prévalence.

Pour l'ankylostomiase, l'ascaridiase et la schistosomiase, on a observé une diminution plus importante du nombre d'oeufs que de la prévalence. Les interventions pratiquées au niveau de l'approvisionnement en eau et de l'assainissement on également eu un impact important sur la survie des enfants. Neuf études ont indiqué une diminution médiane de 60% de la mortalité infantile générale, et on a calculé qu'elle était de 55% dans les six études rigoureuses; malheureusement, aucune de ces dernières études ne s'est précisément intéressée à la diminution de la mortalité due aux maladies diarrhéiques.

Dans la plupart des pays en développement un meilleur approvisionnement en eau et des efforts d'assainissement peuvent donc avoir des conséquences importantes et démontrables sur la santé dans tous les groupes d'âge. Les diminutions observées dans la gravité de la maladie sont parfois plus importantes que celles relevées dans son incidence ou sa prévalence; cependant, on néglige trop souvent l'importance de cet impact.

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WATER AND SANITATION
FOR HEALTH PROJECT

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Arlington, Virginia 22209 USA

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EXPLORING INSTITUTIONAL IMPLICATIONS FOR SUPPORTING HEALTH AND SOCIOECONOMIC BENEFITS

by

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and

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Fred Rosensweig has been Associate Director for Human Resources and Institutional Development for the WASH Project since 1981 and a vice president of Training Resources Group since 1984. He is experienced in the development of training plans and systems, management consulting, and workshop design and delivery. He has lived overseas in Senegal, Cameroon, and Tunisia and has provided short-term technical assistance in more than 30 countries in Africa, the Americas, Asia, and Europe.

I. COMMUNITY-MANAGED PUBLIC HEALTH PROGRAMS: WHEN COMMUNITIES AND INSTITUTIONS COME TOGETHER

Over the past two decades, public health programs in the third world have broadened (and sometimes reoriented) their scope to include greater community involvement, simple and appropriate technologies' and disease prevention. Although the water supply and sanitation (WS&S) sector is but one arena in which these elements come into play, it offers certain generalized lessons regarding the health and socioeconomic benefits. Perhaps the most important is that technologies in and of themselves do not guarantee health benefits; only when the technologies are employed consistently and correctly at the household level can they realize their potential to significantly improve health. Communities must first see the value of the new technologies and be willing both to use them and to keep them functioning. Second, the institutional capability must be in place to encourage the community to continue using these technologies as a way to prevent diseases and also contribute to the economic growth accruing from the increased productivity of a healthier population. In so doing, the community gains a greater sense of responsibility for its own health and well-being.

Although this paper was prepared for the workshop on health and socioeconomic benefits, the authors' point of reference is primarily the water and sanitation sector. It is their hope, however, that many of the issues and experiences discussed here will be applicable as well to other community-based public health programs aiming at improving health and socioeconomic benefits.

The first part of this paper addresses the issues affecting sustained community usage of technologies as a way to improve community health. The second addresses the institutional/macro-level issues that relate to ongoing governmental support to communities. WASH experience has shown that the coordination of these two perspectives--household/community and policy and institutional context—holds out the greatest chance for project success and sustainability.

II. CONTEXTUAL ISSUES

Every country faces constraints that affect program implementation whether these be historical, technical, socio-economic, macro-economic, and political factors. WASH has learned that certain contextual factors are especially important to consider when planning and implementing community-based programs.

Level of development. Countries with weak economies overall will likely be unable to provide adequate budgetary support.

Degree of decentralization. Community-based programs, which depend on a decentralized system of government, cannot be run in a

centralized manner. They require ongoing support, at least in the early stages, and this support can be provided only by district or regional offices working closely with communities. If a country has no decentralized operational responsibility to regional offices, a community-based program is unlikely to work.

Acceptability. Because community-based programs must be socially and culturally acceptable to local populations, health interventions must take into account community preferences and socially and culturally determined behaviors. This does not mean these behaviors cannot change, but they certainly cannot be ignored.

Political support. No community-based program will succeed without political support. Because politicians can subvert the program in many ways they are key in supporting the efforts of government officials.

Overall ministry capability. If the Ministry of Health is weak, the development and implementation of a national community-based public health program will be a real challenge. When applicable, this contextual factor must be taken into account during the program's design phase.

Figure 1 and Figure 2 are graphic illustrations of the policy and management issues addressed in this paper. Figure 1 shows the lack of coordination between institutions and communities in the planning and implementation of community-based public health programs. They show the contextual factors influence how communities behave and how institutions behave.

Within communities, households are influenced by these contextual factors in making decisions regarding community and household-level policies. These decisions in-turn determine how households and communities will behave. A similar process takes place at the institutional level. Institutions are influenced by the contextual factors in making decisions and formulating policies, which determine how they behave.

As Figure 1 shows, the same contextual factors are present at the community and institutional levels. However, there is often little relationship between what communities require to improve their public health and what institutions do in support of such a strategy.

Figure 1

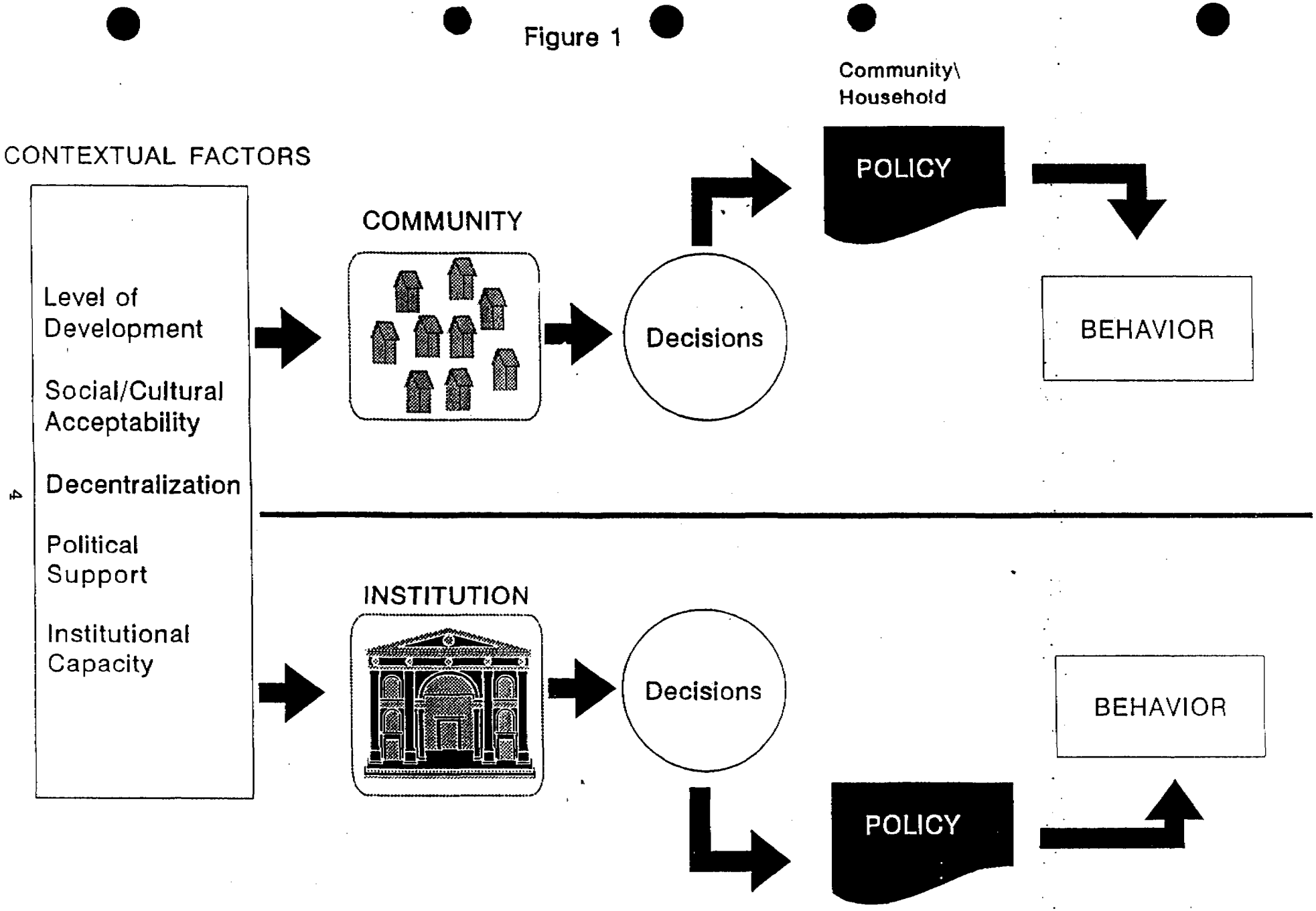

Community\
Household
CONTEXTUAL FACTORS
Level of Development
Social/Cultural Acceptability
Decentralization
Political Support
Institutional Capacity
COMMUNITY
INSTITUTION
Decisions
Decisions
POLICY
POLICY
BEHAVIOR
BEHAVIOR

Figure 2 shows how a more coordinated and integrated partnership between these two levels will bring about a partnership likely to sustain community-based public health efforts. Figure 2 shows how process skills such as team building, field methods, and problem solving link institutions to communities, and vice versa. If such a partnership were present, national-level decisions would be made in support of long-term utilization and sustainability of technologies that could ensure eventual health outcomes.

III. PARTICIPATION AND HEALTH EDUCATION: BUILDING VILLAGE-LEVEL CAPACITY

A. Villagers as Managers

Water and sanitation projects take the issue of community involvement very seriously. Historically, community participation has been considered a tool to attain lower per-unit costs, greater coverage, and lower costs to government in management and operations and maintenance. While participation may have implied these economic and financial savings, expectations were never completely realized nor did they always translate into health benefits.

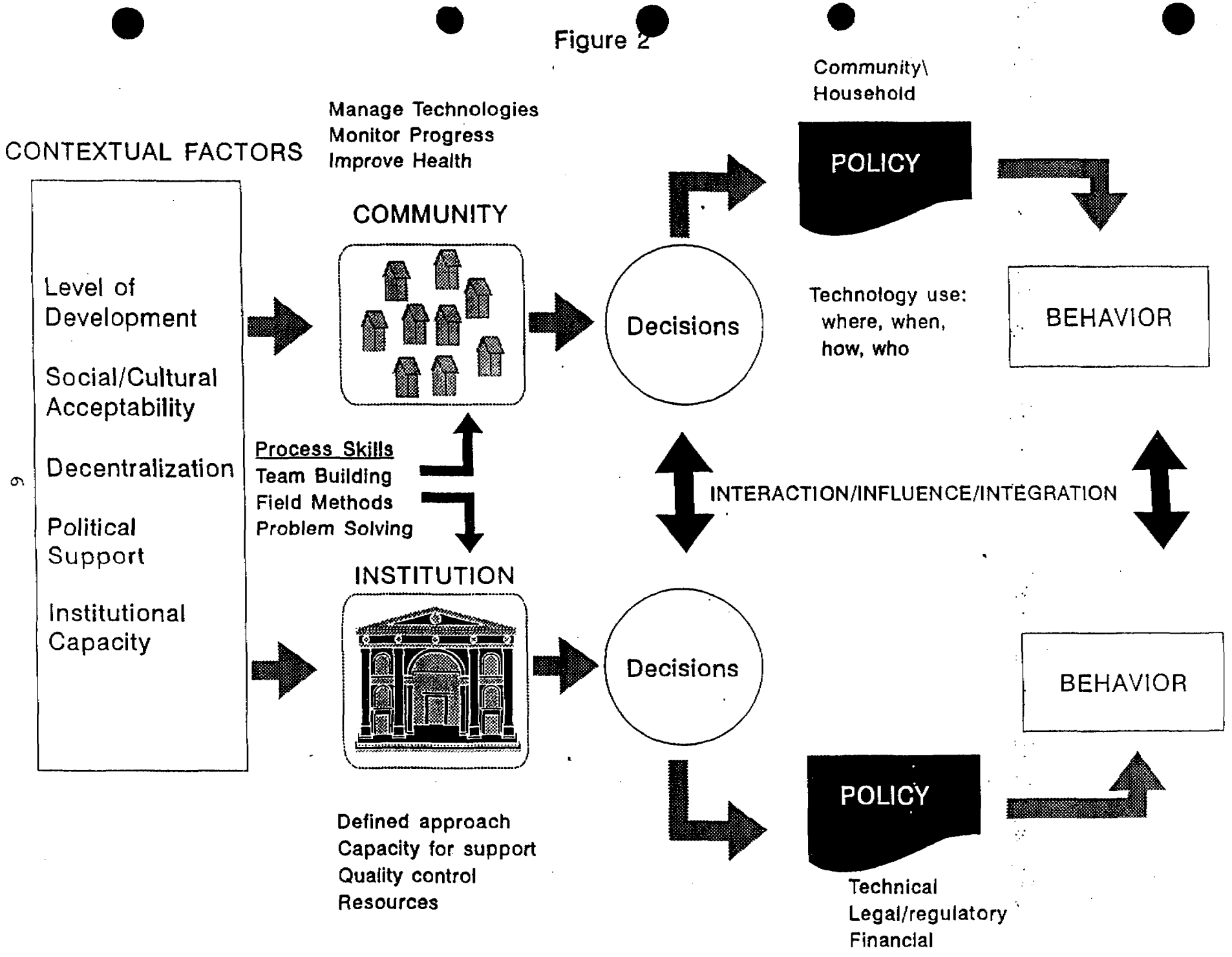
The past decade has shown that communities need much more than a limited degree of participation in water supply and sanitation projects; they also need to both integrate the new technologies into everyday behaviors and be responsible for their management. This means that people will take care of shared WS&S resources in much the same way that they care for other communally owned assets.

In recent years the concept of community project participation has enlarged to encompass management. Whereas a community's participation was originally confined to fulfilling directives of the implementing agencies, the added responsibility of management means that the community takes "charge". A significant distinguishing characteristic of community management is the relationship that communities and implementing agencies develop, one that is based on partnership and trust instead of on subordination and dependency. Such an approach has certainly not meant less work for implementing agencies or national institutions. In fact, it requires even more up-front and labor-intensive approaches, the kind of approaches that respect the resource base and capabilities of community people.

What exactly does "taking charge" mean from the community perspective? Any or all of the following play a part in community management:

- Communities genuinely want the proposed technologies.
- Communities have enough information to make informed decisions.

Figure 2


Community\
Household
Manage Technologies
Monitor Progress
Improve Health
CONTEXTUAL FACTORS
COMMUNITY
POLICY
Level of Development
Social/Cultural Acceptability
Decentralization
Political Support
Institutional Capacity
Decisions
Technology use:
where, when,
how, who
BEHAVIOR
Process Skills
Team Building
Field Methods
Problem Solving
INTERACTION/INFLUENCE/INTEGRATION
INSTITUTION
Decisions
BEHAVIOR
POLICY
Defined approach
Capacity for support
Quality control
Resources
Technical
Legal/regulatory
Financial

- Communities understand the options and are willing to take responsibility for the type of technology they have selected.
- Communities see the technology as important enough to invest in recurrent costs.
- The service received from the technology is consistent with community needs.
- Communities are able to manage and maintain the technology.

All of these elements help to ensure that the community progresses beyond the most immediate task of water system or latrines construction and actually assumes management functions that will ultimately result in anticipated benefits.

