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**Evaluation of the Costs and Benefits of Water
and Sanitation Improvements at the Global
Level**

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and

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Summary

The aim of this study was to estimate the economic costs and benefits of a range of selected interventions to improve water and sanitation services, with results presented for 17 WHO sub-regions and at the global level. Interventions evaluated include (1) improvements required to meet the millennium development goals (MDG) for water supply (by halving by 2015 the proportion of those without access to safe drinking water), (2) meet the water MDG plus halving by 2015 the proportion of those without access to adequate sanitation, (3) increasing access to improved water and sanitation for everyone, (4) providing disinfection at point-of-use over and above increasing access to improved water supply and sanitation (5) providing regulated piped water supply in house and sewage connection with partial sewerage for everyone. Predicted reductions in the incidence of diarrhoeal disease were calculated for each intervention based on the expected population receiving these interventions. The costs of the interventions included the full investment and annual running costs. The benefits of the interventions included time savings associated with better access to water and sanitation facilities, the gain in productive time due to less time spent ill, health sector and patients costs saved due to less treatment of diarrhoeal diseases, and the value of prevented deaths. The results show that all water and sanitation improvements were found to be cost-beneficial, and this applied to all world regions. In developing regions, the return on a US\$1 investment was in the range US\$5 to US\$28 for intervention 1, remaining at similar levels for interventions 2, 3 and 4. The main contributor to benefits was the saving of time associated with better access to water supply and sanitation services. When different cost and benefit assumptions were used, the cost-benefit ratios changed considerably, but even under pessimistic scenarios the potential economic benefits generally outweighed the costs. Due to uncertainties in many of the data inputs, it is recommended to conduct detailed country case studies as a follow-up to this global analysis.

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Introduction

In the developing world, diseases associated with poor water and sanitation still have considerable public health significance. In 2003, it was estimated that 4% (60.7 million DALYs) of the global burden of disease and 1.6 million deaths per year were attributable to unsafe water supply and sanitation, including lack of hygiene [1]. During the 1980s and 1990s there was considerable investment in the provision of water supply and sanitation in developing countries. By 2000, however, still a significant proportion of the world's population remained without access to improved water and sanitation (see Table 1). In Africa, roughly 40% of the population do not have access to improved water supply and sanitation, and in Asia 19% are without access to an improved water supply and 52% are without access to an improved sanitation [2]. Other regions of the world have higher rates of access, but even in Latin America and the Caribbean many millions remain without.

Table 1: Water and sanitation coverage by region

| Region | Coverage (%) | |
|-----------|--------------|------------|
| | Water supply | Sanitation |
| Africa | 62 | 60 |
| Asia | 81 | 48 |
| LA&C | 85 | 78 |
| Oceania | 88 | 93 |
| Europe | 96 | 92 |
| N America | 100 | 100 |

Source: WHO/UNICEF/WSSCC 2000 [2]

In order to increase the rate at which access to improved water and sanitation is extended, further advocacy is needed at international and national levels to increase resource allocations to this process. In the current climate where poverty reduction strategies dominate the development agenda, the potential productivity and income effects of improved access is a significant argument to support further resource allocations to water and sanitation. Cost-effectiveness analysis is proving an increasingly important tool in the allocation of funds within the health sector, although cost-benefit analysis remains the form of economic evaluation most useful for resource allocation to different government-financed activities. While there are many criteria for allocating resources to different ministries and government programmes, the relative economic costs and effects of different programmes and interventions remain critically important.

The issue of perspective continues to be a challenge for those working in the field of economic evaluation of development projects. This was recognised in the case of environmental health interventions by a WHO discussion document [3], and later for the case of water supply [4]. Presentation from a certain perspective is important not

only from the point of view of financing, but knowing who benefits also helps in advocating interventions that target certain groups or entities, such as the poor, or perhaps private industry. In the case of improving access to water and sanitation, there are several considerations if the analysis is undertaken from the societal perspective:

- In terms of financing interventions, it is important to make a clear distinction between the public and private sectors or spheres. Should water and sanitation be provided at zero or subsidised cost by the government, or should the beneficiary pay the full cost? Are there other agencies that are able to bear some of the cost, such as non-governmental organisations or the private sector?
- In terms of who receives the benefit, a similar public-private distinction should be made with a further desegregation by benefiting government ministry on the one hand (health, agriculture, trade, infrastructure, finance, etc.) and private sector beneficiary on the other (industry, agriculture, household).

Therefore, economic evaluation including cost-benefit analysis should not only aim to provide information on economic efficiency, but also provide other policy-relevant information on who benefits and, therefore, who may be willing to contribute to the financing of interventions.

Methods

Interventions

The range of options available for improving access to water and sanitation is wide, especially in low-income settings where large proportions of the population have access to only the most basic facilities. For developing countries, WHO favours intervention options that are low cost, that are feasible that do not require heavy maintenance.

The entire analysis presented in this paper is based on changes in water and sanitation service levels. Table 2 categorises which types of service are ‘improved’ and which are considered to be ‘unimproved’. Note that services can be defined as unimproved not only if they are unsafe, but also if they are unnecessarily costly, such as bottled water or water provided by tanker truck.

Within the broad categorizations presented in Table 2, two further distinctions can be made:

Table 2: Definition of ‘improved’ water supply and sanitation

| Intervention | Improved | Unimproved * |
|--------------|--|--|
| Water supply | <ul style="list-style-type: none">• House connection• Standpost/pipe• Borehole• Protected spring or well• Collected rain water• Water disinfected at the point-of-use | <ul style="list-style-type: none">• Unprotected well• Unprotected spring• Vendor-provided water• Bottled water• Water provided by tanker truck |
| Sanitation | <ul style="list-style-type: none">• Sewer connection• Septic tank• Pour-flush• Simple pit latrine• Ventilated Improved Pit-latrine | <ul style="list-style-type: none">• Service or bucket latrines• Public latrines• Latrines with an open pit |

* Due to being either unsafe or costly

Source: Global Water Supply and Sanitation 2000 Report [2]

First, there are **basic**, low technology improvements to water and sanitation services:

- ‘Improved’ water supply, generally involving better access and protected water sources (e.g., stand post, borehole, protected spring or well, or collected rain water). Improvement does not mean that the water is safe, but is it more accessible and some measures are taken to protect the water source from contamination.
- ‘Improved’ sanitation, generally involving better access and safer disposal of excreta (septic tank, pour-flush, simple pit latrine, small bore sewer, or ventilated improved pit-latrine).

Second, there are **further** improvements that make the water or sanitation services safer, or more convenient:

- Water disinfection at the point of use. In the present analysis, the use of chlorine is examined.
- Personal hygiene education.

Finally, there are high technology improvements such as

- Regulated water supply through a household connection, providing water that is safe for drinking.
- Household connection to the sewerage system, and at least partial treatment of the sewage.

Based on these different improvements, five different interventions are modelled in this study, by assuming a shift between exposure scenarios (levels I to VI) shown in Table 3 [5]. These are:

Intervention 1.

Millennium targets: halving the proportion of people who do not have access to improved water sources by 2015, with priority given to those already with improved sanitation. This means: Scenario VI to Vb, or Scenario Va to IV (applied to half the population without improved water supply).

