WATER AND SANITATION FOR HEALTH PROJECT

WATER SUPPLY AND SANITATION IN CHILD SURVIVAL

A Report to, and Discussion by, an Expert Panel

convened by

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Panel Members

Dr. Robert E. Black
Department of International Health
School of Hygiene and Public Health
Johns Hopkins University
Baltimore, Maryland 21205

Dr. John Briscoe (Panel Convener)
Department of Environmental Sciences and Engineering
School of Public Health
University of North Carolina
Chapel Hill, NC 27514

Dr. David de Ferranti
Water and Urban Development Department
World Bank
Washington DC 20433

Dr. Alexander Langmuir (retired)
Center for Disease Control
Atlanta
Georgia 30333

Dr. W. Henry Mosley
Department of Population Dynamics
School of Hygiene and Public Health
Johns Hopkins University
Baltimore, Maryland 21205

Observers

Dr. John Austin, Office of Health, USAID
Dr. Ken Bart, Office of Health, USAID
Dr. Larry Cowper, Office of Health, USAID
Mr. William Goldman, HPN, Asia and Near East Bureau, USAID
Dr. Ray Isely, WASH Project
Mr. Eugene McJunkin, Office of Health, USAID
Ms. Monica Sinding, Asia and Near East Bureau, USAID
Mr. Leo St. Michael, WASH Project
Dr. Z. Rosenberg, Office of Health, USAID
Ms. Ann Tinker, Office of Health, USAID
Dr. Dennis Warner, WASH Project

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EXECUTIVE SUMMARY

At the request of the Director of the Office of Health, USAID, an Expert Panel was convened to discuss the role of water supply and sanitation programs in health and child survival, and to make policy recommendations to the Office of Health regarding water supply and sanitation sector activities.

Regarding the relationship between improved water supply and sanitation conditions and health, it was agreed that:

... because water supply and sanitation projects have multiple impacts, care needs to be exercized in the application of conventional cost-effectiveness analyses to such projects;

... because adequate water supply and sanitation facilities are necessary but not sufficient conditions for improvements in health, the provision of improved facilities may be essential for improving health (by reducing exposure to fecal-oral pathogens) without having a large, direct impact on health status;

... the long-run effect on child survival resulting from improved water supply and sanitation conditions are probably substantially greater than would be expected on the basis of an assessment of the immediate effects on diarrheal disease;

... despite these factors, a review of the immediate impact of water supply and sanitation projects on morbidity due to diarrheal diseases shows that these impacts are usually substantial.

The panel recommended that USAID take the following considerations be taken into account in formulating policy in the water supply and sanitation sector:

1. A balanced portfolio

Improvements in child survival depend on the implementation of a set of activities. The disease-specific interventions (such as oral rehydration therapy and immunizations) are likely to have an immediate impact. The impact of the broad-spectrum interventions (such as water supply and sanitation) are likely to take some time to be fully realized.

2. Fostering self-sustaining interventions

Major emphasis should be placed on those interventions that have the prospect of being self-sustaining in the long run. Improvements in water supply in most circumstances have a high potential for meeting this criterion. Accordingly water supply and sanitation projects should be planned to incorporate cost recovery mechanisms so that maintenance and replication may become self-sustaining. USAID should place major emphasis on financial, technical, institutional and training support to foster the maintenance and replication of self-sustaining water and sanitation systems.

3. Strengthening epidemiologic capability

A major problem in setting priorities is the lack of reliable epidemiological data on the health impact of water supply and sanitation systems. USAID could play a major role in supporting the development of epidemiological capacity in developing countries to collect, analyze and use local data.

4. Strengthening health component of non-health USAID projects

The bulk of USAID resources spent on water supply and sanitation activities are funded not through the Health Account, but through other Development Assistance accounts and through Economic Support Funds. The Office of Health needs to ensure that expertize available to the Office (primarily through the WASH Project) be used to ensure that water supply and sanitation projects funded from other accounts incorporate the financial, technical, institutional and epidemiological elements necessary for maximizing the impact on health.

5. Policy dialogue with developing countries

USAID, working with other bilateral and multilateral agencies, should strenuously press the governments of recipient countries to release funds from inappropriately subsidized water supply and sanitation projects and for the incorporation of cost recovery objectives into most water supply and sanitation projects.

1. The Scientific Basis of Present USAID Policy on Water Supply and Sanitation vis a vis Health and Child Survival

Improvements in water supply and sanitation conditions played a fundamental role in improving health in industrialized countries in the 19th century (1). In the mid-1970's it was generally agreed that water supply and sanitation had a similar role to play in the transition to low mortality rates in developing countries. As a consequence of this belief, water supply and sanitation were included as integral parts of the Primary Health Care (PHC) package, and the 1980s was declared to be the United Nations' International Drinking Water Supply and Sanitation Decade.

Upon closer examination of the PHC strategy it was argued (2) that insufficient resources were available to implement the complete package of PHC interventions, and that only those interventions which were most cost-effective in terms of reducing infant mortality should be implemented. In particular it was argued (Table 1) that the cost per infant death averted through water supply and sanitation programs was much higher than the cost per infant death averted for a Selective Primary Health Care package which included oral rehydration therapy, DPT and measles immunizations, malaria treatment and breastfeeding.

INTERVENTION	COST/CHILD DEATH AVERTED
Selective PHC	$200 - $250
Community Water Supply and Sanitation	$3,600 - $4,300

Table 1: The cost-effectiveness of water and sanitation programs compared to a Selective Primary Health Care package (after (2)).

A second piece of influential policy-oriented research was a national-level comparison of life expectancy among countries with low and high water and sanitation coverage (3). This study (Figure 1) suggested that at both low and high levels of socio-economic development improvements in water supply and sanitation conditions would have relatively little effect on health, and that it was in the "middle-level" countries that the effect would be greatest.