B. Technologies and Behaviors: Striking a Balance

Although sustained usage of WS&S technologies is critical to achieving anticipated health benefits, it is not uncommon to find project technologies based on factors other than people's needs, resources, and preferences. Most often, one finds technologies developed to address a particular problem such as, for example, mosquito control or the prevention of fecal contamination. And while the development of these technologies may have addressed mosquito eradication or the isolation of fecal matter, rarely have the projects emphasized sustained usage of the technologies over time.

WASH experience with latrine installation is instructive. The VIP latrine, for example, has long been considered one of the most effective and efficient means of isolating human feces. Yet, although its design addresses technical issues such as those relating to unpleasant odor, only much later did projects take into account peoples' preferences. For example, was a dark enclosed structure the community's preferred way of handling unpleasant odor?

In these earlier projects, hygiene education was used as a method to encourage people to use a given technology and to carry out daily maintenance of the infrastructure. Recent philosophical shifts, however, stress the use of hygiene education as a strategy for changing or supporting behavior, as well. In promoting the integration of behavioral elements into the development of technologies, social science is making an important contribution to project sustainability. Unfortunately, however, the concept of behavior as an important building block in the development of technologies is still rather new and sometimes misunderstood. Suffice it to say that the design and development of effective technologies to address public health issues must begin with a better understanding of existing behavior—high risk and positive. Then project planners, in collaboration with community members, can

target the behaviors to be changed so as to achieve objectivs of community-level health improvements.

IV. DEVELOPING THE PROCESSES FOR IMPLEMENTATION OF COMMUNITY BASED INTERVENTIONS

A. Measurement Issues

Projects whose principal output is technologies will, logically, measure success according to the number of units installed. Thus, latrines, water systems, numbers of houses sprayed for malaria control, or technologies for production of economic goods may be seen as the only end products, a view that ignores the importance of the community participation process and the benefits to be gained thereby. Even when donors and implementing agencies do recognize the importance of process, they often have no way of measuring it as a part of project inputs and outputs.

The processes required by participation and behavioral change are really at the heart of community-based public health efforts. These processes of capacity building are based on learning new ways of doing things e.g., learning how the technologies are managed and used to improve health. The technologies themselves, are only a part of the solution to sustainability and improved health; however, other elements, such as these processes of learning, are often harder to measure.

B. Opening Up Communication

Because the processes of developing community capabilities are relatively new, process skills—which demand expertise in facilitation and problem solving—are still quite rare. The norm is for agency staff merely to define solutions and provide instructions for implementing them, solutions moreover that come about solely through technological inputs. In addition, high-level decisionmakers and national policymakers may lack adequate channels and skills to communicate with those implementing community-based public health activities. As a result, decisions may be based not on realities but on political priorities or available budgets. Despite the importance of such items, policy-makers need to recognize that not all issues are of budgetary nature.

Communication difficulties may exist at the district level, as well. Before they can promote community-based health interventions, these staff must learn to become listeners and facilitators to community groups, and, in so doing, begin to develop a collaborative relationship with communities.

District-level staff must also develop the capacity to communicate their needs constructively to managers and supervisors.

C. Developing District-Level Skills

To address the issues previously raised and, more specifically, to address village-level public health activities, those working at the district level often need to gain skills in the following areas:

Team work. Although district health teams may initially include only those involved in disease prevention and public health, team members soon realize that clinical and district-level government staff are also needed. Thus, the concept of teams as inclusive rather than exclusive bodies is an important one to develop.

Training. To work effectively at the local level, district staff will need a combination of communication, listening, and facilitation skills. All of these help promoters develop the capability to implement short training sessions with community groups.

Problem-solving. Even when the initial approach of district staff may be to provide solutions, they often come to realize that problem solving with community groups generates solutions that are much more appropriate and acceptable to the community at large.

D. Developing Health Education Skills

To function effectively as health educators, district-level staff will need to—

1. Recognize the ineffectiveness of targeted messages and health talks that are memorized and have little relevance to what people actually do and believe. Posters alone may not always do the job. For example, extension staff are sometimes astonished to find that—despite the visual aids prominently displayed throughout a particular village—residents do not see mosquitos as the cause of malaria symptoms.

2. Collect data using field methods such as interviews, focus groups, and observations. Staff will often be surprised to discover what people actually do, as opposed to what they say they do. Observational data is generally harder for staff at this level to collect, and one-to-one training in such skills may be necessary.

3. Analyze the data and determine the key behaviors that need to be understood.

4. Develop messages from the data which seek to change harmful behavior or build upon helpful behavior.

5. Communicate the messages. It is important for health workers to understand that TV and posters may not be viable modes of communication for certain purposes and with certain groups. To be effective, these staff must first understand who the target groups are and then determine how to reach them.

E. Monitoring Progress

Staff working at the local level, that is, both community groups and district-level staff, need to monitor and evaluate the effectiveness of community-based public health programming. Clearly, monitoring systems at this level will be different from those at the national level. For example, national-level indicators will not include information on how many water containers are covered, yet such numbers would serve as an important local barometer of project effectiveness.

F. Policy Review Meetings and Workshops

Policy review meetings between district staff and national-level supervisors and policymakers should occur at regular intervals. Processes need to be established so that district-level staff can participate in these meetings. District staff may need to work on presenting their needs more effectively at these meetings.

G. Training Methodologies

Over the decades, we have learned that the most effective training is that which has been tailored to the needs of participants. For training at the district and community levels to be effective, it needs to be short and held at regular intervals. Between training sessions, participants work on assignments in the form of measured tasks that increase participants' skills and help them explore appropriate ways to integrate these skills into their work. Follow-up training should occur within a few months to review what activities have been carried out and look at both successes and also constraints.

Training that is periodically repeated, with assignments in between, is particularly effective because it creates a sense of accountability from both participants and trainers. When participants know the trainers will be returning to review progress, they usually take their assignments more seriously. But more importantly, this approach allows participants both time and opportunity to try out their new skills and begin to imbed them into their work processes.

In successful community-based projects, district staff and community members share a good bit of the responsibility during implementation. However, support is needed from the central level, as well. The next section discusses macro and institutional issues that relate to implementation and looks at a variety of channels for governmental support.

V. POLICY AND MANAGEMENT

A. Policy Issues

A successful national community-based program requires a supportive set of policies. These policies must be not only formulated but also implemented. Often, countries have the right policies in place, but they are ignored, unenforced, or poorly implemented.

A community-based bed net program should address a number of policy issues.

1. Financing. Who will pay for the public health and the necessary commodities? Are the communities willing to pay, or will there be an ongoing subsidy from the government? Will the communities purchase the needed commodities in bulk, or will these items be purchased individually? If the communities purchase them, how will the funds be collected and managed?

2. Regulations. Are there any restrictions on what kind and how much insecticide can be used?

3. Institutional Consideration. Will ministries other than the Ministry of Health be involved in program implementation? If so, what will be their role and how will coordination among ministries take place?

B. Basic Principles

Although each country's program needs to be tailored to its own realities, there are certain general principles that should be followed:

1. The government should not pay for commodities used in implementation on an ongoing basis, if the program is to be affordable and sustainable.

2. Roles and responsibilities of all the institutional actors should be clearly defined.

3. Flexibility in working with communities should be the norm. This will permit the use of different approaches

from one community to another and also from region to region.

4. The program should receive ongoing political support.

5. The program should involve the private sector, especially in the sale of materials, commodities, and infrastructive maintenance.

C. Institutional Issues

To ensure success, governments must be heavily involved in community-based programs. Often, however, too little attention is paid to securing this involvement, as it is sometimes felt that development programs can successfully bypass the government. While it is true that governments should not be direct service providers, they can play a vital catalytic and facilitative role in creating conditions for programs to succeed. Thus, a health program's community-based structure does not mean that government should withdraw, although over time its involvement should diminish significantly. In the short run, however, involvement will need to be substantial.

There are eight ways in which government, though both central ministry and regional or district offices, can support a community-based public health program.

1. **Determine the most effective approach.** There is no single "correct" way to work with communities, as they will vary in the effectiveness of their leadership, the existence of an effective health committee, the acceptability of the technology within the community, the financial resources available, etc. Yet, despite these differences, certain guidelines can be developed that will form the basis for working with project communities. The approach should include three phases: a promotional period leading to acceptance of the idea, program implementation, and ongoing monitoring.

Several issues need to be addressed in developing an approach:

- Whether and how to work with existing committees
- Who will pay for technology costs and maintenance and commodities
- How the money will be collected
- Amount of contact needed with each community

2. **Develop institutional capability at central and regional levels.** Any national program will require the development of institutional capability at both national and regional levels, a process that may require the strengthening of existing structures or the development of new ones (such as a small

unit in the central ministry responsible for the community public health program).

At the national level, these are the key responsibilities:

- Organize national-level training events.
- Coordinate activities with other concerned ministries.
- Provide technical assistance to regional offices on the bed net program.
- Monitor and evaluate overall program effectiveness.
- Provide financial resources for activities of national interest.
- Organize seminars where regions have an opportunity to exchange experiences with one another.

These are the main regional level responsibilities:

- Work directly with project communities.
- Provide training to communities.
- Monitor and evaluate program effectiveness at the community level.
- Coordinate with other ministries at the local level.
- Raise awareness of the importance of program with communities and other community officials.
- Provide backup support after the program is initiated.

3. **Determine staffing needs at all levels.** Part of the institutional-capability issue is the need for adequate staffing at the national and regional levels. No intervention will be successful if staff are not assigned primary responsibility for it; this may mean that community public health programming are all they do or that community public health programs are only part of their job responsibilities. What should be avoided, however, is tapping individuals who are already overloaded or ill trained for their roles. If a public health program becomes national in scope, it will require several people who devote full-time to the program at the central level. On the regional and community levels, full-time staff may or may not be necessary, depending on the size of the target population, the adequacy of existing regional staff, etc.

4. **Determine training needs at all levels.** Training will be needed at all levels--whether national-level staff, regional staff who work directly with communities, or community members. For this training to be effective and coordinated, a system needs to be developed that includes a training plan, skilled trainers, effective materials, training sites, and training capability for management. Such a system may be incorporated into a ministry training system, if one exists, or it may need to be developed.

5. **Determine logistical support needs.** Logistical support at both the central and regional levels will be a key element. At the central level, it includes financial resources to develop and produce training materials, provide technical assistance (travel and per diem), organize training workshops, and provide expenses associated with the management information system. At the regional level, logistical support includes adequate transport to visit communities and a budget to support training events, reproduce materials, and develop support materials, and buy fuel.

6. **Develop a communications strategy to create awareness and demand for public health programs.** The public health program must be seen as beneficial by the communities as well as by government officials and politicians. One way to "market" the program is to develop a communications strategy aimed at both communities and officials. Another important strategy is health education; community members need to be convinced of the value of public health. This is best done through communication materials that deliver the same messages to all communities. These materials should be developed at the national level, but adapted for regional differences. They can cover a wide range of formats including videos, television and radio spots, posters, brochures, billboards, etc.

Government officials and politicians are key players in this effect, since they provide support for the efforts of extension-level staff. Workshops, direct conversations, and seminars are effective ways to influence this audience. Some carefully targeted written materials may also be effective.

7. **Develop a health education program.** Programming in this area is often less than effective due to insufficient intradepartmental coordination within the Ministry of Health. For a public health initiative, coordination among the departments of health education, primary health care, and possibly others will be necessary. The national level needs to be responsible for materials development, regional staff training, and program planning. The regional level should also develop certain materials and should handle community training, program implementation, and monitoring.

8. **Develop a management information system to monitor progress.** Successful implementation of a national program requires ongoing monitoring and evaluation. The information gathered will allow the Ministry of Health to assess how the program is going, identify problems, and take measures to resolve them. A management information system defines which information needs to be collected at which levels and determines the indicators of successful performance. Regional staff will need to collect information from communities, aggregate it, and pass it on to the national level. Such a system will require

staff and resources, but without it the program will be relying on impressions and ad hoc and anecdotal data.

VI. CONCLUSION

This paper has described the essential ingredients of a partnership between communities and governments. The larger question, however, concerns ways to increase and sustain community ability to assume more responsibility for public health activities. To address this question, a different paradigm is called for, one that develops capability and changes attitudes at both community and national levels. To bring about this paradigm change, both communities and national institutions will need to change certain behaviors. By shifting responsibility to communities, governments will be giving up power and control and also acknowledging that they may not always know what it best for communities. For their part, communities must begin to play a broader role in decision making and self-management. Such changes do not come easily and may take place only in small increments. A redefinition of governmental and community roles will take time and political will, but in the long run will be worth the effort.

AN ANALYSIS OF THE WATER AND SANITATION SECTOR PLANS IN THE NATIONAL PROGRAMMES OF ACTION IN AFRICA AND ASIA

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JANUARY 1993

1. BACKGROUND

The National Programmes of Action (NPA) have been conceived as national perspective plans for the period up to year 2000 for human development in general and targeted to the development of children in particular. They seek to focus priority attention on the needs of the human development sector within national plans by institutionalizing that attention in the form of a programme for action that prioritizes goals within countries, commits resources and sets time-frames to achieve them.

The overall approach to the NPA has been that the NPA is to be seen in conjunction with the national plans of country governments for economic and social development and located in their macro-economic contexts. Since initial conditions in human development status vary widely across countries , broad sectoral goals identified at the global level are to be modified and adapted to the needs of each country. Sector situations need to be analyzed, problems defined, goals modified according to need and country-specific strategies developed for achieving those goals in the NPA. The water and sanitation sector component of the NPA's of the countries of Africa and Asia prepared under this effort are reviewed here. Under review are only those documents that have been received up to 31 December 92.

2. GOALS OF WATER AND SANITATION SECTOR IN NPA

The goals identified for the water and sanitation sector to be incorporated in the National Programmes of Action are :

(a) universal access to safe water by 2000
(b) universal access to sanitary methods of excreta disposal by 2000
(c) complete eradication of guinea-worm.

Sector plans reviewed address these goals.

3. CRITERIA FOR REVIEW

To review the water and sanitation sector component of the NPA's it becomes necessary to develop a set of criteria that covers the structure or format of the NPA's and the strategies they contain to achieve sector goals. Based on the objectives set for the NPA initiative, the following criteria are adopted for sector review here.

NPA Format

(a) Has the NPA located sector goals in the country's macro-economic context and modified goals or added additional goals based on national situation?

(b) Has the NPA set up standards for defining problems and for levels of goal attainment in the sector?

(c) Has the NPA identified resource requirements for meeting sector goals/ Has it proposed resource-restructuring in favor of the sector?

NPA Strategies

1. Does the NPA contain a strategy for mobilizing the resources required for the sector?

2. Does the NPA sector strategy promote greater community participation?

3. Does the NPA sector strategy address issues of sustainability in terms cost recovery for asset creation or operation and maintenance?

4. Does the NPA propose resource allocation within the sector in favor of low-cost technologies?

5. Does the NPA contain a targeting strategy for vulnerable areas and populations (mostly rural or peri-urban in Asia and Africa) to redress issues of distributional bias?

6. Does the NPA identify areas needing technology support?

7. Does the NPA have a strategy for capacity building in the sector?

8. Does the NPA contain a strategy for any improved institutional mechanism for the sector?

9. Does the NPA have a strategy for drawing on inputs from the private sector and NGO's for the sector?

10. Does the NPA sector strategy enhance the role of women in the sector?

11. Does the NPA have a strategy for developing inter-sectoral linkages for the sector with other sectors- especially health, education and environment sectors?