Intervention 2.

Millennium targets with sanitation targets: halving the proportion of people who do not have access to improved water sources **and** improved sanitation facilities, by 2015. This means: Scenario VI to IV, or Scenario Va or Vb to IV (applied to half the population without improved water supply and half the population without improved sanitation).

Intervention 3.

Access for all to improved water and improved sanitation. This means: Scenario VI, Va and Vb to IV (applied to the entire population without improved water and the entire population without improved sanitation).

Intervention 4.

A minimum of water disinfected at the point of use for all, on top of improved water and sanitation services. This means: Scenarios VI, Va, Vb and IV go to Scenario III.

Intervention 5.

Access for all to a regulated piped water supply and sewage connection into their houses. This means: Scenarios VI, Va, Vb, IV and III go to Scenario II.

All the interventions were compared to the situation in 2000, which was defined as the baseline year. Therefore, in the analysis, account is taken of the proportion of populations in each country who did not have access to 'improved' water and sanitation in 2000.

Table 3: Selected exposure scenarios

| Level | Description | Environmental faecal-oral pathogen load |
|-------|---|---|
| VI | No improved water supply and no basic sanitation in a country which is not extensively covered by those services, and where water supply is not routinely controlled | Very high |
| Vb | Improved water supply and no basic sanitation in a country which is not extensively covered by those services, and where water supply is not routinely controlled | Very high |
| Va | Improved sanitation but no improved water supply in a country which is not extensively covered by those services, and where water supply is not routinely controlled | High |
| IV | Improved water supply and improved sanitation in a country which is not extensively covered by those services, and where water supply is not routinely controlled | High |
| III | Improved water supply and improved sanitation in a country which is not extensively covered by those services, and where water supply is not routinely controlled, plus household water treatment | High |
| II | Regulated water supply and full sanitation coverage, with partial treatment for sewage, corresponding to a situation typically occurring in developed countries | Medium to low |
| I | Ideal situation, corresponding to the absence of transmission of diarrhoeal disease through water, sanitation and hygiene | Low |

Based on Prüss *et al.* 2002 [5]

Geographical focus

The analysis was conducted at the country level, and the results were aggregated (weighted by country population size) to give the regional averages (17 WHO sub-regions categorised according to epidemiological indicators) (see Appendix Table A 1.1). For presentation of results, a sample of five sub-regions was chosen to reflect a range of results as well as a range of geographical areas: sub-Saharan Africa epidemiological pattern E (AFRO-E), Americas epidemiological pattern D (AMRO-D), European epidemiological pattern C (EURO-C), South-east Asia epidemiological pattern D (SEARO-D) and Western Pacific Region epidemiological pattern B (WPRO-B1). Together, these five sub-regions account for 55.4% of the world's population in the year 2000, and contain the world's most populous two countries: India (SEARO-D) and China (WPRO-B1). The complete data for all regions are presented in Appendix Tables A 2 (taking account of projected population growth until year 2015) and Appendix Tables A 3 (assuming constant population until year 2015).

Cost measurement

An incremental cost analysis was carried out, with an estimate of the costs of extending access to water supply and sanitation for those currently not having access. Incremental costs consist of all resources required to put in place and maintain the interventions, as well as other costs that result from an intervention. These are separated by investment and recurrent costs. Investment costs include: planning and supervision, hardware, construction and house alteration, protection of water sources and education that accompanies an investment in hardware. Recurrent costs include:

operating materials to provide a service, maintenance of hardware and replacement of parts, emptying of septic tanks, and latrines, regulation and control of water supply, ongoing protection and monitoring of water sources, water treatment and distribution, and continuous education activities.

The main source of data inputs into the estimate of the initial investment costs of water and sanitation interventions was the Global Water Supply and Sanitation Assessment 2000 Report [2], which gave the investment cost per person covered in three major world regions (Africa, Latin America and the Caribbean, and Asia/Oceania), presented in Table 4.

Table 4: Initial investment cost per capita

| IMPROVEMENT | INITIAL INVESTMENT COST PER CAPITA (US\$ YEAR 2000) | | |
|-------------------------------|--|-------|-------|
| | AFRICA | ASIA | LA&C |
| Water improvement | | | |
| House connection | 102 | 92 | 144 |
| Standpost | 31 | 64 | 41 |
| Borehole | 23 | 17 | 55 |
| Dug well | 21 | 22 | 48 |
| Rainwater | 49 | 34 | 36 |
| Disinfection at point of use | 0.13 | 0.094 | 0.273 |
| Sanitation improvement | | | |
| Sewer connection | 120 | 154 | 160 |
| Small bore sewer | 52 | 60 | 112 |
| Septic tank | 115 | 104 | 160 |
| Pour-flush | 91 | 50 | 60 |
| VIP | 57 | 50 | 52 |
| Simple pit latrine | 39 | 26 | 60 |

Source: Global Water Supply and Sanitation 2000 Report [2]

The estimation of recurrent costs was more problematic due to the lack of easily available data sources. Values from the literature were combined with assumptions for the various components of recurrent costs which are presented in Table 5. Cost assumptions were based on the likely recurrent cost as a percentage to the annual investment cost, using values from the literature (World Bank and other international projects).

Table 5. Assumptions used in estimating annualized and recurrent costs

| IMPROVEMENT | Length of life In years (+ range) | Operation, Maintenance, Surveillance as % annual cost (+ range) | Education as % annual cost (+ range) | Water source protection as % annual cost (+ range) |
|-------------------------------|--|--|---|---|
| Water improvement | | | | |
| Household connection | 40 (30-50) | 30 (30-30) | - | 10 (5-15) |
| Standpost | 20 (10-30) | 5 (0-10) | - | 10 (5-15) |
| Borehole | 20 (10-30) | 5 (0-10) | - | 5 (0-10) |
| Dug well | 20 (10-30) | 5 (0-10) | - | 5 (0-10) |
| Rainwater | 20 (10-30) | 10 (5-15) | - | 0 |
| Sanitation improvement | | | | |
| Sewer connection | 40 (30-50) | 30 (15-45) | 5 (0-10) | - |
| Septic tank | 30 (20-40) | 10 (0-10) *** | 5 (0-10) | - |
| VIP | 20 (10-30) | 5 (0-10) | 5 (0-10) | - |
| Simple pit latrine | 20 (10-30) | 5 (0-10) | 5 (0-10) | - |

Table key: * For regulated water supply add to this: Water treatment costs (60 litres/person/day, at US\$0.30/m³ (Africa and Latin America) and US\$0.20/m³ (Asia) treated and distributed).

** To calculate sewerage costs, partial sewerage is taken to cost US\$0.15/m³ (based on water usage per person) (range US\$0.10 to US\$0.20), using WHO data treatment costs.

*** To calculate sewerage costs, sewage disposal is assumed to cost US\$2/person/year For VIP and simple pit latrine and US\$3/person/year for septic tanks.