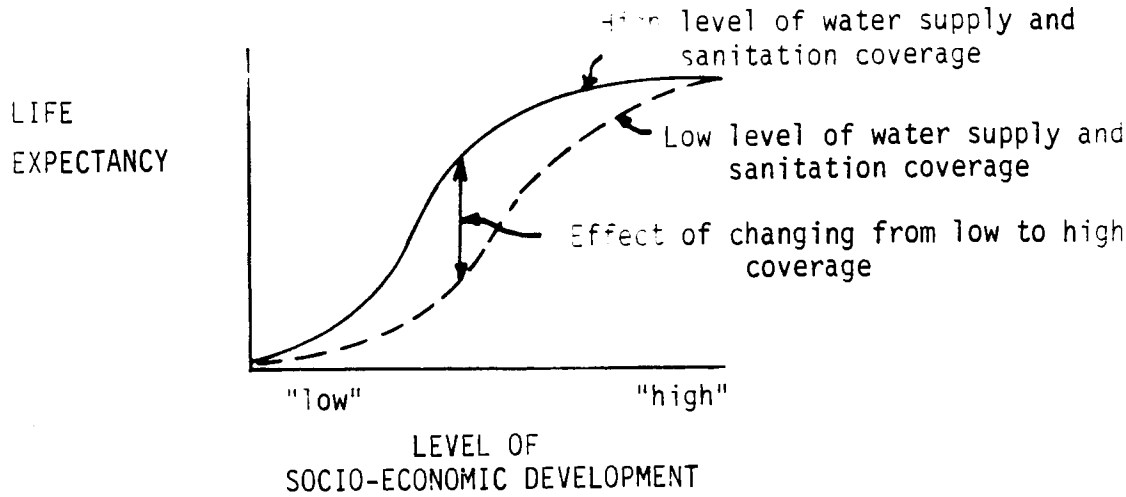


Figure 1: Relationship between level of socio-economic development, level of water supply and sanitation service, and life expectancy (after (3))

As a result of these analyses, the de facto policy of the Office of Health of USAID has been that water supply and sanitation interventions may occasionally be sensible at relatively advanced stages of the development process, but not cost-effective at the earlier stages where other interventions such as immunizations, oral rehydration and family planning make more sense. Thus, for instance, in the Asia Region consideration may be given to a water supply program in Thailand (a middle-level country) but not in Bangladesh (a poor country). Similar analyses have been carried out at other development agencies (such as UNICEF) and similar conclusions reached.

2. The Child Survival Initiative

Over the past couple of years strong support in the Congress has developed for "the Child Survival Initiative". Because of the belief that investments in water supply, in particular, are not "cost-effective", the bill authorizing the Child Survival Fund does not list "water supply" as one of the legitimate Child Survival activities (4). ("Sanitation", which is generally understood to include personal hygiene and excreta disposal, is included.)

3. Concerns with present policy

The Office of Health in USAID has two related concerns with regard to water supply, sanitation and health. First, the Office is concerned that the portfolio of activities given priority by the Office may be too heavily weighted towards the biomedical programs which promise short-term results and too heavily weighted against programs such as water supply which yield their full benefits only in the long run. In particular, there is concern that by relegating to a secondary role those activities which are particularly dependent on institutional development (such as water supply and sanitation),

the fundamental problem of medium- to long-term development in the high mortality countries (and especially sub-Saharan African countries) is not being addressed. Second, noting that most AID-funded water supply and sanitation activities are funded through non-health accounts, the Office of Health is concerned that the health impact of these expenditures is not being maximized.

4. Charge of the Expert Panel

At the request of the Director of the Office of Health, USAID, a panel of experts in epidemiology, sanitary engineering and economics (see page 2) was convened to:

... review the evidence on the relationship between water supply, sanitation and hygiene education activities and child survival (presented in Sections 5 and 6 below);
... identify gaps in existing knowledge; and
... provide information to be used by the Office of Health in devising a water supply and sanitation strategy for the Agency.

5. Presentation to the Panel, I: **Issues in assessing the cost and effectiveness of water supply and sanitation interventions**

To orient the discussion of the Panel, the Panel Convener prepared a background document which outlined present USAID policy in this area, summarized key issues on the relationship between water supply and sanitation activities and child survival, and suggested areas in which the Office of Health might be involved. A summary of this background material is presented in Sections 5 and 6.

5.1. **Funding of water supply and sanitation activities in developing countries**

Figures 2 and 3 present information on approximate annual levels of overall investment in water supply and sanitation in developing countries and on the expenditure of USAID funds in the sector.

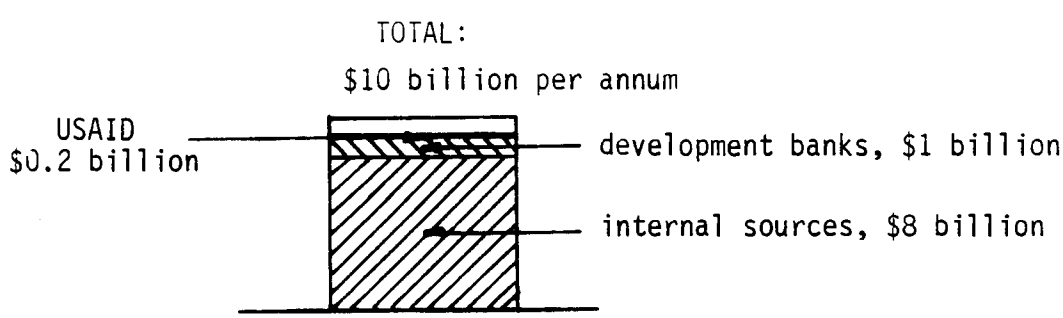


Figure 2: **Approximate annual investments in water supply and sanitation sector in developing countries (after (5)**