12. Does the NPA sector strategy propose revamping the existing monitoring and evaluation mechanism for the sector to make it

more open, accountable and to enable it to become a lever for action?
The findings of the review are detailed below.

4. REVIEW OF WATER AND SANITATION SECTOR PLANS IN NPAs

I. Modification of Goals and Time-Frames/ Addition of goals

Goals and time frames set for the sector have been modified in some NPAs. The goal of universal access to drinking water by the year 2000 have been accepted by most countries while the goal relating to universal access to sanitary methods of excreta disposal has been down scaled in many NPAs on the ground that the revised goals are more realistic in terms of resource availability.

A few countries in Africa have revised the goal of universal access to safe drinking water. These countries are Benin, Chad, Rwanda, Swaziland, and Uganda. Coverage in Burundi, Equatorial Guinea, Kenya , Central African Republic, Senegal and Sudan are presently below 50% and it may be unrealistic to expect achievement of the projected 100% coverage. Nigeria projects only 44% achievement at current levels of resource allocation (this is a drop in coverage which it appears is based on upward revision of per capita standard now adopted) but has set a target of 100% if resources become available. In Asia, targets appear more realistic and Lao PDR, Nepal, Indonesia and Vietnam which have low coverage at present have not projected universal coverage. Bhutan and Maldives may also find it difficult to achieve targets set.

Sanitation goals have been reduced by most countries under review both in Asia and Africa and several countries have projected less than 50% coverage in rural sanitation by 2000. However, achievement of this goal ,being dependent on individual behavior, can become possible if there are substantial increases in education and consequent awareness of hygiene. Sanitation goal achievement therefore become contingent on the success of a strategy of inter-sectoral action.

Few countries have presented additional goals. The goal of guinea-worm eradication is dependent on performance in the decade in countries like Nigeria, Ghana, Uganda, which have presented detailed time-bound plans.

Though the NPAs, by and large, subscribe to the international goals set, the NPA's presented need to be evaluated from the point of view of previous performance in the eighties and their current status in the sector. This is especially relevant for the WATSAN sector as the eighties was also the decade dedicated to providing access to safe water and sanitation

for which countries had developed action-programs in response to an international commitment (The International Drinking Water Supply and Sanitation Decade)
(See Annexure 1)

Summary

*** Most NPAs accept the Summit goal of universal access to safe water by 2000**
*** Most NPAs have reduced the goal for sanitation- especially rural sanitation**
*** Additional goals in the sector have not been listed by most countries.**
*** Goals set seem to be overly optimistic in some countries in terms of previous performance**
*** Many NPA's have not desegregated goals in terms of rural and urban.**

II. Defining Standards for Goals.

UNICEF guidelines on assistance for NPA preparation suggests that standards for goals should be defined by country governments based on their definition of the problems. The goal of universal access to safe water for example, has to be evaluated on the basis of the proportion of population that have access to an adequate amount of safe water located within a convenient distance from the user's dwelling. The definitional standards for "adequate" in terms of quantity (liters per capita per day),"safe" in terms of water quality and "convenient " in terms of distance from the user's dwelling have been left for country governments to determine.

Similarly the goal of access to sanitation is to be measured in terms of the percentage of population with access to a sanitary facility for human excreta disposal in the dwelling or located within a convenient distance from the user's dwelling where "sanitary facility" and "convenient" are to be defined by country governments.

While many NPAs have explicitly stated the standards they would use for measurement, some have not. There are variations across countries in both Asia and Africa. India, for example, has set a standard for defining convenient access to a safe water source of 1000 meters distance and 500 meters elevation and one source for 100-150 people. Norms for convenient access is 1000 meters in Namibia and Ghana while Kenya has set the same standard of 1000 meters for those areas that it considers to be of "high potential', while fixing a standard of 5000 meters for areas with "low potential".In terms of water quantity countries have a wide range of per capita availability targeted- 20 lpcd in Namibia and Ghana, 30 lpcd in Nigeria, 40 lpcd in India while

Sudan has a goal of 10 lpcd for its drought-prone areas. Most countries have set higher standards for urban water supply. All such standards necessarily have to be country- specific and in tune with resources at the country's command and its geohydrological conditions. However they also have to be of such nature as to realize program objectives. It is also essential that water quality standards are more clearly set especially when surface water storage and rain water collections are proposed to be used in Indonesia, Sudan, Uganda, Maldives. One issue that may need to be considered relates to country-specific habitation patterns and micro-level sociological features. For example the scattered pattern of living in parts of rural Africa and Asia may necessitate dilution of a minimum population norm.

Summary

*** Many NPAs have set specific standards for sector goals**
*** Water quality standards have not been set by most countries.**

III. Estimating Resource-Requirements and Resource Mobilization Strategy

In respect of estimating resource requirements, there is wide variation among the NPAs and while some NPAs present detailed costing many others have not even included this in their sector plans. Ideally NPA's were expected to work out multiple cost scenarios depending on policy/ technology mix under consideration. They were also to rationalize these costs in terms of resource savings effected through inter-sectoral action as NPA's are conceived as inter-sectoral plans of action. In doing this, they were to locate the sector and the NPA in the macro-economic framework of the country and to explain constraints that inhibit achievement of goals and state remedial action. The possible reduction in public investment due to macro-level resource constraints as part of Structural Adjustment programs that many countries are undergoing required a separate worst-case scenario assessment that would consequently argue for increased external assistance to the sector and inter-agency collaboration (between multi-lateral institutions) to meet sector goals. This is especially relevant to the water and sanitation sector as it is the most cost-intensive sector of the NPA. Resource-restructuring in favor of the sector, if any, has not been indicated in most NPAs.

As regards resource mobilization, many NPAs have not detailed specific strategies. Annexure 2 gives resource requirements and resource mobilization strategies for the sector in the NPAs reviewed.

Summary

*** Most NPAs need to detail resource requirements for the sector and proposed financing strategies. This is a weak component in many NPAs.**
*** A large number of the NPAs reviewed depend heavily on donor support to the sector and as such realistic estimation of donor commitments are important.**
*** Most NPAs have provided for adoption of low-cost technology for cost reduction.**
*** User charges are proposed in a large number of NPAs as part of financing strategy - chances of operationalization becomes important.**
*** community participation is seen as cost-reducing.**

IV. Enhancing Community Participation/ Social Mobilization

Community participation and the need for social mobilization is an area of focus in almost all NPA sector plans and as such is refreshingly different from the earlier hardware- driven approach. The NPAs reveal that the increasing emphasis country governments have placed on this stems from the following:
(a) a realization that governments have to move from the supply side to the demand side to optimize investments made in the sector ,especially in the context of identified gaps between service provision and use,
(b) governments need to debureaucratize the sector to make people owners of the program and not mere recipients so as to improve delivery
(c) the sector goals,especially sanitation, depend heavily on changes in attitude, knowledge and practices of individuals and households
(d) communities can contribute their resources-financial and otherwise to the sector and
(e) community participation can generate inter-sectoral linkages for the sector.

While NPAs uniformly endorse the idea, many countries need to move from rhetoric to action in terms of proposing real transfer of control of sector program management to communities and community organizations. Decentralization of institutional mechanisms of delivery of services need to be detailed. There cannot be any meaningful empowerment without transfer of power.

There also needs to be guarded optimism on many of the sector proposals on community participation. Many NPAs, especially in Africa seem to "abdicate" the task of rural water supply to be effected through community participation. Given the high degree of distributional bias between the rural and the urban sector in much of Africa, community participation should not get used as an alibi to deny public investment to the more

vulnerable sections of society. Some NPAs have used "community participation" to fill resource-gaps which need to be examined in detail. User charges are proposed in many NPAs as a method of enlisting public participation and meeting resource constraints. Community participation, though seen as resource-saving through inter-sectoral linkages has not been adequately accounted in terms of costs saved. That community participation helps to build in "process" aspects into development along with "products" informs most NPA's reviewed. Ghana, Zimbabwe, Malawi, Uganda, Bangladesh and Nepal have given adequate focus to this issue in their NPAs.

Summary

*** NPAs endorse community participation as idea and broad strategy.**
*** NPAs see community participation as resource-saving**
*** Most NPAs base sanitation strategy on social mobilization.**
*** Some NPAs may tend to "use" community participation to substitute public investment and this may reinforce existing distributional bias.**
*** NPAs see community participation as opportunity for integrated strategy on water and sanitation.**

V. Sustainability: Meeting Costs for Infrastructure Creation and O&M

Issues of operation and maintenance of systems have been discussed in some NPAs only. While many NPA's do not envisage capital investment on water supply to come from user contribution, they project user charges as a major financing strategy for sustainability of systems and meeting O&M costs. The countries that have proposed levying user charges as part of resource mobilization for ensuring sustainability are listed in Annexure 2.

However, the position is different for sanitation where the strategy proposed in most NPA's stress user action for asset creation except a few countries where provisions for the weaker sections of society are to be provided by governments.

Most NPA's see O&M needs being undertaken by the community through varying institutional arrangements in rural water supply. They also see O&M costs being paid by local communities as a method of increasing community control over assets.(See Annexure 2)

A comparison of sector status between countries in Asia and Africa reveal a broad trend where countries in Asia, in the water sector, are moving over from an infrastructure-creation phase into a consolidation phase where O&M issues become very

important. On the other hand, the low coverage , especially in rural water supply in many African countries provide an opportunity to incorporate sustainability and O&M issues into sector plans from the early stage itself.

Sector plans of Malawi, Ghana, Zimbabwe, Nigeria, Uganda, Kenya, Lao PDR, Nepal,Vietnam, Bangladesh, India have all addressed the issue to varying degrees.

Summary

*** O&M issues addressed only in some NPAs**
*** Community based O&M planned for RWS in some countries**
*** User contribution for O&M mostly supported as sector strategy.**
*** Rural Sanitation mostly through direct action by community/household.**

VI. Adoption of low-cost technology in the sector

NPA sector plans of most countries explicitly state a preference for low-cost technologies, especially for rural water supply. Future expansion of the existing network is also biased in favor of lower cost options. The UNICEF objective of low-cost and high impact has been internalized in most sector plans. There is a preference for handpumps which should result in resource-restructuring in favor of lower cost options. To some extent, the macro economic resource constraints may have forced countries to prefer these. More importantly, the backlog task being in rural water supply has also forced governments to explore low-cost and user-friendly technologies.

Rain water harvesting and use of protected surface sources have also been proposed by some countries. Sanitation methods considered, are by and large, low-cost except in urban sewerage systems.

Many countries have proposed hand-pump based strategies for rural water supply. Countries which have stated a marked preference for low-cost options are Sudan, Malawi, Zimbabwe, Uganda, Nigeria,Ghana,Kenya, Nepal, Vietnam, Bhutan,Maldives Bangladesh, Pakistan, Indonesia and India.

Summary

*** Low-cost options adopted in sector plans**
*** Standardization of technologies and costs may be an issue.**

VII. Targeting in Sector Plans

NPA sector plans of many countries have not included an effective targeting strategy while sector status, especially in many countries of Africa, reveal a need for doing so. The percentage of population covered with water supply in 1990 in Africa was only 39% for rural areas while it was 76% for urban areas. This distributional bias has to be focussed in the sector plans of the NPAs for redressal through targeting. This seems to call for massive public investment in rural water supply to serve the as yet unserved populations. NPAs give a feeling that countries have been inhibited from doing so because of macro level resource constraints.

There is also an apprehension (which cannot be substantiated) that in many countries, the opposite kind of targeting may take place and the distributional bias may become aggravated with the urban sector claiming more resources. This is because the sector plans provide for system rehabilitation and since most of the network presently exists only in urban areas, they would have the first claim on resources. System rehabilitation will indirectly result in continued neglect of the rural sector in the absence of pro-rural targeting.

Though NPA sector plans were to become inter sectoral plans of action, only some documents reveal a targeted strategy for directing effort to areas of water-borne diseases. The weakness in the sanitation component of the sector calls for effective geographic targeting to direct resources to areas vulnerable to water-borne diseases.

The NPA of India has a strategy of targeting resources for scheduled tribes (indigenous people) in its rural water supply plan. Ghana, Kenya, Namibia, Nigeria, Sudan, Uganda, Zimbabwe India, Indonesia and Nepal have all proposed one or the other form of spatial targeting to serve the unserved.

Summary

*** Targeting for vulnerable areas/sections of society needs to be done better in view of existing distributional bias**
*** Rural and peri-urban areas need to be targeted**
*** System rehabilitation proposed in NPAs may adversely affect targeting.**
*** Needs of health sector call for better spatial targeting**

VIII. Identification of Areas needing Technology Support

Sector NPA's have focussed more on activities for the decade and less on problem analysis. Consequently there is not much detailing of areas requiring technology support. Sector plans do

mention developing new technologies or improving existing ones- Bangladesh plans to induct a superior pump for shallow areas (Super Tara) and VLOM /appropriate low-cost technology pumps are being referred for induction in some countries. Kenya plans to undertake detailed geophysical investigations and develop district level maps. The application of technology for meeting sector goals may need greater elaboration.

Summary

*** Need greater elaboration**

IX. Capacity Building in the Sector

While sector plans in NPAs discuss capacity building, few indicate specific plans. NPAs of Swaziland, Zimbabwe, Namibia and Ghana discuss aspects of capacity building. From the sector NPAs it is evident that many countries will require support for capacity building activities in terms of training in new technologies, project management and inter-sectoral coordination.

The inter-sectoral goals of the NPA require developing participatory models of training with cross-sectoral participation. The sector goal of guinea worm eradication requires coordinated activity by the water and health sectors. Capacity building in management information systems is referred to in some NPAs- notably Sri Lanka and Zimbabwe. Water quality monitoring has been identified in some NPAs as a major area requiring capacity building.

Summary

*** Areas need to be more clearly identified.**

X. Restructuring Institutional Arrangement

This appears as strategy in sector plans as community participation proposed in sector plans necessitates restructuring in favor of decentralized institutional arrangements. NPAs reveal that governments are becoming more sensitive towards using local community arrangements.

Swaziland proposes to involve its traditional administrative arrangement of Tinkhundla in rural water supply management. Malawi, Zimbabwe, Tanzania, Ghana, Nepal, Bangladesh,India and Sri Lanka have proposed modifications in the institutional arrangements. Sri Lanka plans to create a centralized coordinating body which will also set up a data bank. Most NPA's visualize coordinated action with sectoral functionaries of health , education and environment. India proposes to have

district level programming for the sector while many countries plan to delegate planning and implementation functions to the district level.

Summary

*** Institutional arrangements show a trend towards decentralization.**

XI. Enhancing the Role of Women in the Sector

Empowerment of women finds mention in many NPA's though there are no special institutional arrangements. Community participation and social mobilization see women as key participants. Sector benefits are seen to be primarily going to women in terms of reduction in drudgery . The conventional view of women as target group in health education and sanitation programs (and not as key decision makers) persist. The sector documents that highlight the role of women are Namibia, Ghana and Nepal.

Summary

*** No sector specific plan.**

XII. Support to the Sector from Private Sector/ NGO's

Private Sector:

Sector plans in some NPA's delineate specific areas for private sector support. Resource mobilization for water and sanitation activities from private sector and through incentives to business has been planned in some countries. Private sector is expected to promote sanitation through development of a marketing network for sanitary ware. It is already playing a contributing role in sector activities and this is expected to be stepped up.