Table 6 presents the annual costs of each improvement per person reached, based on the intervention costs and assumptions in Tables 4 and 5. It can be seen that the costs vary considerably between different types of improvement. For example, water improvement varies from US\$0.33 per person per year in Africa for disinfection at the point of use, to US\$12.75 for household water connection including both hardware and software components. Other simple water supply improvements, such as borehole, dug well or standpost at under US\$2.50 in Africa are considerably cheaper than piped water options. For sanitation the cost differences between the cheapest (small pit latrine at US\$4.88) and the most expensive options (household connection with partial treatment at US\$10.03) are not so great, but still important.

Table 6. Annual costs for improvements on a per-person-reached basis

| INTERVENTION | Annual cost per person reached (US\$ year 2000) | | |
|---|---|-------|-------|
| | Africa | Asia | LA&C |
| Improved water supply | | | |
| Standpost | 2.40 | 4.95 | 3.17 |
| Borehole | 1.70 | 1.26 | 4.07 |
| Dug well | 1.55 | 1.63 | 3.55 |
| Rain water | 3.62 | 2.51 | 2.66 |
| Disinfected | 0.33 | 0.26 | 0.58 |
| Regulated piped water in-house (hardware and software) | 12.75 | 9.95 | 15.29 |
| Regulated piped water in-house (software only) | 8.34 | 5.97 | 9.06 |
| Improved sanitation | | | |
| Septic tank | 9.75 | 9.10 | 12.39 |
| VIP | 6.21 | 5.70 | 5.84 |
| Small pit latrine | 4.88 | 3.92 | 6.44 |
| Household sewer connection plus partial treatment of sewage (hardware and software) | 10.03 | 11.95 | 13.38 |
| Household sewer connection plus partial treatment of sewage (software only) | 4.84 | 5.28 | 6.46 |

Based on annual investment costs (Table 4) and recurrent cost assumptions (Tables 5 and 6)

Health benefits

Knowledge of the health benefits of the five interventions is important not only for a cost-effectiveness analysis, but also for a cost-benefit analysis as some important economic benefits depend on estimates of health effects. Over recent decades, compelling evidence has been gathered that significant and beneficial health impacts are associated with improving water and sanitation facilities. The routes of pathogens to affect health via the medium of water are many and diverse. Five different routes of infection for water-related diseases are distinguished: water-borne diseases (e.g. cholera, typhoid), water-washed diseases (e.g. trachoma), water-based diseases (e.g. schistosomiasis), water-related vector-borne diseases (e.g. malaria, filariasis and dengue), and water-dispersed infections (e.g. legionellosis). While a full analysis of improved water and sanitation services would consider pathogens passed via all these routes, the present study focuses on water-borne and water-washed diseases. This is partly because, at the household level, it is the transmission of these diseases that is most closely associated with poor water supply, poor sanitation and poor hygiene. Moreover, water-borne and water-washed diseases are responsible for the greatest proportion of the direct-effect water and sanitation-related disease burden.

In terms of burden of disease, water-borne and water-washed diseases consist mainly of infectious diarrhoea. Infectious diarrhoea includes cholera, salmonellosis, shigellosis, amoebiasis, and other protozoal and viral intestinal infections. These are transmitted by water, person-to-person contact, animal-to-human contact, and food-

borne, droplet and aerosol routes. As infectious diarrhoea causes the main burden resulting from poor access to water and sanitation, and as there are data for all regions on its incidence rates and deaths, in this analysis the impact of interventions is exclusively measured by the following two indicators:

- Reduction in incidence rates (number of cases reduced per year).
- Reduction in mortality rates (number of deaths avoided per year)

These were calculated by applying relative risks taken from a literature review [5] which were converted to risk reduction when moving between different exposure scenarios (based on the current water and sanitation situation). Risk reductions are presented in Table 7 below.

Table 7: Relative risks with lower/upper uncertainty estimates for different scenarios

| Scenario | I | II | III | IV | Va | Vb | VI |
|----------------|---|-----|-----|------|------|------|------|
| Lower estimate | 1 | 2.5 | 4.5 | 3.8 | 3.8 | 4.9 | 6.1 |
| Best estimate | 1 | 2.5 | 4.5 | 6.9 | 6.9 | 8.7 | 11.0 |
| Upper estimate | 1 | 2.5 | 4.5 | 10.0 | 10.0 | 12.6 | 16.0 |

Based on Prüss-Üstün *et al.* 2004 [6]

The number of people in each exposure scenario were taken from coverage data collected for the Global Water Supply and Sanitation Assessment 2000 Report [2], presented below in Table 8.

Table 8: Distribution of the population in exposure scenarios, 2000

| Subregion | II [%] | IV [%] | Va [%] | Vb [%] | VI [%] |
|-----------|-----------|-----------|-----------|-----------|-----------|
| AFR-D | 0 | 54 | 5 | 6 | 35 |
| AFR-E | 0 | 42 | 10 | 9 | 38 |
| AMR-A | 99.8 | 0 | 0 | 0 | 0.2 |
| AMR-B | 0 | 76 | 1 | 9 | 14 |
| AMR-D | 0 | 68 | 0 | 7 | 25 |
| EMR-B | 0 | 83 | 5 | 8 | 4 |
| EMR-D | 0 | 66 | 0 | 16 | 18 |
| EUR-A | 100 | 0 | 0 | 0 | 0 |
| EUR-B | 0 | 79 | 8 | 1 | 12 |
| EUR-C | 0 | 94 | 5 | 0 | 1 |
| SEAR-B | 0 | 70 | 3 | 7 | 19 |
| SEAR-D | 0 | 35 | 0 | 53 | 12 |
| WPR-A | 100 | 0 | 0 | 0 | 0 |
| WPR-B | 0 | 42 | 1 | 33 | 24 |

Based on WHO/UNICEF/WSSCC 2000 [6]

Non-health benefits

There are many and diverse potential benefits associated with improved water and sanitation, ranging from the easily identifiable and quantifiable to the intangible and difficult to measure [4]. Benefits include both (a) reductions in costs and (b) additional benefits resulting from the interventions, over and above those that occur under current conditions [7]. Some of these benefits – the direct benefits related to the health intervention - are used for calculating the cost-effectiveness ratio (CER) in terms of cost per DALY avoided [8]. All these benefits, on the other hand, can be used in calculating the cost-benefit ratio (CBR), which is a broader measure of economic efficiency [9, 10].

Limited by measurement problems, the aim of this analysis is not to include all the benefits, but to capture the most tangible and measurable ones, and identify who the beneficiaries are. This approach was adopted not only because of the difficulties of measuring some types of economic benefit due to environmental changes [11-13], but also because the selected benefits were those most likely to occur in all settings.

For ease of comprehension and interpretation of findings, the benefits of the water and sanitation improvements not captured in the DALY estimates were classified into three main types: (1) direct economic benefits of avoiding diarrhoeal disease; (2) indirect economic benefits related to health improvements; and (3) non-health benefits related to water and sanitation improvements. These benefits are presented in Table 9, grouped by main beneficiary. As a general rule, these benefits were valued in monetary terms using conventional economic methods for valuation [12-14]. Details concerning the specific valuation approaches are described for each benefit below.