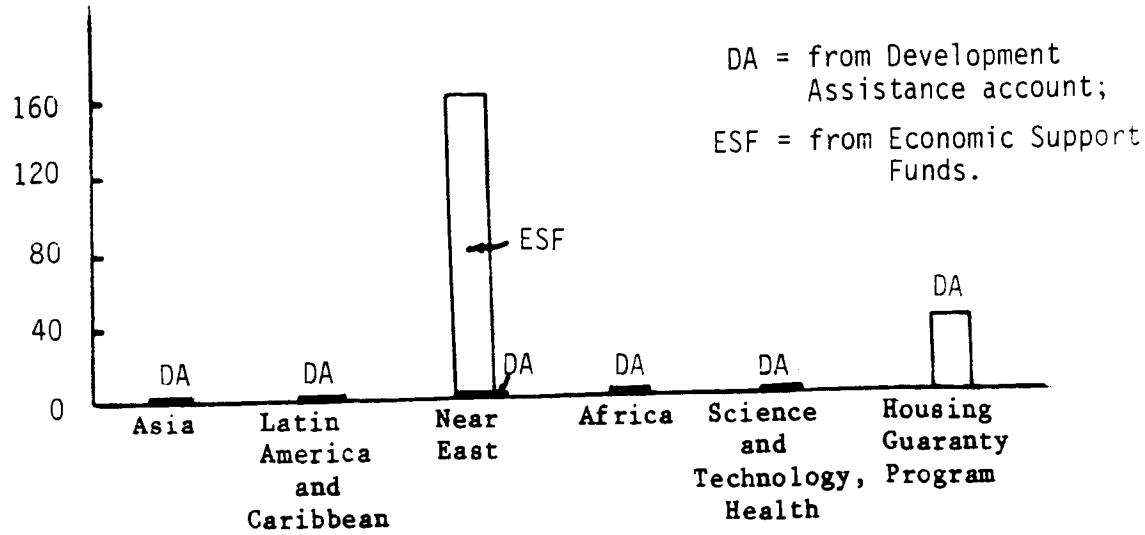


Figure 3: **AID expenditures on water supply and sanitation projects in 1982 (after (6))**

These data have several implications for a discussion of the role of AID in the area of water supply, sanitation and health. First, since the developing countries themselves provide the bulk of funding in this sector, changes in sector policies will require changes in internal developing country policies. "Policy dialogue" with developing country governments is thus an important task. Second, because, in terms of external financing the international banks play a dominant role and AID a minor role, AID influence in the sector is increased to the degree that AID works with the international banks. Third, because the bulk of AID resources spent in the sector are not from the health account but from Economic Support Funds and from other Development Assistance Accounts, the greatest opportunity for influencing health through improved water supply and sanitation services is by ensuring that the health impact of these expenditures made through non-health accounts is maximized.

5.2. Taking account of the multiple impacts of water and sanitation programs

The use of a formal analytic procedure (such as cost-effectiveness) for setting priorities for the use of health sector funds is essential if AID funds are to be spent wisely. As presently applied, however, the cost-effectiveness approach used by AID does not deal adequately with interventions (such as water supply and sanitation projects) which affect not only child survival but also a set of other health outcomes (including child morbidity and morbidity and mortality in other age groups) and a variety of non-health (social, economic and political) outcomes. To deal with water supply and sanitation projects in this framework it is necessary to undertake two supplementary analyses so that such programs may be compared with other health sector programs. First, it is

necessary to partition the total costs of water supply and sanitation interventions into those costs which can be attributed to non-health benefits and those (the remaining) costs which are attributable to health benefits. Second, it is necessary to express the set of health outcomes in terms of a common denominator such as "equivalent child deaths".

With regard to the partitioning of costs, it has been argued (7) that, under a reasonable set of assumptions, the willingness of consumers to pay for the service is a measure of the non-health benefits and that, therefore, the cost attributable to health is the difference between total costs and willingness to pay. Where tariffs are set correctly and where user charges are made, this difference will be the cost which is incurred through public funds. As an example, in the case of Lima, Peru (Table 2), if a piped water supply were installed in areas presently served by water vendors, the full costs of such a supply would be borne by the consumers, with the result that there would be no drain on public funds.

	Quantity used lcd	Monthly expenditure
Not served by piped system	23	105
Served by piped system	152	35

Table 2: Cost of water to consumers who are served and not served by piped water in Lima, Peru (8)

In this particular instance all costs would be borne by private payments; in many other cases only a small proportion of total costs have to be borne by public funds. To make this "cost partitioning" concept useful for planners, the key requirement is information on the willingness of consumers to pay for water supply and sanitation services in different settings. On the basis of present (inadequate) knowledge it would appear that the willingness to pay for water supply and sanitation services may be roughly as shown in Tables 3 and 4. A pressing sectoral need, both for these analytic purposes and for instituting sustainable schemes based on recovery of a substantial portion of total costs, is for better empirical data on both willingness to pay for different levels of service in different social and natural settings, and a better understanding of the financing mechanisms which translate this willingness to pay into actual payments.

		Income Group	URBAN Wet	URBAN Arid	RURAL Wet	RURAL Arid
LEVEL OF SERVICE	HIGH	Rich	+++++	+++++	+++	+++++
		Poor	+++	++++	++	++++
	MEDIUM	Rich	++++	+++++	++	++++
		Poor	+++	++++	+	+++
	LOW	Rich	+++	++++	+	++++
		Poor	++	+++	0	+++

Note: "+++++" indicates very high and
"+" indicates very low willingness to pay.

Table 3: Anticipated willingness to pay (as proportion of household income) for water services in different social and natural settings

		Income Group	URBAN	RURAL
LEVEL OF SERVICE	HIGH	Rich	++++	+++
		Poor	+	+
	MEDIUM	Rich	+++	++
		Poor	+	+
	LOW	Rich	++	+
		Poor	+	0

Table 4: Anticipated willingness to pay (as proportion of household income) for sanitation services in different social and natural settings

If the estimates on Tables 3 and 4 are even roughly correct, the implication is that substantial private payments can be expected for: water supplies in most unserved urban areas (generally low income areas); any level of water supply in arid rural areas; water piped to the house in rural areas where abundant water is available; any level of sanitation service in urban areas. The implication is that it is in these settings that the costs to be borne from public sources would be lowest and, ceteris paribus, in these instances that interventions are more likely to be cost-effective.

The second requirement for developing a correct estimate of "cost per infant death averted" for water supply and sanitation interventions is a method for expressing the full range of morbidity and mortality effects of such programs in terms of "equivalent infant deaths". An analogous problem has been addressed by the Institute of Medicine study on setting priorities for vaccine development (9) by eliciting from a panel of public health experts the "infant mortality equivalents" of reductions in morbidity and in mortality among other age groups. A similar procedure could be followed for water supply and sanitation programs.