NGO's:

NGO support figures prominently in sector plans in NPA's. They are seen as direct providers of service in many cases and in other cases as catalysts for collective action for sector goals. Sector review reveals that many countries have a positive on-going collaboration with many NGO's. NGO's are also helping the targeting needs of the program by locating their activities in the disadvantaged areas within countries. Their programs tend to be more integrated than government programs.

Summary

***Private sector and NGO's seen as partners**

XIII. Inter-sectoral Coordination.

The critical strategy in the approach of the NPA is inter-sectoral coordination and this cannot be said to have been realized in the sector plans reviewed. Inter sectoral coordination in the NPA ought to result in positive sum outcomes through:
(a) synergistic linkages between sectors,

(b) resource-saving as a result of these linkages,

(c) and thereby developing a model of collective action that ensures the environment that creates and sustains human development.

The overarching philosophy behind the NPA being such inter-sectoral action, the extent to which this has been achieved becomes a major indicator to measure the output of not merely the sector plan but the NPA in general and whether this marks a radical departure in social planning as against a "cut and paste" job of sectoral aggregation.

The NPA seeks to create the widest reach with the least cost and therefore resource savings effected through such coordinated action can enhance sectoral targets. The goals of the NPA are interdependent and ideally one sector should piggy-back on another. For example, while NPAs have projected low coverage in terms of universal access to sanitation by the year 2000, if education targets are reached there would be a natural upscaling of sanitation as a result of hygiene consciousness and consequent reduction in disease and improvement in health.

Delivery can become cost-effective by integrating multi-sectoral functions to be undertaken by the same agency. Operationalization of such inter-sectoral action is contingent on decentralization and maximizing community participation because needs are integrated at the level of the community. To that extent, promotion of community participation envisaged in sector plans, will promote a climate for inter-sectoral effort.

Sector plans propose to integrate the water and sanitation sectors which are divided responsibilities in some countries.

Sector plans also show integration of sector messages in school curricula and linkages with education sector in general.

Sector plans in water and sanitation have close linkages with health and environment sectors in addition to education. Integrated action is seen to be planned in guinea-worm endemic areas and diarrhoea prone areas . This has been developed

further to generate cross- sectoral targets for performance in the sector plans of Ghana and Malawi which seems to have given targets of the health sector relating to diarrhoea and cholera to the WATSAN sector.

Summary

*** Inter-sectoral action attempted but not enough**
*** Expected to be realized through decentralization/community participation**
*** Cost-saving through cross-sectoral action not estimated.**
*** Cross-sectoral targets need to be set to institutionalise inter sectoral action.**

XIV. Improved Monitoring and Evaluation.

Management Information Systems (MIS) in NPAs ought to become a powerful instrument for advocacy and mobilization. "Every NPA must contain monitoring mechanisms with the potential of being used as levers for action"(CF/EXD/1991-014/7 November 1991). The overarching goal of the NPA being to promote people-centered development through collective, coordinated action, a new open,visible, people-controlled MIS ought to be attempted. The sector plans do not detail specific proposals in this regard. But to the extent that many NPAs have proposed decentralized and community managed sector activity, it could perhaps be presumed that , to some extent, a new MIS would come into existence. This however needs to be followed up. Ghana and Malawi have stated that they would revamp the MIS to give a central role to the community. Countries like Zimbabwe and Sri Lanka have proposed use of information technology in improving MIS. The critical issue here would be that of access, as in mant developing countries information technology introductions in MIS is seen to be used only to increase the command of the implementing agencies on information and not to increase the command of people over that information. An MIS for a national programme for social development should attempt to reverse this centralization .

Some areas for consideration for restructuring MIS to realize the objectives stated in UNICEF memo cited above are listed here and pertain not just to the sector under review.

(a) Persuading countries to develop cross-sectoral targets. For example, targets related to water and sanitation being given to education sector, targets of the health sector being given to water and sanitation sector etc. This could contribute to better inter-sectoral action.

(b) NPA's should restructure MIS to be "outward" and not "upward". Bureaucratic reporting channels are oriented upward. A plan for social development should be monitored primarily by the

community. Specific ways to build this in should be worked out for the sector and the NPA in general.

(c) The idea of an NPA being a new initiative in social planning, it could consider a new MIS in the form of a social audit or people's monitoring. This could be operationalized through evaluations in the form of "Citizen's Reports" that could be organized through a networking of NGO's and could supplement evaluations of formal agencies of government.

(d) Country-specific people's institutions should be identified and made to play a major role in a new MIS for a new way of doing things.

Summary

*** Sector plans have conceived MIS in traditional formats**
*** Wanted- a people-based MIS**
*** MIS should be restructured to promote inter-sectoral action by allocating cross sectoral targets.**
*** MIS should become "outward" in terms of accountability.**
*** Consider social audit, "Citizen's Report" etc. as means.**

5. CONCLUSIONS AND HOW TO IMPROVE SECTOR PLANNING THROUGH THE NATIONAL PLANS OF ACTION

1. The NPA initiative has enabled country governments to draw up perspective plans for the sector to year 2000. It has resulted in many countries being able to identify resource requirements for meeting sector goals. This should help sector planning to become realistic in terms of goal-setting.

What is also revealed is that goals for coverage in the water and sanitation sector in many countries presently appear unrealistic in terms of comparison with previous performance. The focus therefore ought to be in devising appropriate resource mobilization strategies and targeting.

2. While most countries have accepted goals set internationally of universal access to safe water, many countries have set low targets for sanitation, especially rural sanitation. The coverage proposed for rural sanitation could be scaled up if intersectoral effort through health education is operationalized and accounted.

3. As far as setting standards for goal attainment, many countries have not detailed water quality standards. This ought to be a focus in sector planning to realize the objective of improved health.

4. Many NPAs have not detailed resource requirements linked to the choice of technology options for rural, peri-urban and urban areas. These should be projected separately to be able to evaluate focus and cost-effectiveness of intervention.

5. Resource-mobilization strategies have to be located in the macro-economic and socio-political contexts of country governments as ideally the NPA exercise seeks to do. These have been attempted only in a few NPAs. Development of strategy being dependent on these macro factors, sector planning should focus on better understanding the macro environment to identify the do-able.

6. Sector status of many countries reveal a high degree of distributional bias against rural and peri-urban areas and need a more clearly articulated targeting strategy in the plans. In countries which have proposed investments in system upgrading, there is a strong likelihood of resources being continued to be directed to the urban sector as most existing systems are in urban areas. Sector planning should become sensitive to this bias and devise appropriate targeting mechanism to reach the unserved and the under served.

6. There is a general favoring of low-cost technologies in most NPAs. Standardization of costs and technologies could be attempted to the extent possible.

7. Community participation is endorsed as a major strategy to be adopted in the sector. This needs to be followed through to appropriate institutional restructuring in the direction of decentralization. Sector planning ought to break the idea down to specific operational measures that result in direct action by the communities. As community mobilization is critical to sanitation/health education goals of NPAs, sector planning should attempt to build in professional communication expertise to trigger off such mobilization.

8. Community participation has been envisaged in many NPA's as resource-saving. While promoting the idea, care ought to be taken to see that this does not become a denial of public investment to under served areas.

9. In terms of viability, cost-recovery for O&M for water supply has found favor in many countries. In those countries which are moving from an infrastructure creation phase to a consolidation phase , sector planning needs to particularly focus on issues of operation and maintenance. Sector plans here should squarely address issues of sustainability in terms of cost-recovery/user charges.

10. Sustainability in terms of environment management should become integrated in sector planning through multiple levels of

intervention like integrated plans of action for water management, orienting implementors/ communities on the issues through training/ communication.

11. Inter-sectoral action, the key to the NPA has been inadequately appreciated. The possibility of achieving targets through cross-sectoral effort, for example sanitation targets considered to be unachievable in terms of resource-constraints become achievable if goals set in the education/health sectors are fulfilled, needs to be taken into account. Similarly opportunity for resource saving through inter sectoral-action has not been accounted. One concrete suggestion here is to experiment on developing **cross-sectoral targets** in the NPA, ie if a sector can begin to absorb targets of another sector on which it impacts and be able to quantify it. Can targets of the health sector in areas highly prone to water borne diseases be absorbed by the WES sector? . Similarly sanitation coverage to be effected from changes in individual action resulting from interventions in health education could be quantified to develop targets and measure performance. This is required to institutionalize intersectoral effort and seize the opportunity presented by the NPA initiative.

12. Sector plans have presented roles for the private sector which is seen as increasing. Private sector participation should be enlisted also for software and communications requirements through imaginative public-private interface. For example, would private sector companies in developing countries be interested in promoting health education is a question that needs to be addressed.

13. NGOs have been acknowledged as potential allies in the WES sector. Their support could be enlisted for not merely support in delivery but also all aspects of planning and implementation through participatory fora while drawing up sector components of NPAs.

14. MIS proposed in sector plans need to be revamped in terms of open, visible, people-controlled systems to contribute to the overall objective of the NPA of social development. Sector planning can be considerably strengthened by broadbasing the evaluation mechanism . This kind of open, social monitoring involve developing innovative formats and lobbying for the acceptance of these systems by the executing agencies of national governments.

15. Advocacy for sector goals should become part of the sector planning process of NPA's.

ANNEXURE 1

TABLE 1
PERCENTAGE OF POPULATION COVERED WITH SAFE DRINKING WATER AND SANITATION: STATUS IN 1980, CURRENT STATUS AND PROJECTED TARGETS IN NPA

COUNTRY	STATUS IN 1980		CURRENT STATUS		NPA TARGET	
	Water	Sanitation	Water	Sanitation	Water	Sanitation
AFRICA						
Benin	20	24	54		70	
Botswana					95	70
Burkino Faso			69		90	
Burundi	24		49	19.4	100	
Cent. Afr. Rep.			18	45		
Chad			26		75	
Djibouti			83.5	55.2	100	100
Egypt	75		89			
Equ. Guinea			34.7	41.5	100	100
Ghana	47	27	60.6	50.6		
Guinea	17	13	60	12.5	100 (R/U)	40/80
Kenya	26	30	48.6	41.5		
Malawi	41	83	56			
Mauritius	99	94	95			
Namibia			64 (1985)	32	100	100
Nigeria			63.0	64.8	100	
Rwanda	54	51	64	56.7	80	70
Senegal	42	33	48.3		100	100
Sudan			47.6	26	100	90
Swaziland	43		60	43	80	80
Tanzania	39		56			
Tunisia	35		92.2	95.3	100	100
Uganda	35		21.1	31.9	75	75
Zambia	42		59		100	100
Zimbabwe	33	4	74	21	100	50 (R)
Bangladesh	38	3	79.7	20	100 (1995)	35

Bhutan	8		34.2	13		
China			79.1			
DPR Korea						
India	41	6	85.2	16.2	100	
Indonesia	24	24	56.9	38	60 (1995)	60
Lao PDR			34.6	11.4	80	60
Maldives	5	15	49.4	23.9	100	100
Nepal	14	2	37	6	77	31
Pakistan	25		56.1	24.4	100(U) 70 (R)	100 (U) 50 (R)
Philippines			80	70.6	100	100
Republic of Korea	66		100	100	100	100
Sri Lanka	33	69	71.2	60.2	100	100
Thailand	63	46	95.4	89.7	100	100
Vietnam	41.9	62.1	41.9	62.1	80	50

ANNEXURE 2

Table 2
COUNTRIES, RESOURCE REQUIREMENTS ESTIMATED AND RESOURCE MOBILIZATION STRATEGIES

COUNTRY	RESOURCE REQUIREMENTS FOR THE SECTOR PLAN	RESOURCE MOBILIZATION STRATEGY
Kenya	No detailed estimates for the sector. General economic scenario projections. Annual requirement projected as 129 Million US $.	User charges proposed for services in overall strategy
Sudan	Total estimates for sector estimated as 663 million US $ up to year 2000. No disaggregation on the basis of program type and no year-wise break up.	Proposes 50% sharing between national govt and ESA. Community to meet 25% costs. Using least cost technology option-handpump wherever possible.
Tanzania	Not indicated	Not indicated
Zambia	Not indicated	Not indicated
Swaziland	Total estimates for period 1992-2000 shown. Annual resource need estimated at 1.4 Million US $.Not desegregated	Not indicated
Ghana	Resource requirements estimated in detail. Desegregated year-wise linked to physical achievement.	User charges proposed. Expects higher public investment. Supplemented by ESA.
Zimbabwe	Detailed estimates available Desegregated year-wise and linked to physical achievement	Fiscal incentives to employers for activities in sector. Loan support from Central to local government. Direct action by community with state as facilitator in sanitation.
Tunisia	Total estimates shown for NPA up to 2000. Not desegregated. Annual requirement estimated as 99 Million US $.	Not indicated
Yemen	Not indicated	Not indicated
Malawi	Total requirements shown. No disaggregation	Not indicated
Mauritius	No sector plan	
Morocco	Not indicated	

Egypt	No sector plan	
Botswana	Year-wise requirement up to 97 shown.	60% from domestic sources. ESA for remaining.
Uganda	Resource needs estimated for medium term and up to 2000 and resource gap indicated.	Taxes, cross-subsidy, community contribution and privatization of part of sector activity.
Nigeria	Detailed estimates with agency wise break up. Technology options linked to financial requirements. Annual requirement estimated as 316 Million US $.	Resources expected through loans for urban water supply
Guinea	Sector requirements for decade estimated based on high, medium and low government revenues and linked fall in ESA support. Basis for calculations for the WATSAN sector not given. Annual requirement estimated as 53 Million US $.	User charges seen as substantial portion of costs but not quantified
Namibia	Sector estimates unclear.	
Djibouti	Not indicated	
Burkina Faso	No estimates	
Senegal		
Equatorial Guinea	Annual requirement estimated as 8 Million US $.	
Chad	Annual requirement estimated as 13 Million US $.	
Benin	No estimates	
Rwanda	Annual requirement estimated as 16 Million US $.	
Central African Republic		
Burundi	Annual requirement estimated as 32 Million US $.	
Nepal	Total resources for sector in decade estimated. Sector gets roughly 5 to 6% of national plan historically. Projections made for donor support. Annual requirement estimated as 53 Million US $.	General strategies given(and not sector-specific) like "social tax", fiscal incentives to business etc. User charges proposed for sector but not quantified.

Vietnam	Resource needs estimated based on cost per unit per beneficiary basis. Linked to physical achievement. Annual requirement estimated as 28 Million US $.	66% funds expected (US $ 53.9) from donors, primarily UNICEF. Remaining to be raised locally.
Philippines	Not indicated	
Lao DPR	Total sector cost given. Resource gap estimated. ESA funds projected. Annual need estimated as 9 Million US $.	Community contributions to supplement national and donor funds.
Maldives	Not indicated	
Bhutan	NPA in the form of 2 projects- one on RWS and another on UWS with cost estimates.	Sector plan 90% dependent on donor support
China	Not indicated	
Republic of Korea	No resource constraint	
India	Not indicated	
Thailand	Not indicated	
Indonesia	No details	Decentralization to raise funds at provincial, District, community levels. Private sector support planned.
DPR Korea	Not indicated	
Pakistan	Total requirement estimated. Annual requirement works out to 570 Million US $. Sector costs 38% of NPA .	General. Supplementing national funds with external support. Freeing of public investment from economic sector to generate resources for social sector
Sri Lanka	Activity-wise (within sector) costs projected for decade. Annual requirement estimated as 40 Million US $.	No details
Bangladesh	Funds requirement up to 1995 for sector estimated in total. Annual requirement works out to 25 Million US $.	Existing external support to sector from DANIDA and SDC expected to continue. No details.