(1) Direct economic benefits of avoiding diarrhoeal disease

‘Direct’ in the definition of Gold *et al.* includes “the value of all goods, services and other resources that are consumed in the provision of an intervention or in dealing with the side effects or other current and future consequences linked to it” [8]. In the case of preventive activities – including improvement of water and sanitation facilities – the main benefits (or costs avoided) relate to the health care and non-health care costs avoided due to fewer cases of diarrhoea and other water-associated diseases.

Cost savings in health care related mainly to the reduced number of treatments of diarrhoeal cases [5, 15]. As shown in Table 9, costs saved may accrue to the health service (if there is no cost recovery), the patient (if there is cost recovery) and/or the employer of the patient (if the employee covers costs related to sickness). To whom the costs are incurred will depend on the status of the patient as well as on the nature of the payment mechanism in the country where the patient is seeking care. These mechanisms vary from one country to the other. In economic evaluation, what is most important is not who pays, but the overall use of resources, and their value. In the current analysis, therefore, the direct costs of outpatient visits and inpatient days incurred to the health services are assumed to equal the economic value of these services.

For the treatment of diarrhoea, health service unit costs are taken from WHO regional unit cost databases. As shown in Table 10, the total cost avoided is calculated by multiplying the health service unit cost by the number of cases avoided, using assumptions about health service use per case. Due to a lack of studies presenting data on the number of outpatient visits per case, it was assumed that an average case would visit a health facility once, with a range of 0.5 to 1.5 visits. Once hospitalised, the

average length of stay was assumed to equal 5 days (range 3 to 7). In the base case 8.2% of cases were assumed to be hospitalised (data collected by WHO) with a range of 5% to 10% of patients hospitalised. The rest were assumed to be ambulatory. For the sensitivity analysis the base case unit costs were multiplied by 0.75 and 1.25 for the low and high treatment cost savings, respectively. The unit costs included the full health care cost (consultation, medication, overheads, etc.). These data give a mean cost varying between US\$10 and US\$23 per case of diarrhoea treated, depending on which of the 14 sub-regions is considered.

Table 9: Economic benefits arising from water and sanitation improvements

| BENEFICIARY | Direct economic benefits of avoiding diarrhoeal disease | Indirect economic benefits related to health improvement | Non-health benefits related to water and sanitation improvement |
|--|---|---|---|
| Health sector | <ul style="list-style-type: none"> ▪ Less expenditure on treatment of diarrhoeal disease | <ul style="list-style-type: none"> ▪ Value of less health workers falling sick with diarrhoea | <ul style="list-style-type: none"> ▪ More efficiently managed water resources and effects on vector bionomics |
| Patients | <ul style="list-style-type: none"> ▪ Less expenditure on treatment of diarrhoeal disease and less related costs ▪ Less expenditure on transport in seeking treatment ▪ Less time lost due to treatment seeking | <ul style="list-style-type: none"> ▪ Value of avoided days lost at work or at school ▪ Value of avoided time lost of parent/ caretaker of sick children ▪ Value of loss of death avoided | <ul style="list-style-type: none"> ▪ More efficiently managed water resources and effects on vector bionomics |
| Consumers | | | <ul style="list-style-type: none"> ▪ Time savings related to water collection or accessing sanitary facilities ▪ Labour-saving devices in household ▪ Switch away from more expensive water sources ▪ Property value rise ▪ Leisure activities and non-use value |
| Agricultural and industrial sectors | <ul style="list-style-type: none"> ▪ Less expenditure on treatment of employees with diarrhoeal disease | <ul style="list-style-type: none"> ▪ Less impact on productivity of ill-health of workers | <ul style="list-style-type: none"> ▪ Benefits to agriculture and industry of improved water supply, more efficient management of water resources – time-saving or income-generating technologies and land use changes |

Direct costs of a non-health care nature are mainly those incurred to the patient, and are usually related to one or more visits to the health facility, such as transport costs, other expenses associated with a visit (e.g. food and drinks) and opportunity costs (e.g. time that could have been spent more productively). The most tangible patient cost included in the analysis refers to transport, although there is a lack of data on

average transport costs. In the base case it was assumed that 50% (range 0%-100%) of patients use some form of transport at US\$0.50 per return journey, excluding other direct costs associated with the journey. This gives an average of US\$0.25 (range US\$0 to US\$0.50) per patient visit. Other costs associated with a visit to the health facility were also assumed, such as the costs of food and drinks, and added to transport costs, giving US\$0.50 per outpatient visit and US\$2 per inpatient admission (range US\$1-US\$3). Time costs avoided as a result of treatment seeking are assumed to be included in the benefits related to health improvement, and are therefore not included here.

Table 10: Calculation methodology, data sources and values for economic benefits

| Benefit by sector | Variable | Data source | Data values (+ range) |
|---|---|-----------------------------|--|
| 1. Health sector | | | |
| Direct expenditures avoided, due to less illness from diarrhoeal disease | Unit cost per treatment | WHO regional unit cost data | US\$4.3-US\$9.7 (cost per visit) US\$16.1-US\$39.7 (cost per day) <i>Varying by WHO region</i> |
| | Number of cases | WHO BoD data | Variable by region |
| | Visits or days per case | Expert opinion | 1 outpatient visit per case (0.5-1.5) 5 days for hospitalised cases (3-7) |
| | Hospitalisation rate | WHO data | 91.8% of cases ambulatory 8.2% of cases hospitalised |
| 2. Patients | | | |
| Direct expenditures avoided, due to less illness from diarrhoeal disease | Transport cost per visit | Assumptions | US\$0.50 per visit |
| | % patients use transport | Assumptions | 50% of patients use transport (0-100%) |
| | Non-health care patient costs | Assumptions | US\$0.50 ambulatory (US\$0.25-1.00) US\$2.00 hospitalisation (US\$1.0-3.0) |
| | Number of cases | WHO BoD data | Variable by region |
| | Visits or days per case | Expert opinion | 1 outpatient visit per case (0.5-1.5) 5 days for hospitalised cases (3-7) |
| | Hospitalisation rate | WHO data | 91.8% of cases ambulatory 8.2% of cases hospitalised |
| Income gained, due to days lost from work avoided | Days off work/ episode | Expert opinion | 2 days (1-4) |
| | Number of people of working age | WHO population data 2002 | Variable by region |
| | Opportunity cost of time | World Bank data | Minimum wage rate (GNP per capita – value added in manufacturing) |
| Days of school absenteeism avoided | Absent days / episode | Expert opinion | 3 (1-5) |
| | Number of school age children (5-14) | WHO population data 2002 | Variable by region |
| | Opportunity cost of time | World Bank data | Minimum wage rate (GNP per capita – value added in manufacturing) |
| Productive parent days lost avoided, due to less child illness | Days sick | Expert opinion | 5 (3-7) |
| | Number of babies (0-4) | WHO population data 2002 | Variable by region |
| | Opportunity cost of time | World Bank data | 50% minimum wage rate (50% GNP per capita – 50% value added in manufacturing) |
| Value of loss-of-life avoided (life expectancy, discounting future years at 3%) | Discounted productive years lost (0 – 4 years) | WASH study [16] | 16.2 years (9.5 – 29.1) |
| | Discounted productive years lost (5 – 14 years) | WASH study [16] | 21.9 years (15.2 – 33.8) |
| | Discounted productive years lost (15+ years) | WASH study [16] | 19.0 years (16.3 – 22.7) |
| | Opportunity cost per year of life lost | World Bank data | Minimum wage rate |

| Benefit by sector | Variable | Data source | Data values (+ range) |
|------------------------------|--|--------------------------|---|
| 3. Consumers | | | |
| 'Convenience' – time savings | Water collection time saved per household per day for better external access | Expert opinion | 0.5 hours (0.25-1.0) |
| | Water collection time saved per household per day for piped water | Expert opinion | 1.5 hours (1.0-2.0) |
| | Sanitation access time saved per person | Expert opinion | 0.5 hours (0.25-0.75) |
| | Average household size | WHO population data 2002 | 6 people (4-8) |
| | Opportunity cost of time | World Bank data | Minimum wage rate (GNP per capita – value added in manufacturing) |

