Costs and benefits of water and sanitation improvements at the global level (Evaluation of the)

Executive summary

The United Nations Millennium Declaration confirmed
the central role of water and sanitation in sustainable development and the major contribution expanded access to safe drinking water and adequate sanitation can make to poverty alleviation. Poverty reduction strategies dominate the current development agenda. From this perspective, the health and socio-economic benefits of improved access to safe water and adequate sanitation are the most compelling arguments to support resource allocations towards this goal. The benefits and the costs of increasing access to improved water and sanitation vary considerably depending on the type of technology selected. For informed and rational decision-making it is, therefore, crucial to carry out a sound economic evaluation of the various options available in different settings. Decision makers will prefer to invest in options for which the value of total benefits exceeds total costs.

In response to this need, the World Health Organization commissioned an economic evaluation from the Swiss Tropical Institute. In this analysis which was recently completed, the health benefits, the additional benefits, and the costs of a range of interventions to improve access to safe water supply and sanitation services, were assessed for several WHO regions and at the global level. The time horizon chosen in this analysis, for all interventions, is 2015. Two of the interventions selected are related to the target in MDG 7 and the addition made at WSSD in Johannesburg:

- halving the proportion of people without sustainable access to improved water supply;
- halving the proportion of people without sustainable access to both improved water supply and improved sanitation.

The results of this analysis point out that achieving the target for both water supply and sanitation would bring economic benefits; US$1 invested would give an economic return of between US$3 and US$34, depending on the region. Achieving this target would require an estimated additional investment of around US$11.3 billion per year over and above current investments. The benefits would include an average global reduction of diarrhoeal episodes of 10% and a total annual economic benefit of US$84 billion. For most interventions, careful consideration of all benefits and all costs of water and sanitation projects will tip the balance in favour of positive investment decisions.

Funding estimates of safe water supply and sanitation facilities

Total funding requirements for water and sanitation as a whole are difficult to estimate and may vary widely depending on the methodology used and assumptions made. Any calculation to this end will suffer from many uncertainties and substantial data gaps.

In this analysis, the total global costs per year were estimated to achieve a selected number of targets. Costs were calculated as the sum of all resources required to put in place and maintain the interventions. They include investment costs for planning, construction of infrastructure and recurrent costs for operation and maintenance, monitoring and regulation. Total costs were annualized to obtain a final cost per intervention per year, based on the length of life of the specific technology used and a discount rate of 3%.

The costs of providing access to safe water and adequate sanitation will vary from high when high standards are applied and sophisticated technology is used, to substantially lower when simple technology, that demands low maintenance, is used. In this analysis, 'improved' water supply and sanitation refer to low technology improvements. ‘Improved’ water supply involves better access and protected water sources (e.g. stand post, borehole, protected spring or well, or collected rain water). Improvement implies a significant increased probability that the water is safe, and that it is more accessible, and some measures are taken to protect the water source from contamination. ‘Improved’ sanitation involves better access and safer disposal of excreta (septic tank, simple pit latrine or ventilated improved pit-latrine).

This analysis came out with the following findings for five intervention options:

- Halving the proportion of people without sustainable access to improved water supply, would cost around US$1.78 billion per year.
- Halving the proportion of people without sustainable access to both improved water supply and improved sanitation would cost around US$11.3 billion annually. Achieving this target represents an important cost increase compared to the first one, explained by:
    - higher per capita cost of improved sanitation compared to per capita cost of improved water supply services (basic water supply services are mainly public and shared by a high number of persons as opposed to basic sanitation options) and,
    - in absolute terms, the number of persons who need access to improved sanitation to meet the MDG target is higher than the number of persons needing access to improved water supply.
- Access for all to improved water and sanitation services would cost around US$22.6 billion per year.
- Household water treatment using chlorine and safe storage would cost an additional US$2 billion on top of improved water and sanitation costs, taking the global cost to US$24.6 billion.
- Access for all to regulated in-house piped water supply with quality monitoring and in-house sewerage connection with partial treatment of sewage would require a total investment of US$136.5 billion per year.

Wide-ranging estimates of the costs of meeting the MDG water and sanitation target have emerged. A report from the French Water Academy (2004) presents the additional investments needed to meet the MDG target on water and sanitation, to be approximately

US$10 billion per year. The World Panel on Financing Water Infrastructure, chaired by Michel Camdessus (2003), mentioned an extra annual investment cost of also US$10 billion, using the most basic standards of service and technology, to meet this target. But providing full water and sewerage connections, with primary wastewater treatment to the urban population would raise the annual cost of meeting the 2015 goal to US$49 billion. According to the Water Supply and Sanitation Collaborative Council, investing in the most basic standards of service and technology to meet the 2015 target, would require US$10 billion per year. The World Bank mentioned in 2003 an additional investment of US$15 billion per year to reach the Millennium target on water and sanitation. According to the Global Water Partnership report, meeting this target would imply an additional annual investment of US$16 billion. At the WSSD in Johannesburg, it was suggested that the additional investment needed to meet the Millennium target on water and sanitation was between US$14 and 30 billion over and above the current investments. The international NGO WaterAid suggested an increase of US$25 billion. The variation between all these figures is quite considerable and may be explained by the high uncertainty about the technology that will be chosen to meet this target, and the lack of data to estimate its cost.