A ONE-GLANCE STATEMENT ON NPA SECTOR PLANS/STRATEGIES: AFRICA AND ASIA

A. Goals modified (W, S)
B. Standards set
C. Resources estimated

1. Resource mobilization
2. Community participation
3. Sustainability/O & M
4. Low-cost technology
5. Targeting
6. Identification of technology
7. Capacity Building
8. Institutional Restructuring
9. Women empowerment
10. Private Sector/NGO Support
11. Intersectoral Coordination
12. Improved MIS

COUNTRY	FORMAT			STRATEGIES											
AFRICA	A	B	C	1	2	3	4	5	6	7	8	9	10	11	12
BENIN	XW		X	X								X	X	X	X
BOTSWANA	xws		X	X											
BURKINA FASO	xw														
BURUNDI	XS	X	X	X	X	X					X			X	X
CENTRAL AF. REP	X	X	X		X	X	X	X	X	X	X	X	X		X
CHAD	XW		X												
DJIBOUTI															
EGYPT															
EQ. GUINEA			X												
GHANA		X	X	X	X	X	X	X	X	X	X	X	X	X	X
GUINEA	XWS	X	X	X	X	X									
KENYA		X	X	X	X	X	X	X	X	X	X		X	X	X
MALAWI			X		X		X						X	X	X
MAURITIUS					X										
MOROCCO															
NAMIBIA		X			X		X	X	X	X		X	X	X	X
NIGERIA		X	X	X	X	X	X	X	X	X	X		X	X	X
RWANDA	XWS		X			X	X		X						
SENEGAL															
SUDAN	XS	X	X	X	X	X									
SWAZILAND	XWS	X	X		X	X		X	X	X		X	X	X	
TANZANIA										X			X		
TUNISIA			X												
UGANDA	XWS	X	X	X	X	X	X	X	X	X		X	X	X	X
ZAMBIA					X										X
ZIMBABWE	XS	X	x	X	X	X	X	X	X	X	X		X	X	X
ASIA															
BANGLADESH	XS	X	X	X	X	X	X	X	X	X	X		X	X	X
BHUTAN			X	X											
CHINA					X										
DPR KOREA															
INDIA		X			X	X	X	X							
INDONESIA	XWS	X		X	X	X	X	X							
LAO PDR	XWS		X	X	X	X	X	X						X	
MALDIVES					X		X		X						
NEPAL	XWS	X	X	X	X	X	X			X	X	X			X
PAKISTAN		X	X	X	X	X	X	X	X	X	X		X	X	X
PHILIPPINES		X			X										
REP.OF KOREA		X													
SRI LANKA		X	X		X	X	X							X	X
THAILAND		X			X										
VIETNAM	XWS		X	X	X	X	X	X		X				X	

TRIP REPORT TO NAMIBIA, APRIL 12 - 17, 1993

APPENDIX 4

THE IMPACT OF WATSAN (1) ON MALNUTRITION AND UNDER 5 MORTALITY RATES. THE NEED FOR AN INTEGRATED APPROACH

AARON LECHTIG (2) AND BRENDAN DOYLE (3)

(paper for discussion/working document)

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THE IMPACT OF WATSAN ON MALNUTRITION AND EARLY CHILD DEATH - THE NEED FOR AN INTEGRATED APPROACH

1. The objective of this Annex is to review the conceptual basis and the programatic implications of an integrated approach involving community based universal access to safe water, hygienic practices and sanitation (WATSAN).

For this purpose, the conceptual framework presented in Figures 1 and 2 will be used. In these Figures, household access to water and sanitation pertains to the cluster of underlying determinants related to services. Learning hygienic practices is included in the interface between care and access to services.

2. **Diarrhoea as a Cause of Child Death**

One and a half million children under 5 years of age die each year in Africa due to diarrhoeal disease. This is more than one third of all children under 5 years of age who die in the continent every year. About two thirds of those who die of diarrhoea are also malnourished.

3. **Diarrhoea as Cause of Malnutrition**

Duration of diarrhoea could statistically explain up to 18% of the gap in incremental growth in length, in children 3 - 36 months of age (Martorell,1975). Much of the nutritional impact of diarrhoea is mediated through:

1) decreased dietary intake in mothers and children. In children, the presence of diarrhoea is associated with a decrement of 15 -20% of the dietary intake from foods other than breastmilk (Brown, 1990 and Martorell, 1990). In pregnant mothers, diarrhoea acounts for a decrease of 400 kcal/day, or 25% of usual dietary intake (Lechtig 1972);

2) increased fecal loss because of malabsorption; and

3) increased catabolism because of increased rate of basal metabolism.

The combination of these 2) and 3) above, may be equivalent to a further decrease of 10% of dietary intake. This means that in children, the presence of diarrhoea is associated with a decrease of up to 30% of dietary intake. In pregnant mothers this effect could be equivalent to a decrease of up to 35% of their current dietary intake.

Both, inadequate dietary intake and high prevalence of diarrhoea interact synergistically to produce higher prevalence of malnutrition (Lutter, 1990) particularly in low income populations where these two factors are highly prevalent.

Simply stated, a malnourished body weakened by diarrhoea, is prone to infectious diseases, becomes more malnourished and is then more susceptible to further disease. If WATSAN prevents

diarrhoeal disease, the downward spiral of malnutrition and disease leading to death, can be partially prevented.

4. The Food Equivalent of Increased Physical Activity

In rural Africa, women and the girl-child are the traditional fetchers of water and often have to travel 3 kms or more to the nearest water point. Assuming two journeys of 6 km round trip per day, (12 km/day) and an average walking speed of roughly 4 kms per hour over uneven surfaces, about 3 hours per day will be spent in fetching water. An additional one hour must be allowed for queuing, waiting and resting. It is estimated that as much as 40 billion hours are lost each year to water hauling alone in rural Africa (De Rooy, C. and Doyle, B. 1992), this burden is primarily the responsibility of women and the girl-child.

For the average rural African women, roughly an extra 178 calories per hour will be expended while walking to the water point and 210 calories per hour while returning with a full pot(1). The energy expended in fetching a total of 20 litres (2 journeys) of water per day will be 582 calories per day (2). This is 36% of the usual dietary intake of these women (about 1600 cal/day). This is also the equivalent of 166 grams of grain.

In rural Africa, as in many rural areas of developing countries, most women in reproductive age are pregnant, lactating or both.The above energy expenditure is enough to improve fetal growth and produce a significant decrease in the prevalence of low birth weight babies if the women is pregnant (Lechtig et al 1975). It is also enough to notably improve breast milk output if the mother is lactating (Lechtig et al 1979).

1.(a) unloaded: 4 Kmx 57 cal/km = 228 cal/hour; estimated BMR = 50 cal/hour; extra calories expenditure : 228-50= 178 cal/hour

(b) loaded with a full pot: 4 km x 65 cal/km = 260 cal/hour; estimated BMR = 50 cal/hour; extra calories expenditure = 260 - 50 = 210 cal/hour.

Thus, 1.5 hours going with an empty pot; 1.5 hours returning with a full pot of 13 kg (10 litres of water plus approximately 3 kg for the pot = 13 kg) and 1 hour at rest.

2.(1.5 hours x 178 cal/hour = 267 cal) + (1.5 hours x 210 cal/hour = 315 cal) = 582 calories per day.

5. **The Women's Time**

Assuming an average 16 hour working day for the average rural African women, and if time spent in collecting safe water was to be reduced from 4 hours to approximately 1 hour round trip, this reduction of three hours would contribute to an equivalent of 20% of her available working time. Therefore, women could have increased time:

1) to look for better opportunities for income generating activities, resulting in improved access to food at household level and

2) for the nursing mother, more time at home to breastfeed and to care for her child during the critical 0 - 24 months period.

3) to participate in community affairs thereby allowing them to be part of the decision making process, thus facilitating capacity building for empowerment.

4) Furthermore, girls are often used to help the mother collect water. The time required for this purpose may contribute to a significant disincentive to sending girls to school - hence higher rate of female illiteracy which is another important factor in children and women care as well as for child malnutrition and death in Africa.

6. **The Linkages between WATSAN and malnutrition and child deaths**

National data from 84 countries were used to estimate this relationship. The analysis involved a model with malnutrition as the dependent variable and indicators of household access to food, access to health services and safe water and sanitation and proxies of child care as independent variables. Possible intervening variables were statistically controlled for.

In the first step, indicators of each of the three underlying clusters were selected in terms of their association with the prevalence of underweights. The second step was to identify the indicators of each cluster that presented the highest association with malnutrition. These were then introduced in a step-wise analysis. Two variables came out as the best predictors of nutritional status: (see Table 1).

1. The proportion of income allocated for food. This is an indicator of the degree of financial access to food.

2. The percentage of households with access to safe water.

Interestingly, the strong association with malnutrition, observed with the indicator percentage of rural population below absolute poverty level, disappeared once the proportion of income spent on food was introduced. This suggests that the association with poverty, was mediated by the level of resources allocated to food.

It should be acknowledged, however, that in this model the cluster of child care had very gross indirect indicators such as education and total fertility rate. There is a great need for better indicators of this cluster such as time of the mother allocated to care of her children and herself.. Availability of this information will permit better analyses and better decisions.

The above review clearly supports the linkages proposed in the conceptual framework presented in Figure 2. The mechanisms are not only those related to higher prevalence of diarrhoea, but also those related to increased physical activity of women, and decreased time spent for the care of their children and for themselves.

The inference is that WATSAN will significantly contribute to:

1) better weight gain during pregnancy and lower prevalence of LBW babies;

2) better nutrition of lactating women, and increased breastmilk output;

3) lower prevalence of malnutrition and lower under five mortality rates in children;

7. The Need for an Integrated Approach

The above inferences mean that community based interventions that include universal access to safe water and sanitation coupled with improved hygienic practices will make a significant decrease in the prevalence of malnutrition and the under five mortality rates.

These interventions will be particularly effective in populations where the coverage of WATSAN is low, household access to food is inadequate and malnutrition and under five mortality rates are high.

These interventions would provide a key complement to enhance the benefits brought by activities aimed to improve household access to food and inadequate dietary intake.

In areas hit by famine, the under 5 mortality rate is usually increased by outbreaks of diarrhoea of increased severity and duration because of malnutrition. Therefore in these areas,

similar types of WATSAN interventions should be introduced to minimize the occurrence of diarrhoea and thereby obtain optimal utilization of food.

At this point it should be remembered that the conceptual framework presented in Figure 1 indicates that the three underlying clusters: food, health and care are necessary conditions for good nutrition, adequate development and high survival rates.

7. The Cost of a WATSAN Project with Impact on Child Nutrition and Mortality

Options costing less than $30 per capita are considered to be low cost. Some preferred technologies with which UNICEF has extensive experience are: spring protection, gravity feed schemes, dug wells and small diameter drilled wells with VLOM handpumps. Costs per capita for these technologies differ from country to country and programme to programme and depend to a great extent on the availability of local human resources, local materials and equipment. However, it is generally agreed that a per capita cost of less than $10 is achievable with the above options.

India, rich in resources, with good logistical control over its programmes and a strong industrial base, calculated $0.56 per person per year for 20 litres of potable water per person per day for 250 users for each hundpump installed. (State of the World Children 1984). In Bangladesh, the estimate was $2 per capita per year. In Ethiopia this cost is $1.7 per capita per year and is based on the cost analysis of 21 wells drilled in 1990 in Gambella Region. Similar estimates have been produced in Uganda. In all the above cases these costs represent capital investment (start up cost) and do not include the maintenance and other recurrent costs. Likewise, they do not include the cost of sanitation nor that of learning hygienic practices.

The total resources required to ensure universal access to water, sanitation and adequate hygienic practices by the year 2000, are $30 billion annually. The anticipated available resources are roughly $10 billion.

8. The Cost-Effectiveness estimates

Based on data from India and assuming the installation of 4 handpumps utilized by an average village population of 1,000 in whch 20% are children under five years of age, a capital investment of $560 per annum would be needed to reduce diarrhoeal disease and decrease malnutrition and death in 200 children through WATSAN. The estimated cost per child would be about $2.8 per year. The estimated cost per case of malnutrition avoided is $19.0 and the cost per child death avoided is $93.3 (1).

---

(1) If the prevalence of underweights is reduced from 50% to 35%, and the under five mortality rate is reduced from 100 to 70 per thousand. The number of malnourished children

would decrease from 100 to 70. Number of avoided cases: 30; $560/30 avoided cases = 18.7 per avoided case. The number of child deaths would decrease from 20 to 14. $560/6 avoided deaths = $93.3. This estimate assumes that the impact on USHR will be proportional to the impact on malnutrition.

In Ethiopia, the capital cost estimates are three times higher: $8.5 per child;$56.7 per avoided case of malnutrition and $283.3 per child death avoided respectively. Both estimates are in the lower range of costs of interventions based on food supplementation (i.e. $5.0 - 500.0 per case of malnutrition avoided. Ref: Nutrition Sectoral Paper for the ICAAC). No clear estimates are available yet for comparing costs of avoided child death.

9. The Programatic Implications

9.1 The Strategy

From the start, involve the people who suffer the problem as main actors in deciding and implementing the solutions to alleviate or solve their own problem. For this purpose, use the Triple A approach (see Figure 3). Involve the people in:

1) the assessment of their problem (is there a problem?) make the problem visible;

2) the analysis of the main determinants that produce the problem. Develop a common understanding of the nature of the problem. Use of the conceptual framework presented in Figures 1 and 2 will help in this process.

3) deciding a simple plan of action.

4) prioritizing actions that should be implemented.

5) implementing the agreed actions.

6) re-assessing and re-analysing this action.

In this way existing positive Triple A cycles will be enforced and new ones will be created.

9.2 Planning Aspects

The need for Coordination of WATSAN projects with other nutrition and survival impact projects

- The following suggestions could be useful to facilitate the coordination of these activities.

1. - Use high prevalence of malnutrition and high U5MR as criteria to prioritize the geographic areas where WATSAN projects will be developed.

2. - Prioritize the same geographic areas selected above for other projects with impact on nutrition and survival. i.e. breastfeeding, community based nutrition rehabilitation, household food security

projects, control of Vitamin A deficiency (VAD) and Iron Deficiency Anemia (IDA).

3. - Integrate activities aimed to improve access to safe water with those aimed to improve environmental sanitation (i.e. latrines) and particularly with learning and internalization of hygienic practices.

4. - It is essential for any WATSAN intervention intended to contribute to a nutrition impact, to be community driven, such that sustainability is ensured and continued effectiveness is obtained.

5. - In all cases ensure coordination, convergence and directionality of activities. A useful tool for this purpose is the regular use of the conceptual framework at all steps of planning and implementation.

10. Conclusions

1. Community based interventions aimed to universal access to safe water, sanitation and hygienic practices will reduce the incidence, duration and severity of diarrhoea, enable women to participate more extensively in activities that would increase their household access to food; decrease their energy expenditure in fetching water; improve the dietary intake and nutrient utilization of all family members and increase their presence in the home to care for their children and for themselves.

2. As a consequence, the nutritional status of the family as a whole would improve and the under five mortality rate will decrease at an affordable cost. And the human right of universal access to safe water and adequate hygiene will be attained.