5.3. Typical short-run impacts on child survival

At the start of the International Drinking Water Supply and Sanitation Decade it was implicitly claimed that diseases in children in developing countries would be reduced by 80% if water supply and sanitation conditions improved. Probably because of the exaggerated nature of such claims, the pendulum has now swung to a point where it is often claimed that water supply and sanitation programs have little effect on health. In the original Selective Primary Health care calculations, for instance, it was assumed that improved water supply and sanitation conditions would reduce diarrheal diseases by just 5%. A recent, authoritative WHO study (10) has shown that water supply and sanitation programs typically have large impacts on diarrheal disease (Table 5) and even larger impacts on diarrheal mortality.

Improvement in:	# studies	Median % improvement
Water quality	9	18%
Water quantity	17	25%
Quality and quantity	8	37%
Excreta disposal	10	22%

Table 5: Impact of water supply and sanitation interventions on diarrheal morbidity (10).

As a result of this assessment, the WHO Diarrhoeal Disease Control Programme now recommends that water supply and sanitation programs be included in national diarrhea disease control programs (11).

If water supply and sanitation programs are to have an impact on health, it is necessary not only that such facilities be constructed and that they function adequately, but also that these facilities are used appropriately. As it has become evident that serious problems are frequently encountered with the use of improved facilities, so more attention has been given to the hygiene education component of water supply and sanitation programs. In many cases (12) hygiene education programs have been shown to have little impact on actual hygiene practices. In three instances (summarized on Table 6) only one of which is in a community setting, the impact of intensive hygiene education interventions on the incidence of diarrhea has been measured.

COUNTRY	SETTING	INTERVENTION	OUTCOME MEASURE	RESULT
Bangla-desh	Households with index case of shigellosis	Soap and water and education vs. nothing	Secondary shigella cases	Reduction of 84%
USA	Day-care centers, children under 3	Handwashing of staff and education of children vs. nothing	Incidence of diarrhea over 10 months	Reduction of 48%
Guatemala	Lowland villages children under 6	Hygiene education vs. nothing	Incidence of diarrhea	Reduction of 14%

Table 6: Effect of hygiene education programs on diarrheal disease (after (13))

From Table 6 it is evident that, where personal hygiene practices can be improved through hygiene education programs, such interventions may have a substantial impact on diarrhea.

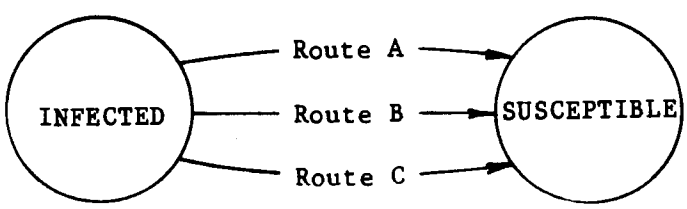
While global figures on costs and benefits are useful for getting a preliminary sense of which programs might be cost-effective, in fact both the benefits and the costs of water supply and sanitation and other health-related programs vary greatly with local social, economic, natural and epidemiologic conditions. It is thus essential to develop locally-applicable data bases on both the costs and the impacts of different interventions. In the specific case of water supply and sanitation, the critical information needs are on the impact of the level of service (such as water distributed through standpipes, through a yard tap or through house taps), and the interactions among water supply, excreta disposal and hygiene education programs. Unfortunately the methodological tools available for evaluating the health impacts of such interventions in specific settings are such that such evaluations are extremely expensive, take years to complete (14) and are often methodologically flawed (15). While recent work (16) offers some hope that valid, rapid epidemiological assessment techniques may be applicable in this area, these methods have yet to be adequately field tested. For the present, health impact evaluations cannot be recommended for most water supply and sanitation projects, and planners have to draw on the global data base suitably modified by an understanding of the specific local epidemiological situation.

5.4. Necessary but not sufficient interventions

In the best of situations (one in which a sound evaluation of the health impact of different levels of water supply and sanitation facilities has been conducted) there still remain two related questions which need to be addressed before a conclusion on the overall health impact of a proposed project can be identified. First, it is necessary (as is done in this section) to consider the possibility that an improvement may be a necessary but not sufficient condition for improving health and, second, it is necessary (as is done in the next section) to understand the relationship between the immediate effects (which are generally measured in impact evaluations) and the longer-term effects of the project.

For a water supply improvement to have an impact on a fecal-oral disease (such as a diarrheal disease) it is necessary, first, that the number of organisms ingested are reduced and, second, that this reduction translates into a reduction in disease. We briefly repeat an argument produced in more detail elsewhere (17), which shows that under conditions of poor overall sanitation, major reductions in exposure may translate into only small reductions in disease.

Consider the simple model shown in Figure 4, below, in which there are three parallel routes through which organisms can be transmitted from one person to another. For the most common type of dose-response relationship (log-linear), it can be shown (Table 7) that elimination of just one transmission route (including the major transmission route) has little impact on disease. Table 7 also shows that elimination of the major transmission route is nevertheless of great importance in reducing disease since it is only when this prior, apparently-ineffective intervention has been undertaken, that subsequent interventions (reducing transmission through the other routes) can be effective. In the simple example given, the elimination of Route A alone only reduces disease incidence by 26%. However, the importance of eliminating Route A is not this direct effect, but rather the fact that it creates the conditions for subsequent interventions to be much more effective. In the example given, if Route B is eliminated prior to the elimination of the Route A, there is little impact on disease whereas, if Route B is eliminated only after Route A is eliminated, this has a major impact on disease.



# of organisms transmitted via the route
70
28
2

Figure 4: Multiple Routes for the Transmission of Fecal-Oral Pathogens

	Exposure Group	Proportion of original number of organisms still transmitted	Proportion of original number of cases of disease still incurred
(1)	Routes A + B + C	100	100
(2)	Eliminate Route A only	30	74
(3)	Eliminate Route B without having eliminated Route A	72	93
(4)	Eliminate Route B after having eliminated Route A	2	15

Table 7: Effect of eliminating different routes on disease incidence

Simple as it is, this model captures some essential features of the real world in which water supply and sanitation interventions operate, and thus has important implications for assessing the impact of such interventions. In the many parts of the developing world where there are several parallel routes for effectively transmitting fecal-oral pathogens, it is quite possible that an improvement in, say, water supply would have little direct impact on health and yet be an important health intervention. In other words, in these circumstances such improvements are a necessary but not sufficient condition for reducing disease.