(2) Indirect economic benefits related to health improvement

A second type of benefit stated by Gold *et al.* is the productivity effect of improving health [8]. These are traditionally split into two main types: gains related to lower morbidity and gains related to less deaths. In terms of the valuation of changes in time use for cost-benefit analysis, the convention is to value the time that would be spent ill at some rate that reflects its opportunity cost. It is argued that whatever is actually done with the time, whether spent in leisure, household production, or income-earning activities, the true opportunity cost is the amount in monetary units that the person would earn over the same period of time if he/she were working [14]. This is a relatively easy estimate to make for those of working age, where the minimum wage can be taken as a minimum value for what their time is worth. Work days gained are valued using the assumed days off work per episode, and multiplying by the number of people of working age and the minimum wage rate. Note, however, that this may overvalue the time gains in countries where a significant proportion of the population works in subsistence agriculture. Per capita Gross National Product (GNP) and value added per worker in manufacturing were used in the sensitivity analysis as low and high values for the opportunity cost of time lost, respectively.

Such a convention is, however, not acceptable for those not of working age, mainly children, or those unable to work. Assuming that children of school age should be at school, then the impact of illness is school absenteeism, which has an impact on their education. For this reason, time not spent at school by children of school age is also valued on the basis of the minimum wage. For the youngest age category, children under five, the assumption is made that a parent or caretaker has to spend more time with sick child than a healthy one, or alternative child care arrangements are needed that impose a cost. Therefore, healthy infant days gained as a result of less diarrhoeal illness are valued at 50% of the minimum wage rate, reflecting the opportunity cost of caring for a sick baby or infant.

A literature search revealed very few studies providing data for the number of days of ill-health attributable to infectious diarrhoea - some studies reported illness rates and changes in illness rates due to changes in risk behaviour, but the actual length of illness is rarely reported. One study in Mexico reported that the average episode for breast-fed infants lasted 3.8 days (standard deviation 2.2) and for formula-fed infants 6.2 days (standard deviation 4.4) [17]. For the present analysis, an average of two

working days lost were assumed per case (range: one to four days) for those of working age, while for those of school age three days of school attendance lost were assumed (range: one to five days). The duration of illness for babies and infants was assumed to be five days (range: three to seven days). While it is clear that the impact of a case of diarrhoea will vary from one individual to another (depending on the severity of infection, resistance of the individual and other determinants), in the absence of adequate data a sub-group analysis is not feasible. Therefore, all cases are valued according to a global average cost.

Table 9 also shows other possible economic benefits related to health improvement. An implication for the health system is that there will be less health workers ill from diarrhoea, thus reducing disruption of the health service caused by staff absence. Similarly, the reduction of productive days lost due to less ill-health in the workforce will be an important benefit to agriculture and companies/industry. However, in order to avoid double counting of these benefits (patient benefits of working days lost avoided and companies' benefits of productivity lost avoided) they are excluded from this part of the analysis.

In terms of diarrhoea associated deaths avoided following the introduction of improved water and sanitation, the expected number is predicted from the health impact model (number of cases avoided times case fatality rate, both of which vary by world region). The convention in traditional cost-benefit analysis is to value these deaths avoided at the discounted income stream of the individual whose death is avoided. If the death avoided was that of a child, then the discounted income stream is calculated from the age at which the person becomes productive. To estimate mortality costs the number of productive years ahead of the individual who would have died also needs to be valued, and depends on the age of the person whose life is saved, and therefore the life expectancy. Using assumptions from a previous cost-of-illness study, assumptions about length of productive life were: 40 years for the age group 0-4; 43 years for the age group 5-14; 25 years for the age group 15-59; and no years for the age group over 60 years [16]. Future benefits were discounted at 3% per year (range: 1% - 5%) and the minimum wage was used to reflect the opportunity cost. For those not yet in the workforce (those in the 0-4 and 5-15 age brackets) the current value for the future income stream was further discounted to take account of the time period before they become income earners.

(3) Non-health benefits related to water and sanitation improvement

Due to problems in measurement and quantification/valuation, and also because of substantial variability between settings, many non-health benefits of the interventions were not included in the present analysis [8]. For completeness sake, however, a brief overview of their nature is presented below.

Beyond any argument, one of the major benefits of water and sanitation improvements is the time saving associated with better access. 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 to households, closer access to latrines and shorter waiting times at public latrines. These time savings translate into either increased production, improved education levels or more leisure time. The value of convenience time savings is 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 sub-region. Different time saving assumptions are made based on whether the source is in the house (household connection) or in the community. In this global analysis estimates of time savings per household could not take into account the different methods of delivery of interventions and the mix of rural/urban locations in different countries and regions, due to the dearth of data on time uses in the literature. Even within single settings, considerable variations in access have been found. For example, a study from Kenya showed that journeys to a local well in a small town averaged between 10 and 30 minutes (median around 15 minutes); and journeys to a kiosk between 3 and 13 minutes (median around 10 minutes) [18]. In Vietnam, the World Bank reported the average daily household water collection time to be 36 minutes [19]. However, to collect enough water for the entire household would require more than one visit, thus requiring closer to one hour or more per household per day. Given the large variation in water availability, it is recognised that savings could vary from a few minutes a day to several hours. For example, a study from Nigeria anecdotally reported that in the dry seasons average journey time to the local springs was 4-7 hours for some rural communities, which does not include waiting time at the spring [20].

Given these wide variations quoted in the literature, as well as the expected enormous differences between settings in the developing world in water availability (current and future), this analysis made general assumptions about time savings following water improvements. It was assumed that, on average, a household gaining access to improved water supply will save 30 minutes per day (range: 15 to 60 minutes) and households receiving piped water 90 minutes per day (range: 60 to 120 minutes). These assumptions give 30.4 and 91.25 hours saved per individual per year, for improved access and piped water, respectively, assuming six members per household (range: eight members for low cost assumption and four members for high cost assumption). For improved sanitation, no data were found in the literature for an estimate of time saved per day due to less distant sanitation facilities and less waiting time. Therefore, after consultation with sanitation experts, an assumption was made of 30 minutes saved per person per day, from improvements along the above lines. This assumption gives 182.5 hours per person per year saved. Time savings for all age categories are valued at the minimum wage, with GNP per capita used as the low value, and value added per worker in manufacturing as the high value. Studies by Whittington in Africa showed that households valued their time spent collecting water at around the average wage rate for unskilled labour [18].