3. In terms of practical implications for planning, it is suggested that the assessment, analysis, action approach and the conceptual framework for analysis of the causes of malnutrition and death should be used as the key strategies to guide the incorporation of these interventions in UNICEF Country Support Programmes. First priority should be allocated to the regions with the lowest coverage of access to safe water, i.e. Africa. As a first step it could be implemented in Area-Based Programmes aiming to gradual expansion at national level.

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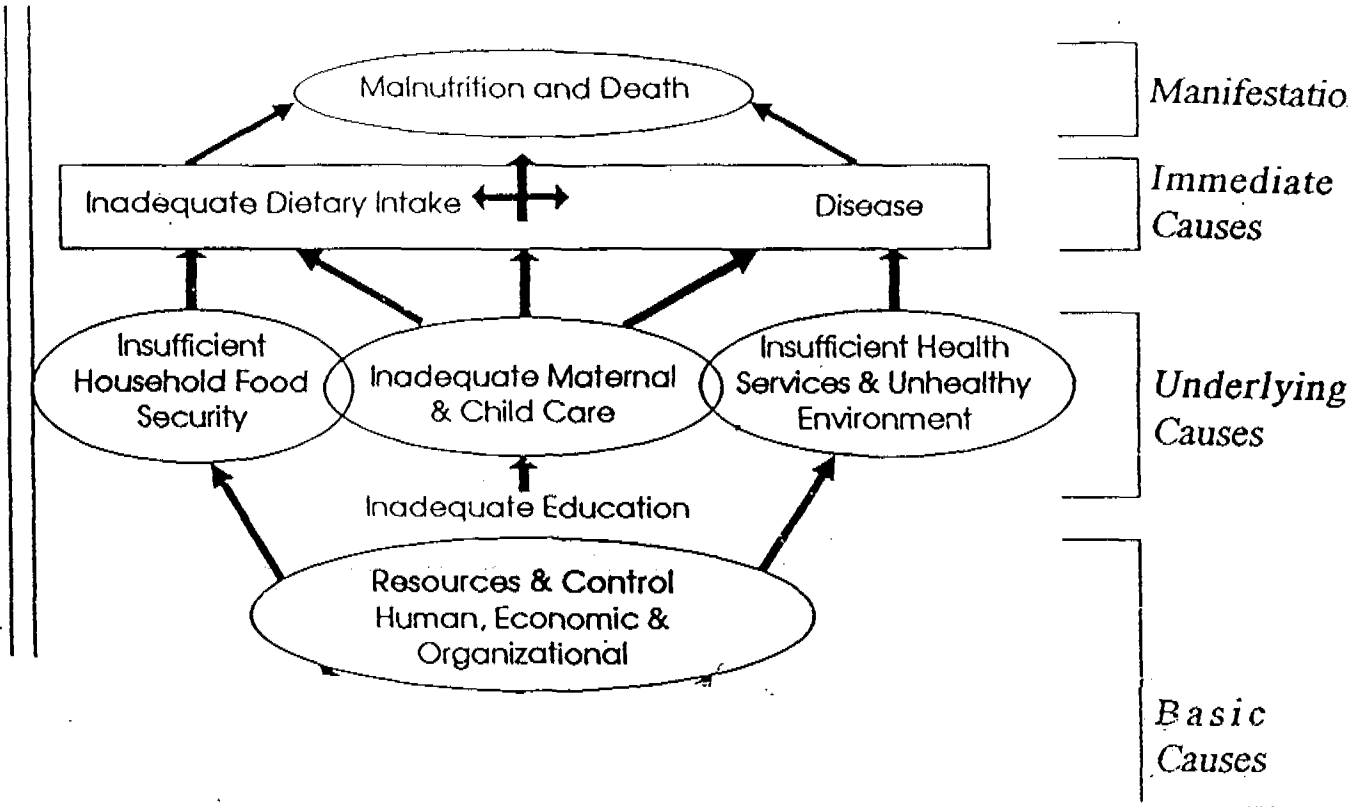


Figure 1 - Conceptual Framework for causes of child death and malnutrition

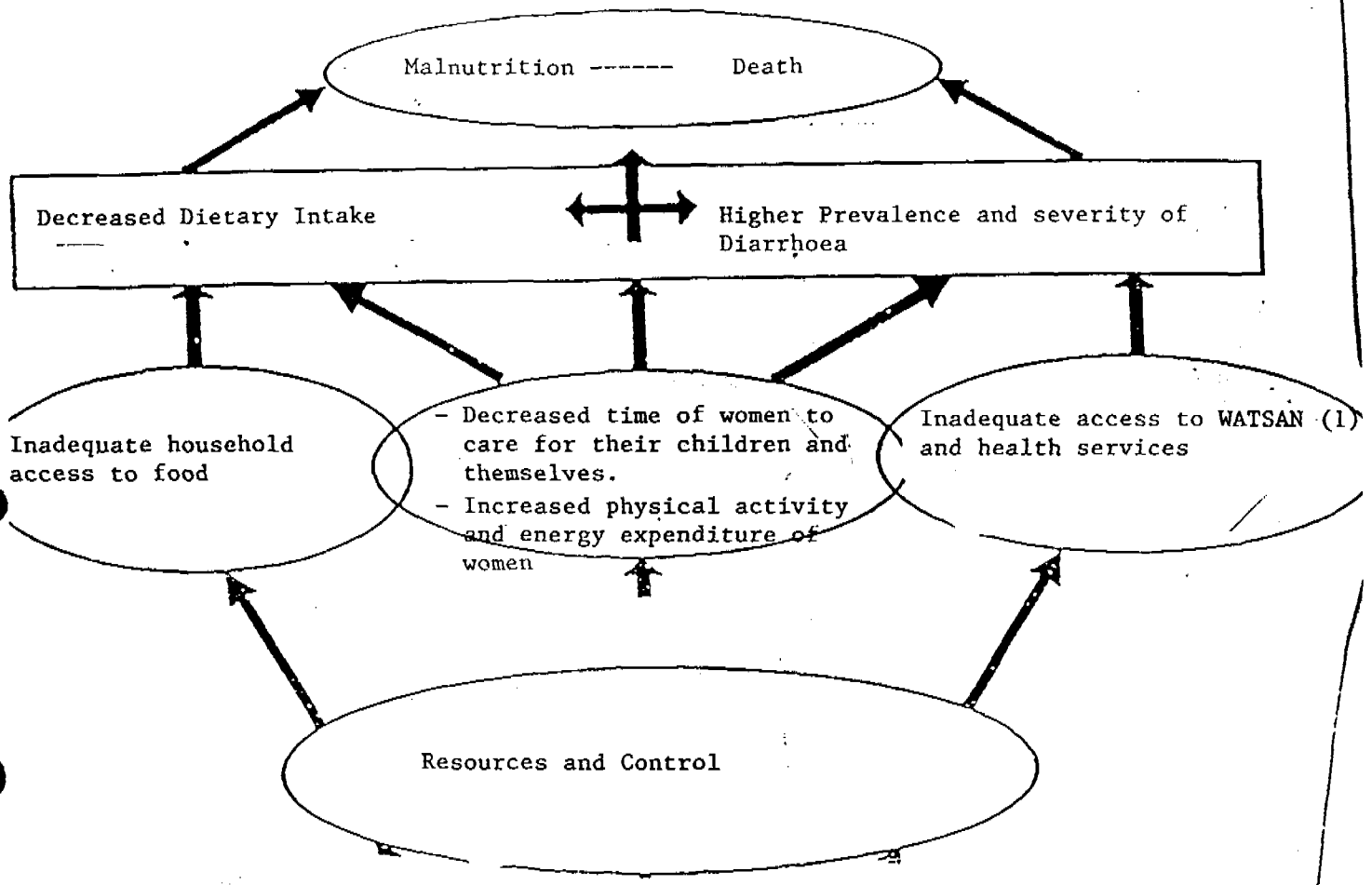
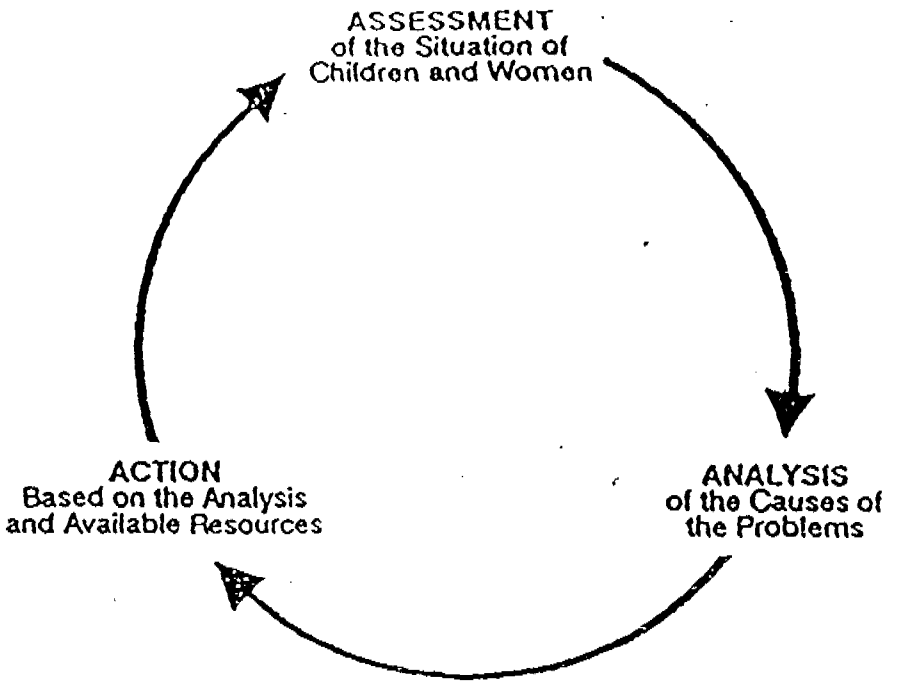


Figure 2 Conceptual Framework applied to WATSAN, malnutrition and child death

(1) WATSAN: safe water,hygienic practices and environmental sanitation.

(2) Hygienic practices represent the overlap with care.

Figure 3: The Triple A Cycle



1 - Reduction of U5MR by 1/3 (70)
2 - Reduction of MMR by 1/2
3 - Reduction of child malnutrition by 1/2
- Reduction of LBW babies to less than 10%
- Reduction of IDA by 1/2
- Elimination of VAD and IDD
- Halving of child deaths by diarrhoea
- 1/3 reduction of deaths by ARI

- Eradication of polio and elimination of NN tetanus
- 90% reduction in measles cases
- 25% reduction incidence of diarrhoea
- elimination of guinea worm disease

7 - Improved Protection of children in especially difficult circumstances and observance of Convention on the Rights of the Child.

- Dissemination of knowledge to enable all families to ensure household food security

- Exclusive breastfeeding 4 - 6 months
- Growth promotion for all

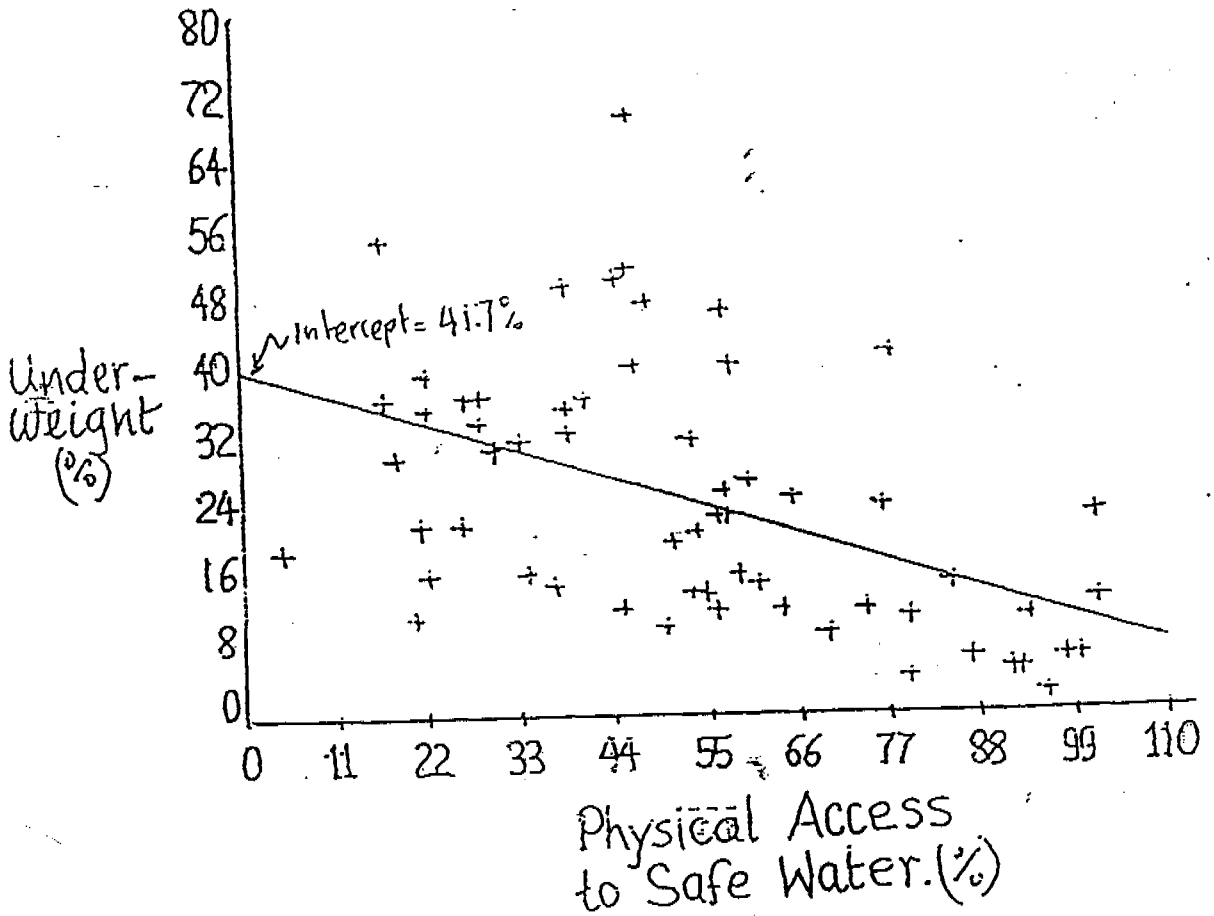
4 - Safe water and sanitaion for all families
- Family planning services and prenatal care for all
- 90% EPI coverage

5 - Basic Education for all children and completion of Primary School by 80%
6 - Reduction of Adult illiteracy by half and equal education opportunities for females
- Dissemination of life skills to all families