As discussed in more detail elsewhere (17), the little available empirical evidence (including that presented in Figure 1 of this report) suggests that this phenomenon is operative in the poorer parts of the developing world. Under such conditions care needs to be exercized before deeming that a water supply or sanitation program was not justified as a health intervention because there was little direct impact on disease.

5.5. Relationship of short- and long-run impacts

While the objective of child survival programs is (obviously) to reduce child mortality, these interventions are usually evaluated by assessing the impact on morbidity or mortality due to a particular disease. In most such analyses it is assumed that, if disease A accounts for 30% of deaths, and if the intervention reduces deaths due to disease A by 50%, then there will be an overall reduction in mortality of 15%.

As illustrated on Figure 5, however, there are three distinct ways in which such specific changes may relate to overall changes in child mortality.

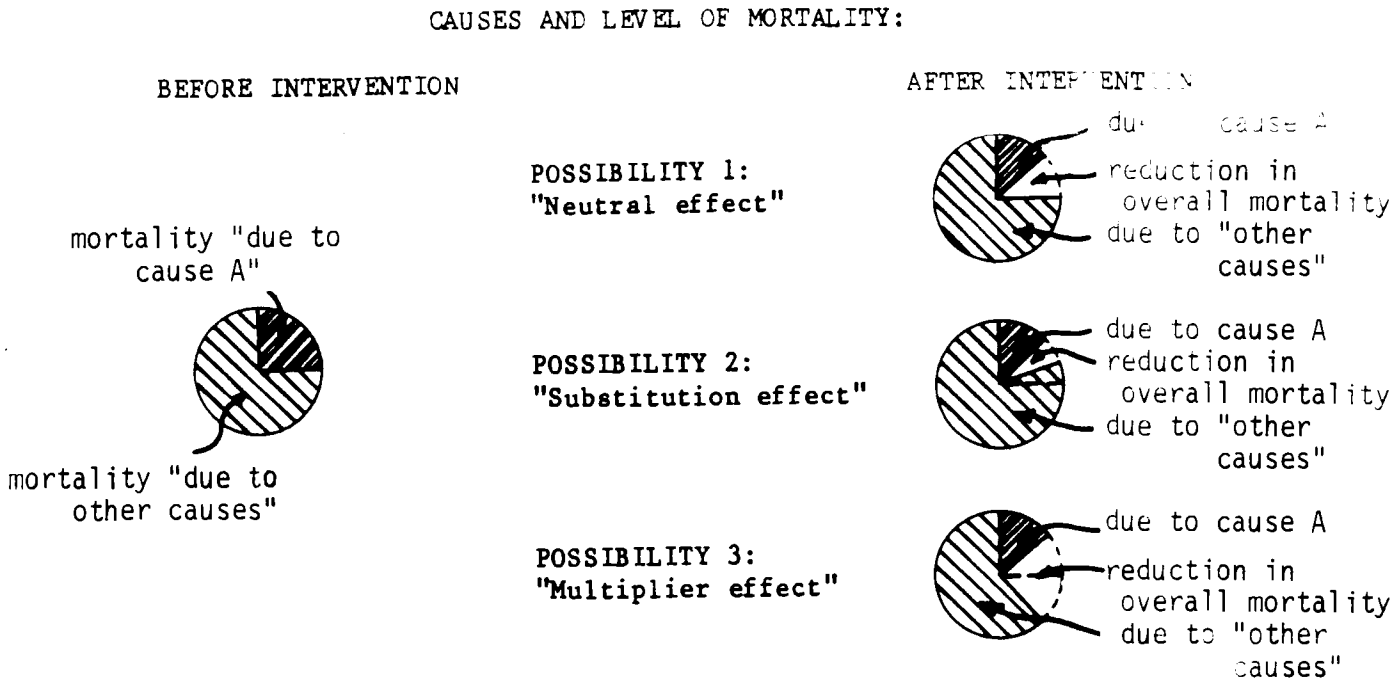


Figure 5: Possible impacts of an intervention on mortality due to specific disease and overall mortality

A key question in assessing the overall impact of a particular health intervention is whether this type of intervention is one for which the "neutral", "substitution", or "multiplier" effect is operative. Because so few studies testing these hypotheses have been carried out, and because the effect of specific interventions will certainly be different in different settings, any general conclusions must be regarded as extremely tentative. The few relevant studies which are available suggest that measles immunizations may save lives not only due to measles but also due to other causes (that is, the "multiplicative" effect is operative), while for oral rehydration therapy in Bangladesh, at least, children whose lives are "saved" may not return to normal mortality risks (that is, the "substitution" effect is operative) (18). What might the effect for a water supply and sanitation intervention be?

There is only one published study (on the causes of mortality declines in urban France in the nineteenth century (1)) which furnishes data adequate for testing this hypothesis. The authors of this study have attributed the different mortality patterns (shown schematically on Figure 6) in the three cities to the differences in the dates when water supply and wastewater disposal conditions were improved in each of the cities. From the detailed age- and cohort-specific mortality patterns it can be deduced which of the three mortality patterns ("neutral", "substitution" or "multiplier") is operative.

