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## **Title**

Note on the Health Impact of Water and Sanitation Services

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Introduction:

Improved water supply and sanitation has impacts in various areas of life, from health to timesavings to social status. While access to water supply and sanitation has improved in the last 20 years, it has been neither as widespread nor as rapid as had been expected. This note examines the role of water and sanitation programs on improving health outcomes, the historical efforts to improve access and the impacts achieved, and the challenges remaining for the future.

Water and Sanitation and Health:

Water-washed diseases are prevalent in areas with inadequate water supplies for people to keep their hands, bodies and environments clean. Diarrhoeal diseases, as well as skin and eye infections, are easily spread under these conditions. Water-borne disease transmission occurs through the consumption of contaminated water, and can affect those illnesses transmitted by the faecal-oral route, including diarrhoeas.

Murray and Lopez calculated that in 1990, 5.3 % of all deaths and 6.8% of all DALYs lost are associated with diarrhoeal and selected parasitic infections, stemming from inadequate access to water and sanitation. (1). Annually, there are around 2.4 million deaths related to water and sanitation mainly resulting from diarrhoeal diseases and occurring mostly among children under 5 (2). Improving the quantity and the quality of water available, providing adequate sanitation facilities and adopting better hygienic practices interrupt the transmission of most faecal-oral disease.

- Water

Reviews by Esrey et al (3;4) show a 16% to 25% decrease in diarrhoeal morbidity resulting from improved water supply. The reviews also show reductions in total mortality (20%) and in

diarrhoeal disease mortality (40%) for some age groups when water is piped either into or near the household. Ten of 16 studies looking at the effects of only improved water quality report positive effects, with a median reduction in morbidity of 17% (4). Of studies assessing the impact of water quantity, 14 of 15 studies reviewed show positive impacts of improvements, with a median reduction of 27% in disease prevalence. The evidence indicates that quantity of water may be more important than its quality (3;4).

- Sanitation

Esrey’s reviews also examined the evidence of the impact of sanitation on health outcomes. Of 30 studies reviewed that looked at sanitation, 21 documented some reduction in diarrhoeal disease, with a median reduction of 22% (3;4). The type of improved excreta disposal method was important, with the greatest reductions reported for flush toilets, although pit latrines were also associated with morbidity reductions. Additional studies, such as one in Lesotho, document similar reduction levels (5). A study of cross-sectional DHS data from eight countries, looking at the effect of improved infrastructure on diarrhoea rate reduction found that improving sanitation but not water resulted in a 37.5 % reduction in diarrhoea rates. The study also found that improving water but not sanitation resulted in a 20.8 % reduction, and improving both resulted in a 37.5 % reduction (6). While the study received some criticism (7), it nonetheless shows that improving access to sanitation can lead to greater improvements in health outcomes than improving access to water.

**Table 1: Morbidity Reductions Achievable Through Water and Sanitation Improvements (3)**

Improvement	Reduction
Quality of water	16%
Quantity of water	25%
Quantity and quality of water	37%
Excreta disposal	22%

- Hygiene

The role of hygiene behaviours in improving health outcomes related to water and sanitation is returning to the forefront of discussions. Earlier work by Feachem noted reductions in diarrhoeal diseases of 32-43% through handwashing with soap in different settings (8). Three studies reviewed by Boot and Cairncross showed that handwashing education and soap availability resulted in reductions of 30-48% in disease prevalence (9). Huttly et al reviewed the impact of hygiene on diarrhoeal prevalence, and calculated that a 35 % reduction in diarrhoeal prevalence was possible (10). Another review by Curtis reports morbidity reductions between 27 and 89% as a result of handwashing (11). There have not been many studies looking at the sustainability of such interventions. One small study, in Indonesia, found that 79% of the women participating in the program (n = 65) still used soap for handwashing two years after the intervention (12).

Access to Water and Sanitation:

Sixteen per cent of the world's population, approximately 1.1 billion people, are still without some form of improved water supply. Close to 40 % of the global population (2.4 billion) are living without adequate sanitation. Inadequate access to water and sanitation is unequally distributed between urban and rural areas, and across geographic regions. Rural coverage of water and sanitation is 71 % and 38 %, respectively, whereas coverage in urban areas is 94 % and 86 %. The vast majority of individuals with poor access to water supply and sanitation are in Asia and Africa--two-thirds of those without water supply and 80 % of those without sanitation live in Asia. Table 2 shows the distribution of access to water supply and sanitation by geographic area and rural/urban status (13).

**Table 2: Distribution of access to water supply and sanitation (13)**

	<b>% Access to water</b>	<b>% Access to Sanitation</b>
Total	82	60
--urban	94	86
--rural	71	38
Africa	62	60
--urban	85	84
--rural	47	45
Asia	81	48
--urban	93	78
--rural	75	31
Latin America & the Caribbean	85	78
--urban	93	87
--rural	62	49
Oceania	88	93
--urban	98	99
--rural	63	81
Europe	96	92
--urban	100	74
--rural	87	92
Northern America	100	100
--urban	100	100
--rural	100	100

**Cost-Effectiveness and Financing of Water and Sanitation Programs:**

Cost-effectiveness analyses of water and sanitation improvements have generally shown them to be much more costly than other health interventions. In 1979, Walsh and Warren calculated that it cost US\$ 3,600 per death averted (1996 US\$10,000), considerably higher than other health sector interventions aimed at reducing diarrhoeal deaths (14). The 1993 World Development Report, *Investing in Health*, estimates cost ranges for the intervention ranging from US \$15-\$200 (15). Perhaps as a result of this high cost-effectiveness ratio, the limited impact of the efforts of the 1980s, and a greater emphasis on cost-effective programming, in the 1990s efforts shifted away from development of water and sanitation to other interventions, such as oral-rehydration therapy.