RESOURCE ALLOCATION TO BASIC NEEDS OF THE POOR = 20/20

Figure 5.-

Underweight by Physical Access to Safe Water



$r = -.49861$

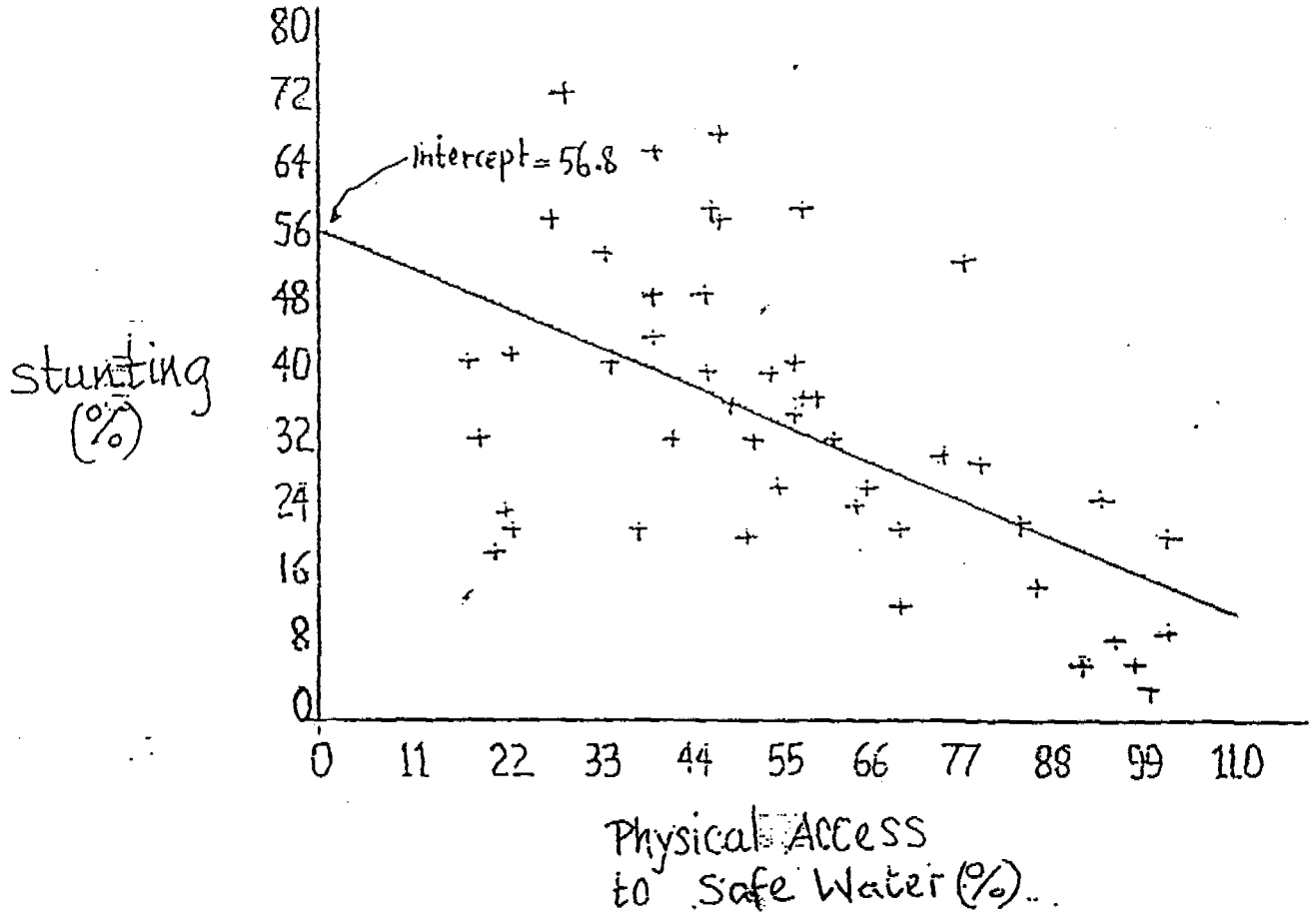
$R^2 = .24861$

Slope = $-.30588$ (SD = .06923)

— Source: Lechtig A., R. Mwadime, S. Baldwin, 1993

Figure 6.-

Stunting by Physical Access to Safe Water



$Y = -.5398$

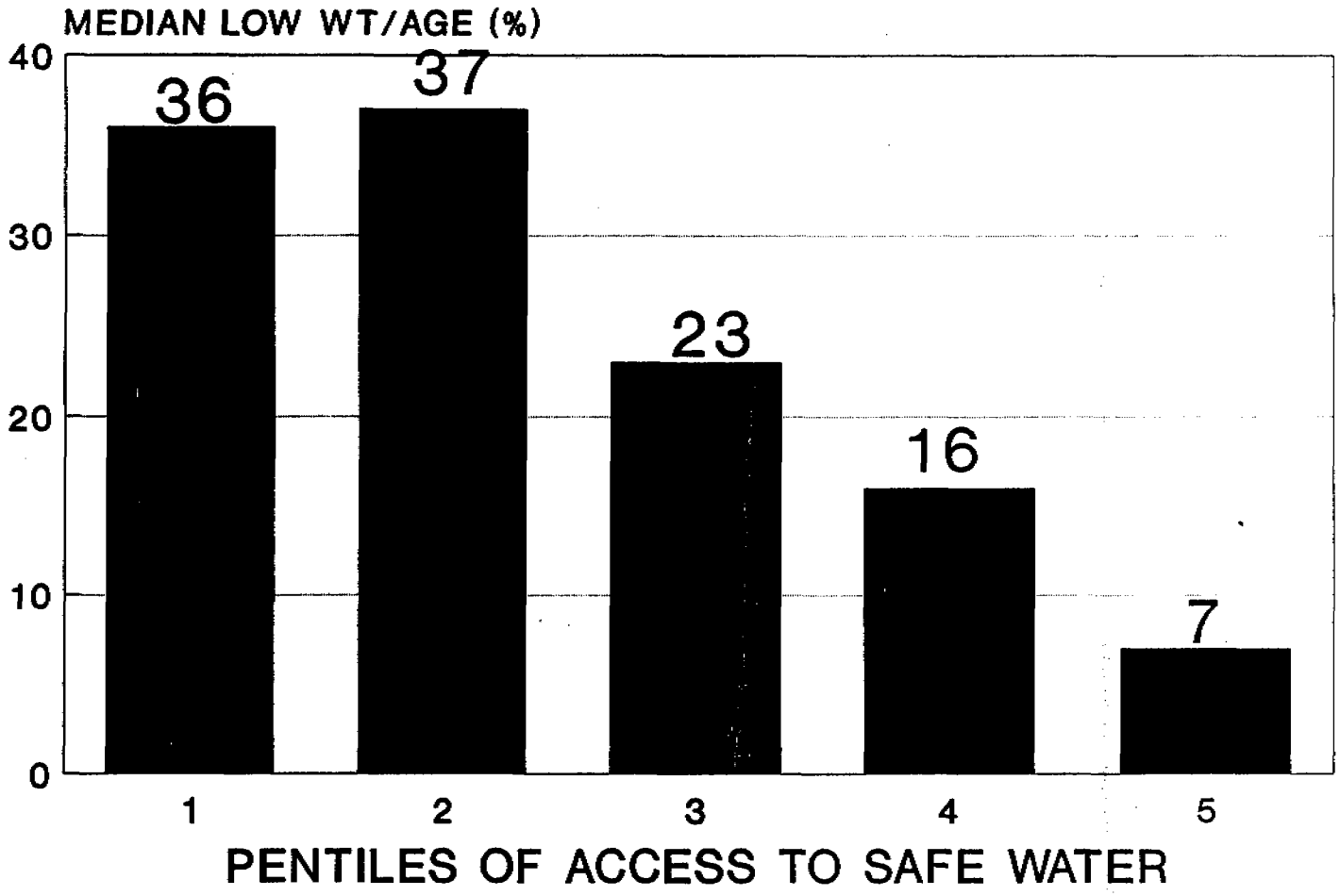
$R^2 = .29142$

Slope = $-.38026$ (SD = .0847)

- Source: Lechtig A., R. Mwadime, S. Baldwin, 1993

ACCESS TO SAFE WATER AND MALNUTRITION

N=59 DEVELOPING COUNTRIES



SOURCE:LECHTIG ET AL 1993

12b/e 1-

LOG PERCENT OF CHILDREN MALNOURISHED (BELOW 80% W/A): ALL COUNTRIES

Multiple R	.77714
R Square	.60395
Adjusted R Square	.45805
Standard Error	.18390

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	7	.97985	.13998
Residual	19	.64766	.03238
F=4.13917		Signify F=.0064	

----------Variables in the Equation----------

Variable	B	SE B	Beta	T	Sig T
Q12	.0099966	0045036	.43348	2.220	.0388**
Q27	-.0091028	.0029815	-.76300	-3.053	.0065**
Q69	-.1269100	.0688800	-.78458	-1.843	.0811*
Q62	.1385800	.1058100	.35721	1.310	.2059
Q78	.0020054	.0019187	.16233	1.045	.3091
Q47	-.0021511	.0024579	-.23983	-.875	.3924
Q22	.0054254	.0139500	.16985	.389	.7017
(CONSTANT)	1.3277000	.9782600		1.357	.1906

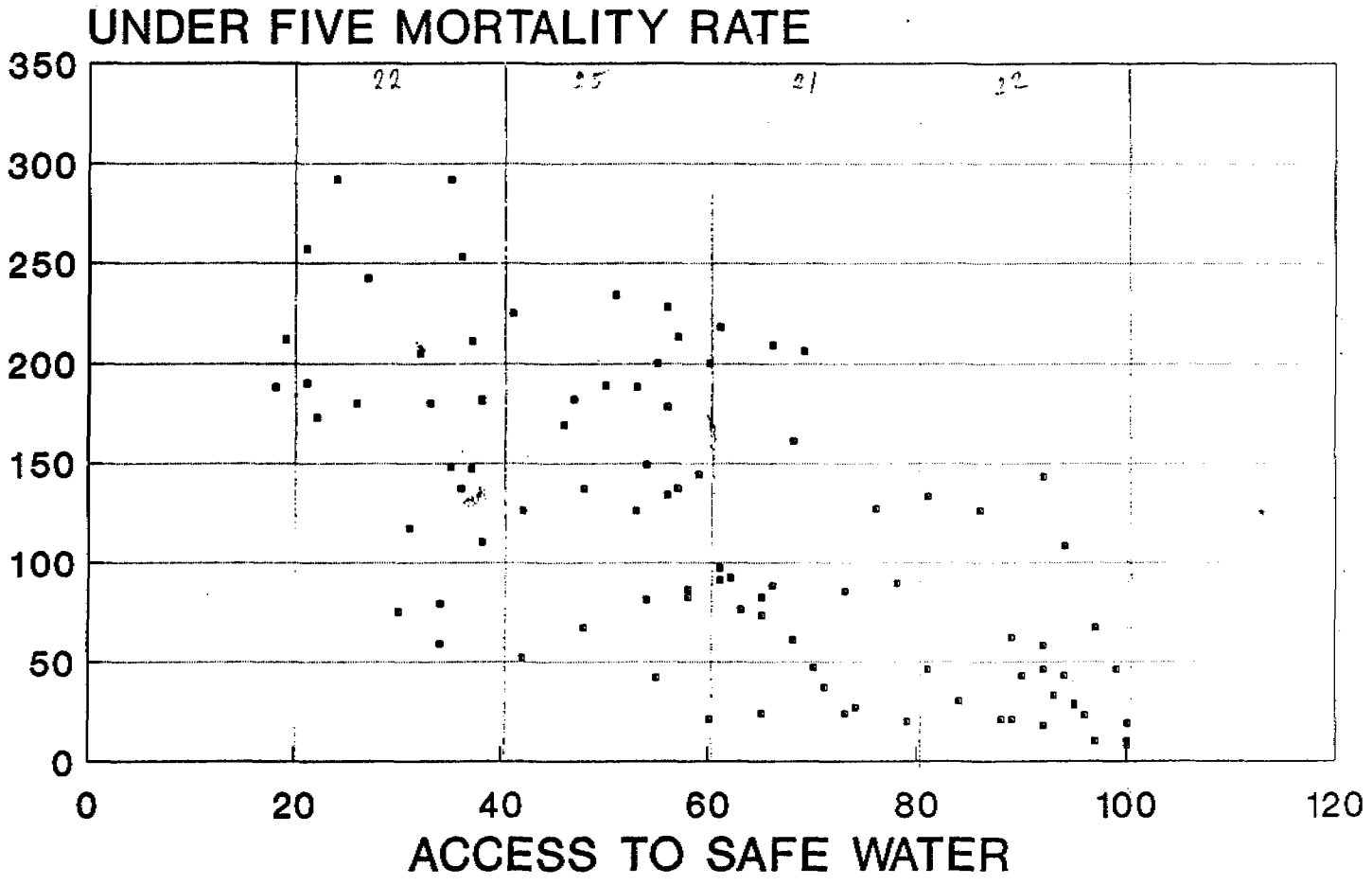
Key:

Q12 - the % of household income (1980-85) spent on all food.
Q22 - life expectancy (1989).
Q27 - the % population with access to safe water.
Q47 - the adult (female) literacy rate (1985)
Q62 - the population annual growth rate (1980-89).
Q69 - the total fertility rate (1989).
Q78 - the % of rural population below absolute poverty level (1980-89).

- Source: Lechtig A, Mwadime R., Baldwin S. 1993

ACCESS TO SAFE WATER AND U5MR

N= 96 DEVELOPING COUNTRIES

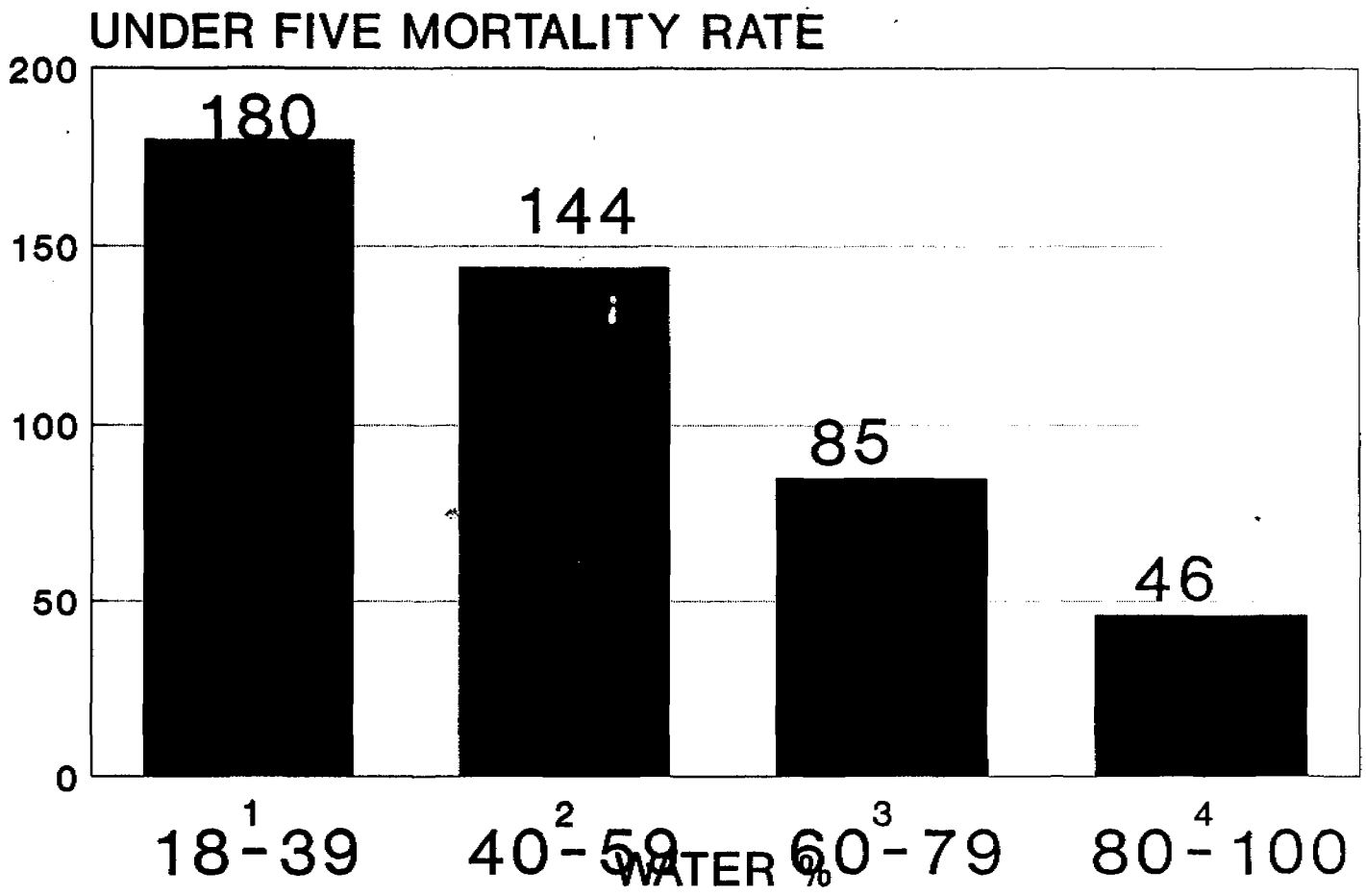


SOURCE: LECHTIG ET AL 1993

13 - 39
40 - 59
60 - 79

ACCESS TO SAFE WATER AND U5MR

N= 96 DEVELOPING COUNTRIES



SOURCE: LECHTIG ET AL , 1993

UNICEF
United Nations Children's Fund

WATER AND SANITATION
A SUMMARY OF EVALUATIONS PERFORMED
October 1991

MARTIN BEYER

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BACKGROUND: UNIVERSAL ACCESS TO SAFE WATER AND SANITATION - A GOAL FOR THE WELL-BEING OF CHILDREN

1. EXECUTIVE SUMMARY

1. Universal access to safe drinking water and sanitary means of excreta disposal are among the goals set for children and development in the 1990s, and is embodied in the United Nations Convention on the Rights of the Child. For over four decades, UNICEF has been involved in support to country programmes aimed at the most marginal populations with a continuation of inputs in this sector as part of the organization's work for the health and well-being of children for the 1990s.