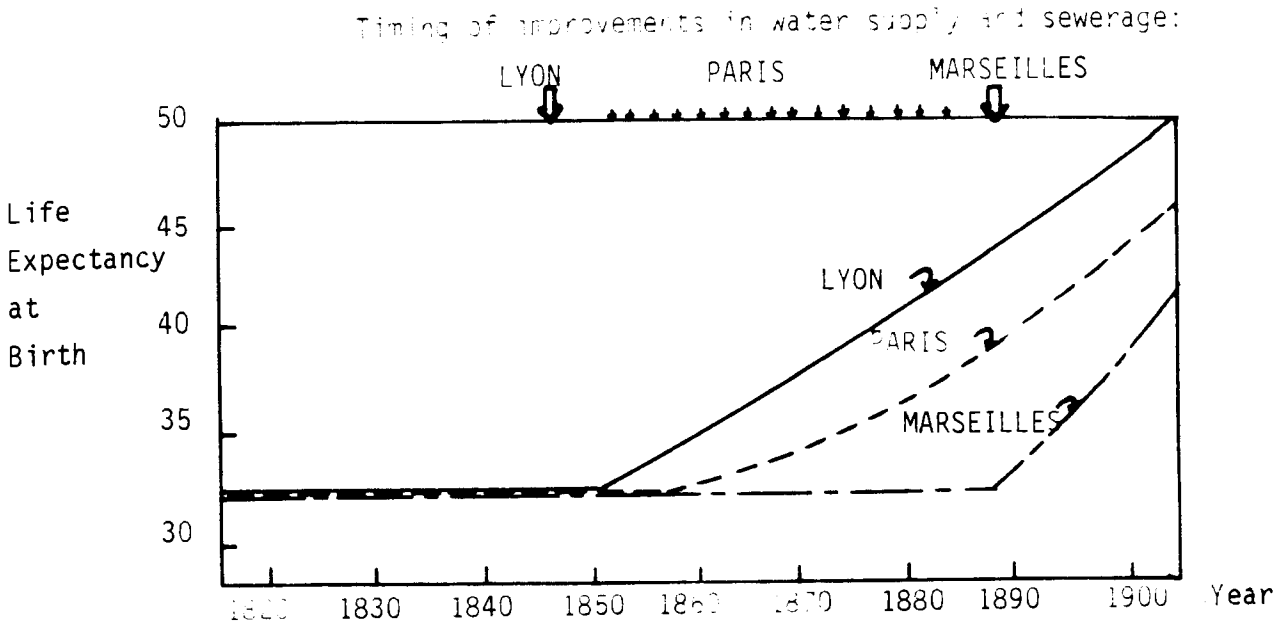


Figure 6: Mortality declines in urban France in the nineteenth century (after (1))

On Table 8 the age- and cohort-specific death rates which might be expected under each of the three hypotheses are presented. In each case it is assumed that the impact on the youngest age group increases over time. On Table 9 the actual age- and cohort-specific death rates for the city in which improvements first took place (Lyon) are presented.

Possibility 1: "Neutral" effect

Age (years)	Average $_nq_x$ in interval 1816-45 (x10,000)	Ratio, average $_nq_x$ in period to that in 1816-1845				
		1816-45	1846-60	1861-74	1875-90	1891-1905
5-19	643	1.00	0.85	0.70	0.55	0.40
20-34	616	1.00	1.00	1.00	1.00	1.00
35-49	710	1.00	1.00	1.00	1.00	1.00
50-64	1344	1.00	1.00	1.00	1.00	1.00
65-79	3606	1.00	1.00	1.00	1.00	1.00

Possibility 2: "Substitution" effect

Age (years)	Average $_nq_x$ in interval 1816-45 (x10,000)	Ratio, average $_nq_x$ in period to that in 1816-1845				
		1816-45	1846-60	1861-74	1875-90	1891-1905
5-19	643	1.00	0.90	0.80	0.70	0.60
20-34	616	1.00	1.00	1.00	1.00	1.00
35-49	710	1.00	1.00	1.00	1.00	1.00
50-64	1344	1.00	1.00	1.00	1.00	1.00
65-79	3606	1.00	1.00	1.00	1.00	1.00

Possibility 3: "Multiplier" effect

Age (years)	Average $_nq_x$ in interval 1816-45 (x10,000)	Ratio, average $_nq_x$ in period to that in 1816-1845				
		1816-45	1846-60	1861-74	1875-90	1891-1905
5-19	643	1.00	0.85	0.70	0.55	0.40
20-34	616	1.00	1.00	0.85	0.70	0.55
35-49	710	1.00	1.00	1.00	0.85	0.70
50-64	1344	1.00	1.00	1.00	1.00	0.85
65-79	3606	1.00	1.00	1.00	1.00	1.00

Table 8: Age- and cohort-specific death rates under "substitution", "neutral" and "multiplier" paradigms

Age (years)	Average $_nq_x$ in interval 1816-45 (x10,000)	Ratio, average $_nq_x$ in period to that in 1816-1845				
		1816-45	1846-60	1861-74	1875-90	1891-1905
5-19	643	1.00	0.85	0.64	0.57	0.38
20-34	616	1.00	0.94	0.95	0.75	0.63
35-49	710	1.00	0.93	0.94	0.82	0.75
50-64	1344	1.00	1.04	1.02	0.90	0.90
65-79	3606	1.00	1.14	1.07	1.06	1.08

Table 9: Actual age- and cohort-specific death rates in Lyon (1)

Comparing the diagonal structure evident in Table 9 with the structure of each of the versions of Table 8, it is evident that the pattern of mortality in Lyon conforms closely to the pattern which would be expected when the "multiplier" effect is operative.

Unfortunately no other, similarly rich, data sets which could be analyzed in a similar way exist. Although, as with other interventions, the effect of water supply and sanitation interventions would be different in different settings, from the single adequate set of data it appears that water supply and sanitation interventions have a multiplier effect on mortality. The effect of this multiplier effect is illustrated in Table 10, in which the long-run effects of the actual environmental improvement (Type B) in Lyon is compared to the effects of a (hypothetical) intervention (Type A) which had the same impact on mortality in the youngest age group in the first period but for which there was no increase in impact over time and for which the mortality experience of the older age groups was not affected.

	Intervention type (%):			Impact of B / Impact of A
	None	Type A	Type B	
Deaths averted in youngest age group:				
(i) In initial 15-year period	0	15.5	15.5	1.00
(ii) In fourth 15-year period	0	15.5	62.4	4.03
Life expectancy of cohort:				
(a) born in the first period following intervention:				
(i) Assuming that age-specific mortality rates have stabilized 15 years after the intervention	100.0	102.7	103.7	1.37
(ii) Using true mortality rates experienced by the cohort	100.0	102.7	105.4	2.00
(b) born in the last (4th) 15-year period, assuming that mortality rates have stabilized	100.0	102.7	118.7	6.93

TABLE 10: The effect of different interventions on short- and long-term mortality (20).