Health benefits of safe water supply and sanitation facilities

Infectious diarrhoea is mainly responsible for the burden caused by water-borne and water-washed diseases. From the health perspective, improving access to safe water supply and sanitation services is a preventive intervention, whose main outcome is a reduction in the number of episodes of diarrhoea and accordingly a proportionate reduction in the number of deaths. Based on published reviews, large surveys and multi-country studies, this analysis estimated the health benefits of improving access to safe water and sanitation at the global level and for several regions. Health impacts of such improvements will vary from one region to another as they depend on the existing levels of water supply and sanitation access and the region-specific levels of morbidity and mortality due to diarrhoeal diseases. Health impacts would be greater in regions where the number of unserved is high and where the diarrhoeal disease burden is significant.

Thus, option 1, achieving the MGD target for water supply only, would lead to a reduction of episodes of diarrhoea of up to 4% in the poorest regions; while option 2, achieving the MDG target for both water and sanitation, would lead to an average global reduction of diarrhoea episodes of 10% (ranging from 0% to 14% depending on the region). For option 3, access for all to both improved water and sanitation would reduce the number of episodes of diarrhoea globally by 16.7% (ranging from 0% to 20% depending on the region); option 4, additional improvement of drinking-water quality such as point-of-use disinfection in addition to access to improved water and sanitation, would lead to an average global reduction of 53% (ranging from to 0% to 55%); and option 5, access to in-house regulated piped water and sewerage connection with partial treatment of waste waters, could achieve an average global reduction of 69%, compared to a situation where there is no access to safe water and sanitation (ranging from 0% to 71.5%).

Non health benefits of safe water supply and sanitation facilities

Beyond reducing the water-borne and water-washed diseases, providing better access to improved water and sanitation confers many other diverse benefits ranging from the easily identifiable and quantifiable (costs avoided, time saved) to the more intangible and difficult to measure (convenience, well-being). As much as feasible, these must be taken into account in a cost-benefit analysis.

One set of benefits related to the health impacts that are relatively easy to quantify, are the cost-offsets. These are the costs avoided due to less illness. The related benefits accrue to both the health sector and to patients themselves. Cost savings in health care are mainly due to the reduced number of treatments of diarrhoeal cases. Also, patients will avoid costs incurred by seeking treatment, including expenditures on care, drugs and transport and the opportunity costs of time spent on seeking care. The global cost savings of intervention option 1 would be US$2.1 billion per year, and would be raised to US$7.3 billion per year for intervention option 2.

Another set of benefits related to less illness are the avoided days lost, with respect to formal or informal employment, other productive activities in the household, or school attendance. They are traditionally split into two main types: gains related to lower morbidity and gains related to less death. This analysis adopted the convention that time spent ill represents an opportunity cost that is valued at a rate linked to minimum wages. The annual global value of adult days gained would be US$210 million for intervention option 1, rising to almost US$750 million for intervention option 2. Due to the considerable health impact of disinfecting water at point-of-use, the value of productive days gained would be over US$4 billion for intervention option 4, and would reach US$5.5 billion for intervention option 5.

Finally, one of the major benefits of improving access to water and sanitation derives from the time saving associated with closer location of the facilities. Time savings occur due to, for example, the relocation of a well or borehole to a site closer to user communities, the installation of piped water supply in house and closer access to latrines. They translate into increased production, higher school attendance and more leisure time. In this analysis, the value of convenience time savings was estimated by assuming a daily time saving per individual for water and sanitation facilities separately, and multiplying these by the minimum wage rate for each region. The annual value of these time savings, spread over the entire population would amount to US$12 billion for intervention option 1, to US$64 billion for intervention option 2, US$229 billion for intervention option 3, and to US$405 billion for intervention option 5.

Conclusion

In the developing world today, poor access to safe water and adequate sanitation continues to be a threat to human health. In 2003, 1.6 million deaths were estimated to be attributable to unsafe water and sanitation, including lack of hygiene; 90% of this burden is concentrated on children under five, mostly in developing countries. In spite of the

considerable investment in the provision of water supply and sanitation in the 1980s and 1990s, in 2000 a significant proportion of the world's population remained without access: an estimated 1.1 billion people were without access to improved water sources and 2.4 billion people lacked access to improved sanitation. Expanding this access is essential to reduce the burden of water-related diseases and to improve the well-being of a large part of the world's population. It is also a vital input into economic development and poverty alleviation.

Evaluating the health and the socio-economic benefits of safe water and adequate sanitation results in a compelling argument in support of further resource allocations to improving access. Therefore, assessing the costs, the health benefits and the additional benefits of improving access to safe water supply and sanitation helps to support rational and informed decision-making, for resource allocation. Among the many possible and valid criteria, the ratio of economic costs and benefits of different intervention options is critically important.

Based on the present analysis, achieving the water and sanitation MDG target would definitely bring economic benefits, ranging from US$3 to US$34 per US$ invested, depending on the region. Additional improvement of drinking-water quality, such as point-of-use disinfection, in addition to access to improved water and sanitation would lead to a benefit ranging from US$5 to US$60 per US$ invested.

From a health point of view, achieving the water and sanitation MDG target, by using simple technologies, would lead to a global average reduction of 10% of episodes of diarrhoea. Choosing more advanced types of technologies such as provision of regulated in-house piped water would lead to massive overall health gains, but it is also the most expensive intervention. The burden of disease associated with lack of access to safe water supply, adequate sanitation and lack of hygiene is concentrated on children under five in developing countries. Accordingly, emphasis should be placed on interventions likely to yield an accelerated, affordable and sustainable health gain amongst this group. The present analysis points to household water treatment and safe storage as one option of particular potential. This intervention results in high health improvements while incremental costs remain low compared to other types of interventions.

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