There has been considerable debate on the appropriateness of traditional cost-effectiveness studies to adequately capture both the true costs as well as program effectiveness in the field of water and sanitation (16;17). Water and sanitation programmes generally occur over long time periods for large populations, with considerable non-health as well as health benefits. Varley et al reassessed the cost effectiveness of water and sanitation on childhood diarrhoea by studying four combinations of *hardware* (basic infrastructure) and *software* (management, regulation, and health promotion) (18). As can be seen in Table 3 below, while the cost-effectiveness of improvements in both hardware and software are similar to those calculated by Walsh and Warren, the costs of adding software to existing hardware, or just adding just one of the components, are comparable to other health interventions. The non-health benefits are not included in these calculations.

**Table 3: Four Scenarios to reassess CE of Water/Sanitation on Childhood diarrhoea (18)**

	<u>Scenario I:</u> adding software to existing hardware	<u>Scenario II:</u> adding software and hardware	<u>Scenario III:</u> adding hardware only	<u>Scenario IV:</u> adding software only
Cost/case averted	12.47	60.58	168.81	6.46
Cost/death averted	4,891	14,253	39,720	1,520
Cost/DALY averted	140	413	1,152	44

The 1980s were designated as the International Drinking Water Supply and Sanitation Decade. Between 1981-1990, governments of developing countries, with support from the international community, made concerted efforts to expand water supply and sanitation services to underserved populations. By the end of the decade, more than US\$134 billion had been invested by governments and the international community into the sector, providing additional access to safe water supplies to an estimated 1.2 billion and sanitation services to 770 million (19). However, progress made was overshadowed by population growth, uneven investment between water and sanitation, and urban-rural disparities. While some regions were able to make

considerable progress in access to either water or sanitation, none of them attained the goals set at the beginning of the decade.

It is clear that most of the effort so far has been biased towards water supply rather than sanitation and towards urban rather than rural areas. This is in part because the existing demand for water supply among the poor is high, rendering it more of a priority (13). Spending on improvements in water and sanitation continues to be significant, while not at the same level as it had been in the 1980s. Longitudinal data suggest that there was no significant increase in water and sanitation investment in the 1980s, compared with the preceding years. Table 4 shows public expenditure levels on water and sanitation, compared to expenditures in health.

**Table 4: Recent trends in expenditures on water and sanitation, as compared to health.**

	Water & Sanitation	Health
Public (% of GDP)	0.6 (1992) <sup>1</sup>	1.9 (1990-98) <sup>2</sup>
ODA (OECD)	1996: \$2.9 billion 1986-96: 3-7% of total*	1996-98 \$3.5 billion (avg.) 10% of total <sup>o</sup>
WB loans, FY00 <sup>‡</sup>	\$621 million	\$1044 million
1 (developing countries, (24)) 2 (low and middle income countries, (25))		
*(13) <sup>o</sup> (26) <sup>‡</sup> (27)		

Whittington noted that people--even poor people--are willing to spend considerable amounts for improved water supply (17;20-22). Household in India and in southern Africa have revealed that in addition to the households served by government projects, four times as many households had made the decision to invest in basic sanitation themselves (13). It appears that the non-health benefits of improved water and sanitation are great, and can be more of an incentive to improving services than health outcomes. For example, a survey of Filipino rural households reported the top reasons for satisfaction with a new latrine to be (in order of importance): lack of flies, cleaner surroundings, privacy, less embarrassment when friends visit, and, finally, reduced gastrointestinal disease (13). Other incentives include reduced time used to fetch water, which impacts women, and particularly young girls.

### Future Directions:

With inadequate cost recovery mechanisms and other constraints, the public sector may be poorly suited to serve as the main provider of access to water and sanitation. Constraints such as limited funding for maintenance of systems, limited community participation in technology selection, inadequate operation and maintenance including lack of sector co-ordination and a lack of political commitment (13) have been difficult to be overcome by the sector. Over the past decade, there has been a fundamental shift in the role governments play in the provision of infrastructure. Many are moving away from ownership and operation and towards monitoring and regulation of services being increasingly provided by the private sector (23).

Given that large portions of the benefits resulting from improved water supply and sanitation accrue outside of health, it is increasingly apparent that they are not solely health sector concerns. While no collaborative strategy has as of yet been proven to be the most effective and efficient, there is increasing promotion of collaboration between the public sector, the private sector, and community participation to deliver these services.

What remains unclear are what incentives are necessary to encourage private providers to increase provision to the poor, and what practical mechanisms might be adopted to increase access to both water supply and sanitation. Since the non-health benefits of improved water and sanitation are great, they might serve as more of an incentive to improving services than health outcomes. Several types of public-private partnerships have been attempted, with more complex ones emerging in lower-middle and middle-income countries. More information is needed on the sustainability of such efforts. The public sector may have to assume a more regulatory role to ensure that social objectives are met, and may need to subsidize or cross-subsidize basic levels of services to satisfy basic health requirements (23).

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