The other benefits tabulated in the final column of Table 9 were not included in the cost-benefit analysis. These benefits relate mainly to improved water supply and they are described briefly below, with a justification for leaving them out.

- Indirect effects on *vector-borne disease transmission* resulting from water and sanitation improvements depend on many local factors and are therefore globally not predictable.
- Costs avoided due to *reduced reliance on expensive water sources /such as vendors) or on unsafe water purification methods*, due to increased availability of cheaper water and phasing out hazardous methods of water purification such as boiling. These gains are excluded for economic reasons. For example, from the societal point of view, water purchases from vendors are a transfer payment and do not represent an economic loss or gain compared to the use of other sources.

- In areas with improved water and sanitation, *property value* is likely to increase [11]. Such an increase is, however, indirect and difficult to evaluate without databases from different regions, and if entire areas receive the improvements the market may not be able to support price increases. Moreover, property value increases represent a transfer of resources and not a gain to society per se.
- There are also *leisure activities* (e.g. *boating, fishing*), *aesthetics and non-use values* associated with improvements in water and sanitation. Non-use is divided into option value (the possibility that the person may want to use it in the future), existence value (the person values the fact that the environmental good exists, irrespective of use), and bequest value (the person wants future generations to enjoy it). However, these are difficult to value, and there are very few data available on these benefits [12, 13, 21].
- Improved water supply also leads to economic benefits related to options for *labour-saving devices and increased water access*, due to changes in location of water sources and increases in water quantity available. These include benefits within the home (e.g. time savings of buying a washing machine, or the home production and small business possibilities), as well as in agriculture or private industry. Agricultural benefits may mean a change in land use (e.g. due to reclaimed land), loss of land (if a reservoir is created), or the option to chose different crops due to increased water availability. However, there are huge variations as well as uncertainties associated with these benefits and costs, especially in a global analysis, and therefore they are left out in this study.

Results

Presentation of results

This analysis generated a huge quantity of data. Selected results are presented for the five interventions and for the five selected WHO sub-regions discussed above, and include (a) the number of people receiving water and sanitation improvements from each intervention, (b) the number of cases of diarrhoea prevented per year, (c) the intervention costs, (d) the potential benefits resulting from the interventions, and (e) finally the cost-benefit ratios. Cost-benefit ratios are presented for all costs and benefits together, followed by costs and selected benefits. All costs are presented in US\$ in the year 2000. Costs and benefits are presented assuming that all the interventions are implemented within a one-year period (the year 2000), hence requiring the annualisation of investment costs using a standard formula (see Table 5 for length of life assumptions) [7]. All results are presented under two assumptions about population growth, first at projected population figures for 2015, and second assuming no population growth from 2000 until 2015. The sensitivity analysis presented reflects the high cost assumptions and low benefit assumptions, to give the most conservative cost-benefit ratios. The ranges used are shown in brackets when presenting the mean values in the text above and Table 9.

In brief, the calculation of the total societal economic benefit is the sum of:

- (1) Health sector benefit due to avoided illness
- (2) Patient expenses avoided due to avoided illness
- (3) Value of deaths avoided
- (4) Value of time savings due to access to water and sanitation
- (5) Value of productive days gained of those with avoided illness
- (6) Value of days of school attendance gained of those with avoided illness
- (7) Value of child days gained of those with avoided illness

Numbers of people reached

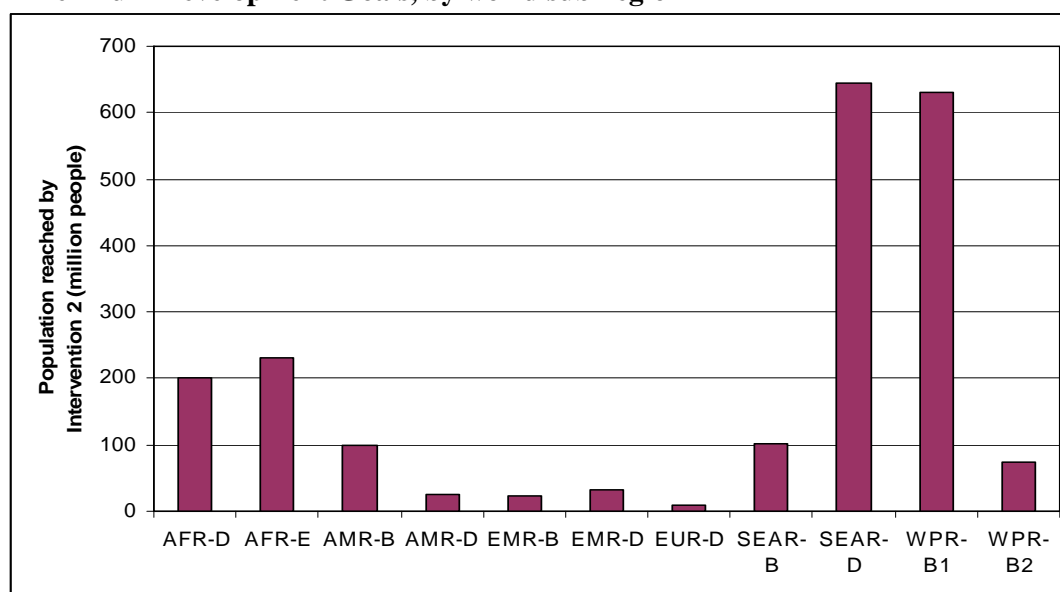
Table 11 presents the number of people receiving improvements by selected WHO sub-regions (AFRO-E, AMRO-D, EURO-D, SEARO-D and WPRO-B1). Appendix Table A2.1 shows the results for all WHO sub-regions. Overall, 693 million people would receive improvements in water supply if the MDG target for water was reached. This corresponds to 9.6% of the world's population by the year 2015. If the sanitation targets were also met (intervention 2), an additional 20.6% - about 1.5 billion people - of the world's population would receive an improvement. Figure 1 shows that the majority of this population is from SEAR-D, WPR-B1, AFR-D and AFR-E.

In bringing improved water and sanitation to all those currently without improved water or sanitation, 42.6% of the world's population would be reached. For many of the least developed sub-regions, at least half of the population is reached by Intervention 3. At a global level, 3 billion people could benefit from improving water supply and sanitation that are currently without improved services. About two thirds of this population are in two sub-regions: SEAR-D and WPR-B1.

Table 11: Number of people receiving improvements

| WHO sub-region | Region/Country | Population (million) | Population (m) receiving interventions | | | | |
|----------------|----------------|----------------------|--|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 116 | 232 | 279 | 481 | 481 |
| 5 | AMR-D | 93 | 11 | 26 | 29 | 93 | 93 |
| 11 | EUR-D | 223 | 2 | 10 | 17 | 223 | 223 |
| 13 | SEAR-D | 1689 | 109 | 645 | 1'073 | 1'689 | 1'689 |
| 15 | WPR-B1 | 1488 | 180 | 631 | 903 | 1'488 | 1'488 |
| WORLD | | 7183 | 693 | 2'161 | 3'060 | 6'326 | 6'326 |

Figure 1: Population reached by achieving the combined water and sanitation Millennium Development Goals, by world sub-region



By improving the quality of drinking water (Intervention 4), a further 3.3 billion people could be reached, summing to a total of 88% of the world's population who could benefit from this intervention by 2015. The same number of people would benefit from intervention 5 (regulated water supply and partial sewerage) as from Intervention 4.