2. Systematic monitoring and evaluation is crucial for enhancing programme management (i.e. planning, implementation and follow-up) of water supply, sanitation and hygiene education components. Participation from governments, other organizations and the communities will strengthen this process and create a strong promotional and motivating effect. In order to summarize the most important experiences of UNICEF-related work, (especially within the last five years), this study analysed some 200 evaluative documents produced on UNICEF-assisted water, sanitation and hygiene education programmes made between 198 - 1992.

3. To enhance programme policies formulation, planning and development of strategies, UNICEF draws from evaluations of its own programmes, and also evaluations made by other agencies. Increasingly UNICEF-sponsored evaluations are carried out jointly with governments (80 per cent of all evaluations in 1991), and with other organizations. During the years 1986-91: UN and other multilateral organizations were responsible for twelve per cent of all evaluations; bilateral agencies, 15 per cent and NGOs in the range of two to eight per cent. Universities, in many cases, participated both in the field work and in the authoring of two to five per cent of the evaluations.

4. This analysis of past evaluations indicate that UNICEF supported programmes (their objectives and plans), follow the policies of the organization. These policies in turn closely relates to the principles set out in the "New Delhi Statement" of 1990, which was included in the recommendations of the General Assembly (document A/45/327) for continued and intensified action during the 1990s.

5. Implementation in relation to present plans and resources indicate that progress is reasonably good with respect to water supply. Environmental sanitation is still lagging behind, but the implementation rate is on the upturn in several countries, such as India and Myanmar[1]. Concerns for effective use and sustainability of the installations are less now than in 1970 or 1980. Governments now tend to give higher priority to water supply and sanitation than in the past. Technologies have become more standardized and easier to maintain, and - to some degree - public awareness of the need for maintenance has increased.

6. The present coverage rates in many countries still stand at one third to one half of universal access to water supply and sanitation therefore, reaching the unserved remains a major concern and is further compounded by rapid population increases.

7. In many evaluations, water supply and sanitation is now seen as important components of the environment (Sudan[2]), with concerns expressed for the quality, conservation and management of water resources (Ethiopia[3]), the physical quality of housing and the surrounding environment (Central America[4]). Actions for improvement are increasingly being included in the programmes, such as drainage in urban slums (Nepal[5]) and the use of wastewater from water points for planting of trees (Pakistan[6]) to prevent erosion.

2. *PRINCIPAL ISSUES AS HIGHLIGHTED IN EVALUATIONS*

2.1 TECHNOLOGIES

8. The technologies used in UNICEF-assisted programmes are considered appropriate, based on their social acceptance, low cost and community-based operation and maintenance. During the last ten years, the number of technological options, particularly for handpumps, have been narrowed down, through better quality control and standardization. In the case of the UNDP/World Bank project for handpumps, testing started out with 78 different designs and ended after eight years indicating around ten Village Level Operation and Maintenance (VLOM) type pumps for different lift ranges, and suitable for community use[7].

9. It is important to continue to monitor development of technologies, particularly those, which could be produced locally. Likewise assessment of cost-effectiveness of technologies is necessary to chart potential possibilities for further lowering costs (Kenya[8], Bangladesh[9]). Effective use and sustainability of installations should also be monitored and evaluated, if possible, in all programmes.

10. A number of constraints frequently referred to (Bangladesh, Pakistan[6]) include increased vulnerability of the environment and increased scarcity of water resources (deforestation, erosion, desertification, lowering of water tables, pollution of soil, water, air). Lack of materials, equipment and transportation are among other constraints. Design of latrines are still based on heavy and bulky materials (Sudan[2], Ecuador[10]) which are creating cost and logistic problems and hamper acceleration of sanitation coverage. Some of these constraints are being offset by increased local manufacture of handpumps, pipes, water well drilling equipment and even lightweight latrine components (Nigeria[13]).

2.2 FROM TECHNICAL TO SOCIAL APPROACHES

11. While technologies provide the basis for the programmes and projects, improvements would not be achieved without the proper acceptance, use and management of the facilities by communities. The last ten years have witnessed a major shift in programme strategies from

technical to social approaches; these changes have come from effective evaluations (Bangladesh[11]).

2.3 Integration of Water Supply with Sanitation and Hygiene Education

12. Health impact studies show that optimal impact on health is achieved through the provision of adequate quantities of water, closely linked to sanitation and hygiene education programmes. As a consequence, integration of water supply, sanitation and hygiene education is now an integral part of programming in most countries (Benin[12]). Sanitation in some countries, e.g. Zimbabwe and Bangladesh, has increasingly become a major focus of interest as a prerequisite to create demand among prospective users.

13. Insufficient user awareness, including health and hygiene practices has also been identified as constraints to programming; the view of many users is that water supply and latrines are frequently more a question of convenience rather than of health, e.g. infant and young child excreta are often regarded as harmless (Nigeria[13]); ; the fact that men and young children do not use latrines to the extent women do - thus apparent coverage may in reality be far from effective coverage. Consequently, there is a need to insure that young children's excreta is hygienically disposed.

14. To effectively integrate water supply with sanitation and hygiene education, it is necessary to make more use of knowledge, attitudes and practice (KAP) studies before planning activities, including studies of hygiene behaviour of young children, as well as the influence and potential for hygiene education by their mothers.

2.4 Inter-sectoral Approaches with Linkages to Primary Health Care, Child Survival and Other Basic Services

15. At operational level, there is still a need to improve intra and inter-sectoral linkages, although in some countries, village health workers (Uganda[14], Kenya[8]) frequently provide health messages through hygiene education. Close linkages between control diarrhoeal diseases and water and sanitation are now formed through combining the preventive hygiene concepts with messages about ORT in the health education curricula. Likewise, links with education for health, hygiene and environmental education in schools is now increasingly applied (Benin[15]). However there is a need to better focus on hygiene education for women and men as separate target groups, adapting curricula to the different perceptions of both groups.

16. There is a need to improve inter-sectoral approaches with linkages to Primary Health Care, Child Survival and other basic services, especially CDD and nutrition/family food production components, these should be strengthened through the promotion of inter-sectoral co-ordination and the inclusion of social scientists/development specialists (rural and urban) in the technical agencies at country level (Nigeria[12]).

2.5 COMMUNITY PARTICIPATION

18. The need to enhance capacity building for community management is recognized in all the programmes. The sense of ownership through involvement of communities is inherent in most programme plans, but community participation is still quite limited in terms of the decision-making, planning and design stages of the projects.

19. Programme sustainability through local committees is present in the majority of programmes, but sometimes these experience difficulties due to lack or insufficient training and support (Central African Republic[16]). Willingness to pay for part of the investment, and for operation and maintenance, has increased (Bolivia[17]), although the management of funds is often not clearly defined.

20. There is a clear need for a better knowledge base of existing power and economic structures in communities before planning for improved community management (Lao[18]).

21. More effective mechanisms should be sought to further motivate communities and train members of "community water committees" and secure a basis for sustainable operation and maintenance.

22. Additional methods can and should be explored in order to encourage and improve cost-sharing and cost-recovery by the communities. This would assist UNICEF in formulating policies to increase community participation for funding of capital costs, and eventually full community funding of operation and maintenance. (Quito[8]).

2.6 INVOLVEMENT OF WOMEN

23. A shift in perception of the role of women and their status is slowly underway in many countries, backed by strong international support (Pakistan[19]). Even though women are the main caretakers and promoters for water and sanitation, their participation in decision-making is very limited. Serious constraint may be the low degree of literacy among women (Central America[4]). Clearly, attention could be given to increasing promotion of women's participation particularly in decision making at the planning and design phase.

24. The sector should include objectives that concern women's health, their advancement through full participation; income-generating activities, facilitated through freeing them from the time- and energy-consuming drudgery in hauling water long distances. (Nepal[20])

2.7 NATIONAL CAPACITY-BUILDING

25. The most efficient national institutions are those where one agency is responsible for rural water supply (Indonesia[21]). The employment of social development and educational specialists in the water agencies (India[22]) has contributed to more effective approache at community level.

Human Resources Development through training is a key factor in national capacity-building.

26. Coordination of training with government and external support agencies for national staff at intermediate and local levels needs further strengthening. On-the-job training has successfully been undertaken with UNICEF support in many countries. It may now, however, be appropriate to help systematize the training efforts and make them more sustainable.

27. It is important that situation analyses of country sector structures including needs and potentials, especially of human resources are prepared in order to more effectively allocate UNICEF funds and other inputs in training.

28. Technical Co-operation among Developing Countries (TCDC) is an important approach in the transfer of technologies and experiences, for example, this has led to rapid acceptance and improvement of village water supply in Vietnam with technologies and practices from Bangladesh. This is being strongly encouraged in order to facilitate exchange of experiences through study visits and inter-country assignment of professional project staff (Pakistan[23]).

29. To accelerate coverage, programmes should encourage and support, where appropriate, the involvement of the private sector in the provision of community and household water supply and sanitation.

2.8 CO-ORDINATION BETWEEN AGENCIES

30. The International Drinking Water Supply and Sanitation Decade 1981-1990 has promoted international co-ordination and co-operation at global level. Through the new Collaborative Council, this co-ordination provides a framework for a global and country level strategy. However co-ordination at country level is still problematic and will necessitate increased capacity building for sector management.

31. UNICEF should help to continue to strengthen and consolidate ongoing inter-agency co-ordination and co-operation at country, regional and global levels, while advocating that governments take full responsibility for co-ordination of external support agencies (India[21], Sudan[24], Lao[17]).

3. *MONITORING AND EVALUATION AS MANAGEMENT AND PROMOTIONAL TOOLS*

32. Monitoring and evaluations of water supply and sanitation programmes and projects have become important tools for programme and project management, although their application, quality and methodology presently vary. These evaluations and related documentation are often used and appreciated at country level. Mid-term reviews, annual reports and Plans of Operation do not always give due credit to evaluations. Nonetheless, the influence of evaluations is visible

in their content. Out of twenty recent Master Plans of Operations, only two quoted evaluations as references.

33. Prominent examples show that evaluations promote national policies and action e.g. the impact of water supply and sanitation in Kwara State of Nigeria[25] showed a 20 per cent increase in rice production after the elimination of Guinea Worm; this prompted government to accelerate such projects in other parts of the country.

34. Policy promotion is being given increased attention during recent years through government participation in about 80 per cent of all evaluations, and governments involvement in a continuous monitoring process. The new Water and Sanitation Monitoring System (WASAMS) initiated by UNICEF and WHO will provide governments with a good base for enhancing sector management (CF-EXD-IC 1991-004).

35. Governments participate in some 70 to 80 per cent of the evaluations, universities in seven to eight per cent. Local consultants account for approximately 25 per cent of the evaluations (increased from 10 per cent in 1980), the quality of their work to quite an extent being excellent. External consultants participate in 10 per cent of the evaluations (decreased from 30 per cent in 1980).

4. CONCLUSIONS

36. The issues raised in this report should be seen against the background of the 1970s being the decade of development of low-cost technologies, the 1980s of the forming of principles for integration of water, sanitation and hygiene education combined with inter-sectoral approaches. The 1990s should promote the application of these combined experiences to achieve greater impact on health, economic and social benefits.

37. To enhance the evaluative process, it is necessary to clarify and detail the role of evaluations in the programming cycle through the Master Plans of Operation, linking these to the country and global monitoring process. Clear, quantifiable objectives and targets should always be defined, and major changes in policies and scope in country programmes should be substantiated in the Plans of Operation through references to evaluations and/or other sources.

38. In using monitoring and evaluation as management and promotion tools, the agency should continue to strengthen government monitoring and evaluation units and functions, particularly through the WHO/UNICEF Joint Monitoring Programme (JMP).

39. UNICEF should continue to monitor the development of technologies, particularly those which could be produced locally, and assess cost-effectiveness in order to chart possibilities for further lowering costs.

40. To effectively integrate water supply, sanitation and hygiene education, more use should be made of KAP studies before planning activities, including studies of hygiene behaviour of young children, as well as the influence and potential for hygiene education by their mothers.

41. Regarding inter-sectoral approaches, linkages to Primary Health Care, Child Survival and other basic services, should be combined through social mobilization activities, especially with CDD and nutrition/family food production components. Increased inter-sectoral co-ordination should be promoted through the inclusion of social scientists/development specialists for rural and urban activities in the technical agencies at country level.

42. To improve community management, a socio-economic situation analysis of communities is necessary before the planning phase. Further ways should be sought to motivate communities and train members of community water committees to secure a basis for sustainable operation and maintenance. Experience exchange between communities should be promoted, and if appropriate even between communities in different countries. Ways should be explored to encourage and improve cost-sharing and cost-recovery for funding of capital costs, and funding of operation and maintenance, which hitherto have not been clearly implemented.

43. The promotion of women's participation and capacity building should be strengthened, particularly for planning and decision-making. Plans of operation should include objectives for women's health; their advancement through full community participation; income-generating activities; and time- and energy-reduction from hauling water long distances.

44. Hygiene education for women and men should be planned as different target groups, adapting curricula to the different perceptions of either group. UNICEF should continue to facilitate ongoing TCDC type of experience exchange through study visits and inter-country assignment of professional project staff. Private enterprises should be encouraged and supported for provision of community and household water supply and sanitation, while safeguarding the poor through the use of low-cost technologies and community-based operation and maintenance approaches. Inter-agency co-ordination and co-operation at country, regional and global levels should be supported while promoting governments involvement and capacity in the sector to fully co-ordinate external agencies and NGOs.

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