As is evident from Table 10 (and a more detailed discussion elsewhere (19)), by not considering whether the effect of a particular program is likely to have a "neutral", "substitution" or "multiplicative" effect, the effect of those programs which have a "multiplicative" effect (such as, tentatively, measles vaccination and water supply and sanitation programs) may be seriously underestimated and the effect of those programs which have a "substitution" effect (such as, tentatively, oral rehydration therapy programs) may be seriously overestimated.

6. Presentation to the Panel, II: **Possible USAID actions in the water supply and sanitation sector**

In considering ways which may be appropriate for USAID involvement in the water supply and sanitation sector, it is useful to consider (Figure 7) the steps which are necessary if investments in this sector are to translate into health impacts.

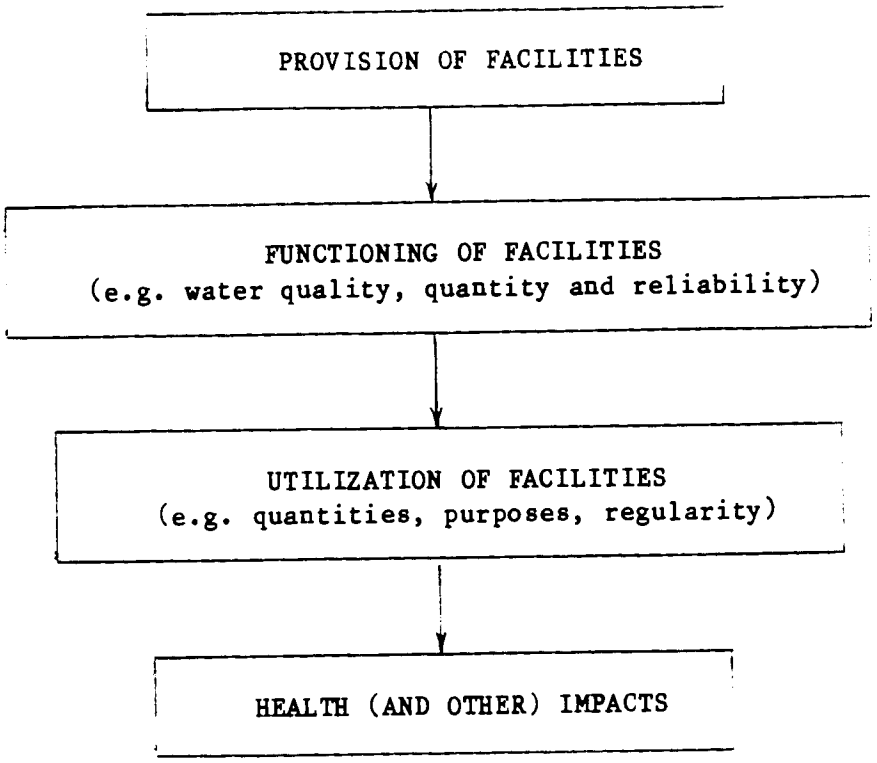


Figure 7: Mechanisms whereby investments in water and sanitation affect health

6.1. Affecting the availability of facilities

A fundamental premise underlying the Declaration of the International Drinking Water Supply and Sanitation Decade was that the critical financial bottleneck in improving access to improved water supply and sanitation facilities was the paucity of external funds available for capital investments. The experience of donor and recipient institutions alike, however, has shown that this focus fails to address the two fundamental financial problems in the sector, namely how to ensure that adequate local funds are generated to ensure that facilities are adequately maintained and operated, and how to develop mechanisms for generating the resources necessary for extending services to those who are presently unserved.

A central element in this "policy dialogue" process is an understanding of the types of programs for which the use of public funds is appropriate, and those for which most financing should properly come from private sources. In principle subsidies from public sources are justified for services which have large external effects, where consumers are uninformed about most of the benefits of the intervention, where the provision of the service is indivisible and where such subsidies serve income distribution goals. On the other hand, payments by the users of the services themselves are appropriate where the externalities are small, where the users are well informed about the major benefits of the service, and where the potential for resource mobilization from user charges is high. Accordingly, as shown on Table 11, in the health sector there will be some services (such as spraying against malarial mosquitos) which are correctly funded primarily from public funds, while there are others (such as urban water supplies and curative medical services) which are correctly funded from user charges for all but the very poor.

GROUP	CHARACTERISTICS	APPROPRIATE SOURCE OF FINANCING: Subsidies from public funds	User charges	EXAMPLES OF ACTIVITIES
A	Large externalities Uninformed consumers Often public goods Unlikely to mobilize resources through charges	MAJOR	MINOR	Spraying against malarial mosquitos
B	Social benefits often exceed private private benefits Consumers' knowledge imperfect Disadvantaged groups might not be met	SOME	SOME	Preventive MCH services Rural water supplies Basic excreta disposal services
C	Externalities small Consumers are well informed Potential for resource mobilization high	MINOR	MAJOR	Curative medical services Urban water supply High level excreta disposal services

Table 11: The appropriate role for public subsidies and user charges (after (20))

Table 11 points out a key element of the policy dialogue which USAID and other external agencies need to carry out with many developing countries. For when actual subsidies from public water supply and sanitation sector funds (of both internal and external origin) are examined, in many cases it is precisely those services (specifically high quality urban water and sewerage services to the middle and upper classes) for which subsidies are not justified that are consuming the bulk of public resources available to the sector. From Table 11 it is also evident that even for rural water supply and basic excreta disposal services the case for complete subsidization from public sources is weak. It is now widely recognized that successful operation and maintenance of these facilities depends on the ability of the local communities to generate at least the funds necessary to cover recurrent costs.

Experience has shown that, although the individual impact of most external agencies (including USAID in most countries) is relatively small, where the external agencies act cooperatively, they can have a critical role in engaging developing country governments in the necessary policy dialogue and in assisting developing country governments to develop appropriate policies.

With regard to the use of USAID health sector resources for financing capital works in the sector, from the above discussion it can be deduced that this may be appropriate only where such projects serve poor communities, where the consumers are willing to pay (in cash or in kind) for a substantial portion of the capital and operating costs, and where the new service would reduce the risk of disease. While local circumstances would determine whether these pre-conditions are satisfied, it is usually the case that it is water supplies to rural and low-income urban populations, and basic excreta disposal facilities to low-income urban residents which are most likely to be satisfy these criteria.