Predicted health impact

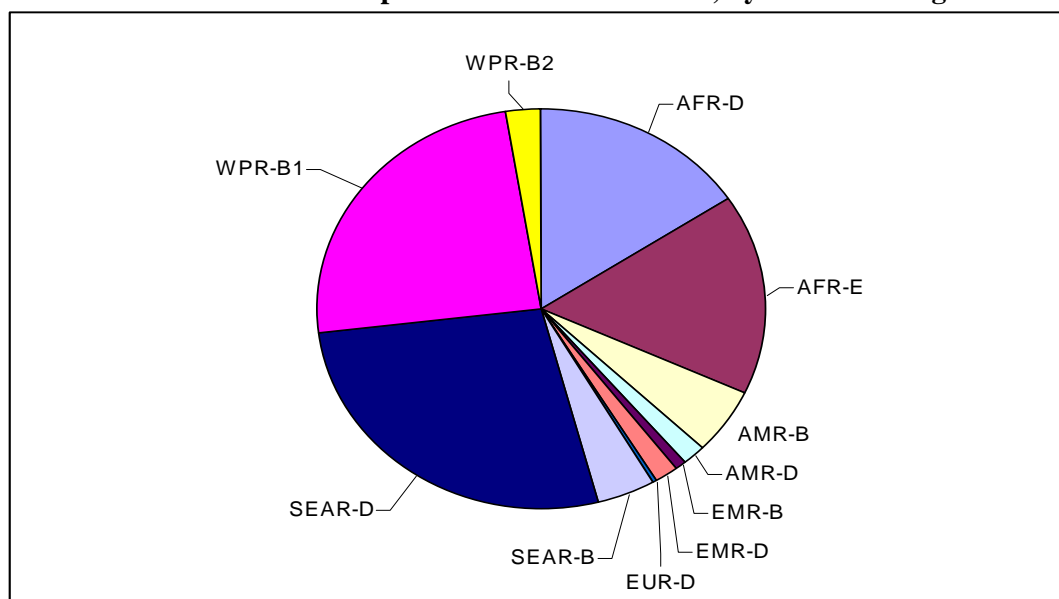
Table 12 presents the total number of cases (in millions) avoided under each of the five interventions. Out of an estimated annual number of cases of diarrhoea of 5.4 billion globally, Intervention 1 potentially prevents 155 million, increasing to 546 million cases prevented for Intervention 2, and 903 million for intervention 3. Clean drinking water and improved sanitation for the entire world (Intervention 4) would hypothetically avoid 2.9 billion cases annually, which is 53% of the number of cases. Intervention 5 would add a further 850 million prevented cases, due to better sewerage. Appendix Table A2.2 and Figure 2 below show that four sub-regions account for the majority of avoided diarrhoeal cases: AFR-D, AFR-E, SEAR-D and

WPR-B1. In terms of cases avoided per capita, if the whole population disinfected their water at the point of use on top of improved water supply and sanitation, the gains would be as high as 1.05 cases avoided per person in Africa, and around 0.40 – 0.60 in most other developing country regions (see Appendix Table A 2.3). Of these cases, globally around 50% are gained by the 0-4 age group. However, the gains by age group vary by world sub-region, depending on the proportion of population in this age group. For example, in China only 20% of diarrhoeal cases avoided are in the 0-4 age group.

Table 12: Annual number of diarrhoeal cases avoided

| WHO sub-region | Region/Country | Pop. (m) | Cases of diarrhoea (million) | Number of cases avoided per year ('000s), by intervention | | | | |
|----------------|----------------|----------|------------------------------|---|---------|---------|-----------|-----------|
| | | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 619 | 28'548 | 87'405 | 127'049 | 345'132 | 439'980 |
| 5 | AMR-D | 93 | 93 | 3'250 | 9'307 | 13'208 | 48'679 | 64'106 |
| 11 | EUR-D | 223 | 43 | 112 | 568 | 1'056 | 19'816 | 27'983 |
| 13 | SEAR-D | 1689 | 1491 | 26'895 | 146'829 | 272'361 | 807'596 | 1'043'922 |
| 15 | WPR-B1 | 1488 | 1193 | 39'454 | 131'171 | 239'104 | 659'687 | 844'381 |
| WORLD | | 7183 | 5388 | 154'854 | 545'950 | 903'004 | 2'860'951 | 3'717'971 |

Figure 2: Distribution of diarrhoeal cases avoided if the combined water and sanitation Millennium Development Goals are achieved, by world sub-region



Intervention costs

Table 13 (and Appendix Table A 2.4) show the estimated costs of achieving the targets defined by the five interventions, by world sub-regions. Intervention 1 has total annual costs of US\$1.78 billion. At US\$11.3 billion annually, Intervention 2 represents quite a significant cost increase from Intervention 1, as the sanitation

improvements are considerably more expensive than water improvements (4 times more expensive, on average). Two sub-regions dominate the global costs of reaching the combined water and sanitation MDGs – SEAR-D (US\$3.6 billion annually) and WPR-B1 (US\$3.3 billion annually).

Figure 3: Share of global costs of reaching combined water and sanitation Millennium Development Goals, by world sub-region