Although there are instances (with the USAID-funded Malawi Rural Piped Water Project being an excellent example) of projects which should be funded in this way, it is also clear that given other, important demands on USAID health sector resources (for oral rehydration and immunization programs, for example) only a few such projects can be funded. As shown in Section 5.1 of this report, the majority of USAID funds spent on the construction of water supply and sanitation facilities are from other Development Assistance accounts and from Economic Support Funds, and not from the health account. The Office of Health might profitably explore the use of expertize in the water supply and sanitation sector (available through the WASH project) to work on improving the design and thus health impact of these expenditures made from other USAID accounts.

6.2. Affecting the functioning of facilities

It is now widely recognized that the major constraint to improving access to adequate water supply and sanitation facilities is a set of related technical, managerial and financial problems which affect the functioning of existing systems. In urban areas the manifestations of these problems commonly include: large losses due to leakage, water meters which are not working and not read, and tariff structures and collection systems which are such that revenues are much lower than costs. In rural areas handpumps are often not maintained, and systems which rely on pumping are often not operating.

These problems are a consequence primarily of the inadequacies of the responsible institutions. The use of modest amounts of USAID resources for the development of the technical, managerial and financial capacity of water supply and sanitation institutions is appropriate in many settings. Not only do such programs make the utilization of existing capital resources more productive, but they assist in developing a capacity for self-sustaining improvement in the sector and thus in the health of the community.

A particularly effective modus operandi for USAID in this area is to work cooperatively with financing agencies in putting together a package for the integrated development of facilities and institutions. The recent USAID/World Bank cooperation in Sri Lanka (21) provides a model for such activities.

6.3. Affecting the utilization of facilities

It is obvious, and yet frequently ignored by planners, that water supply and sanitation facilities will have an impact on health only if such facilities are used in an appropriate manner. A key requirement in ensuring that facilities (particularly those in rural areas where alternatives exist) are used, is careful exploration of the communities wishes in the planning stage, and the incorporation of these findings into the design of the project. An excellent example of the results of both ignoring and paying attention to such factors is a series of AID-funded rural water supply projects in Northeast Thailand (22).

In the first project the views of the population were not elicited — it was simply assumed that because people were poor they could afford only the cheapest level of service. Accordingly, handpumps were installed. The project was basically a failure, with the majority of the pumps not operating and an evaluation reciting the familiar litany of problems ("no spare parts", "insufficient trained manpower", etc.) A second project, too, did not solicit the opinions of the people. A similar low-cost technology was chosen (piped water distributed through standpipes) with similar results. In a third project in the same area, the communities were consulted concerning the level of service to be provided. Although the evaluations of the previous projects had indicated that the people were unwilling to pay the small amounts required

for maintenance of the systems, the people indicated that this was not because they could not afford these payments, but because they did not feel that the new supplies were a real improvement over the traditional, free, surface water supplies. The people indicated that they would be willing to make substantial payments for a level of service (yard taps) which they perceived as being a real improvement over the traditional supply. The third project was designed on this basis and which included a substantial component of institutional development, was a technical, managerial and financial success (22).

As illustrated by this example, a key requirement, particularly in rural water supply and any excreta disposal programs, is the development of systematic methods for eliciting community involvement in the planning, construction and operation of water supply and sanitation facilities. By stimulating the development of such methods, and by ensuring that such factors are taken into account in all AID water and sanitation projects (including those funded by Economic Support Funds and other Development Assistance accounts) the Office of Health could make a major contribution to increasing the health impact of given levels of investment in the water supply and sanitation sector. As with the closely-related institutional development issues discussed in Section 6.2, this is an area which fits closely with AID's overall development goals.

In some instances, the health impact of a water supply or sanitation program is limited because more hygienic practices do not automatically take place as a result of the provision and use of the improved facilities. Where this is the case, and where it is possible to improve hygiene practices through well-designed, culturally-sensitive hygiene education programs, such interventions may lead to substantial health improvements at modest cost.

7. Panel Discussion

To provide a common starting point for the discussions of the Panel, the background material summarized in Sections 5 and 6 was distributed to the Panel members prior to the meeting. The material was presented orally at the meeting and discussed in some detail by the panelists. During the course of the panel discussion, broad consensus was reached on the following key issues which need to be considered by the Office of Health in developing a water supply and sanitation sector strategy:

a. A balanced portfolio

Improvements in child survival depend on the implementation of a **set** of activities. The disease-specific interventions (such as oral rehydration therapy and immunizations) are likely to have an immediate impact. The impact of the broad-spectrum interventions (such as water supply and sanitation) are likely to take some time to be fully realized.

b. Fostering self-sustaining interventions

Major emphasis should be placed on those interventions that have the prospect of being self-sustaining in the long run. Improvements in water supply in most circumstances have a high potential for meeting this criterion. Accordingly water supply and sanitation projects should be planned to incorporate cost recovery mechanisms so that maintenance and replication may become self-sustaining. USAID should place major emphasis on financial, technical, institutional and training support to foster the maintenance and replication of self-sustaining water and sanitation systems.

c. Strengthening epidemiologic capability

A major problem in setting priorities is the lack of reliable epidemiological data on the health impact of water supply and sanitation systems. USAID could play a major role in supporting the development of epidemiological capacity in developing countries to collect, analyze and use local data.

d. Strengthening health component of non-health USAID projects

The bulk of USAID resources spent on water supply and sanitation activities are funded not through the Health Account, but through other Development Assistance accounts and through Economic Support Funds. The Office of Health needs to ensure that expertize available to the Office (primarily through the WASH Project) be used to ensure that water supply and sanitation projects funded from other accounts incorporate the financial, technical, institutional and epidemiological elements necessary for maximizing the impact on health.

e. Policy dialogue with developing countries

USAID, working with other bilateral and multilateral agencies, should strenuously press the governments of recipient countries to release funds from inappropriately subsidized water supply and sanitation projects and for the incorporation of cost recovery objectives into most water supply and sanitation projects.

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