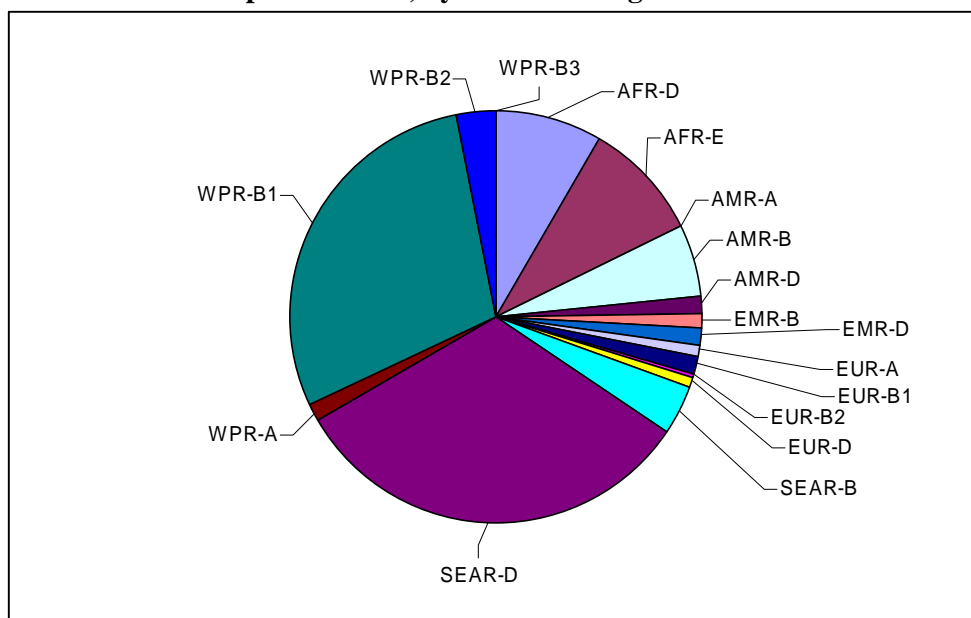


Table 13: Total annual cost of interventions

| WHO sub-region | Region/Country | Population (million) | Total cost of interventions (US\$m Year 2000), by intervention | | | | |
|----------------|----------------|----------------------|--|--------|--------|--------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 268 | 1'074 | 2'149 | 2'306 | 12'201 |
| 5 | AMR-D | 93 | 38 | 157 | 315 | 368 | 2'320 |
| 11 | EUR-D | 223 | 8 | 71 | 143 | 266 | 4'206 |
| 13 | SEAR-D | 1689 | 282 | 3'628 | 7'257 | 7'704 | 35'074 |
| 15 | WPR-B1 | 1488 | 465 | 3'282 | 6'563 | 6'957 | 28'129 |
| WORLD | | 7183 | 1'784 | 11'305 | 22'609 | 24'649 | 136'515 |

Table 13 shows that to reach the entire unserved population with water supply and sanitation services would cost US\$22.6 billion (Intervention 3), which is twice the cost of Intervention 2. Intervention 4 involves only a small cost increase over intervention 3, of US\$2 billion (under 10% increase) as only the cost of chlorination is added.

Finally, at US\$136 billion annually, Intervention 5 involves a massive investment in hardware as well as running costs, representing an almost five-fold cost increase from intervention 4. It is likely that this calculation underestimates the true costs due to lack of reliable data on the costs of regulated water and partial sewerage in developing countries.

The annual cost per person reached with the five interventions is shown in Table 14 and Appendix Table A 2.5. The annual per capita cost is under US\$3.5 in developing sub-regions for Intervention 1, rising to under US\$7.0 for Intervention 2, and up to US\$10.7 for Intervention 3. The cost per person reached for Intervention 4 is lower at under US\$5 per capita in developing regions, due to the massively increased coverage of this intervention at relatively little additional cost. The services provided in Intervention 5 bring the cost per person covered to over US\$20. When the costs are spread over the entire population (see Appendix Table A 2.6), the costs reduce to well under US\$1 per capita for Intervention 1 and under US\$2.5 for Intervention 2.

Table 14: Annual cost per person receiving interventions

| WHO sub-region | Region/Country | Population (million) | Cost per capita per year (US\$ Year 2000), by intervention | | | | |
|----------------|----------------|----------------------|--|-----|------|-----|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 2.3 | 4.6 | 7.7 | 4.8 | 25.4 |
| 5 | AMR-D | 93 | 3.4 | 6.1 | 10.7 | 4.0 | 25.0 |
| 11 | EUR-D | 223 | 3.1 | 7.0 | 8.5 | 1.2 | 18.9 |
| 13 | SEAR-D | 1689 | 2.6 | 5.6 | 6.8 | 4.6 | 20.8 |
| 15 | WPR-B1 | 1488 | 2.6 | 5.2 | 7.3 | 4.7 | 18.9 |

Treatment costs saved due to less cases of infectious diarrhoea

The potential annual health sector costs saved are presented in Table 15 and Appendix Table A 2.7, showing considerable variation between regions and interventions. For Intervention 1, the global costs savings could be US\$2 billion per year, rising to as much as US\$7 billion per year for Intervention 2. In some of the least developed sub-regions (e.g. AFRO-D, AMRO-D, WPRO-B1) the per capita savings are at least US\$0.40 for Intervention 1, rising to at least US\$1.40 for intervention 2, and around US\$2.00 for Intervention 3. These results are closely linked to the avoided cases per capita in Appendix Table A 2.3, but also to the cost saving assumptions used, such as the estimated costs of ambulatory care and hospitalisation and the proportion of cases admitted to hospital. If, for example, it is assumed instead that only a small proportion of current diarrhoeal cases reach formal health services, then the cost savings to the health sectors around the world would correspondingly be significantly lower.

Table 15: Annual health sector treatment costs saved

| WHO sub-region | Region/Country | Population (million) | Annual health sector treatment costs saved per capita (US\$m year 2000), by intervention | | | | |
|----------------|----------------|----------------------|--|-------|--------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 288 | 883 | 1'284 | 3'487 | 4'445 |
| 5 | AMR-D | 93 | 45 | 128 | 181 | 668 | 879 |
| 11 | EUR-D | 223 | 2 | 12 | 22 | 419 | 591 |
| 13 | SEAR-D | 1689 | 262 | 1'431 | 2'654 | 7'869 | 10'172 |
| 15 | WPR-B1 | 1488 | 636 | 2'115 | 3'855 | 10'636 | 13'614 |
| WORLD | | 7183 | 2'020 | 6'975 | 11'624 | 38'337 | 50'022 |

Table 16 shows the patient treatment and travel costs saved, which are much lower than the health sector costs saved. The global patient cost savings are under US\$100 million per annum for Intervention 1, rising to US\$340 million for Intervention 2. The patient cost savings per capita is negligible for most countries for basic improvements in water and sanitation, at under US\$0.20, but these gains rise to over US\$0.35 per capita for interventions 4 and 5. Given that these savings will accrue to specific groups and not the whole population, especially households with children, these benefits could be important for those households. This is especially true where patients have to travel long distances to the health facility, and where public health facilities charge for their services or private health care is used. Appendix Table A 2.9 gives details for all sub-regions.

Table 16: Annual patient treatment costs saved

| WHO sub-region | Region/Country | Population (million) | Annual patient treatment costs saved per capita (US\$m year 2000), by intervention | | | | |
|----------------|----------------|----------------------|--|-----|-----|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 18 | 54 | 79 | 215 | 274 |
| 5 | AMR-D | 93 | 2 | 6 | 8 | 30 | 40 |
| 11 | EUR-D | 223 | 0 | 0 | 1 | 12 | 17 |
| 13 | SEAR-D | 1689 | 17 | 91 | 170 | 503 | 650 |
| 15 | WPR-B1 | 1488 | 25 | 82 | 149 | 411 | 526 |
| WORLD | | 7183 | 97 | 341 | 565 | 1'787 | 2'322 |

Days gained from less illness

Tables 17, 18 and 19 show the number of days gained due to lower incidence of diarrhoea in selected sub-regions, for adults, children and babies, respectively. Under the assumption that 2 work days are lost per case of adult diarrhoea, the global gain is 919 million working days for the total working population aged 15-59 for Intervention 1. When sanitation is added in Intervention 2, the global gain rises to 3.2 billion working days gained. In developing sub-regions, Intervention 1 gives a gain of under 0.10 working days per capita per year for some developing regions (AMR-B, EMR-B, SEAR-B), 0.15 for others (AFR-D, AFR-E), to over 0.30 for WPR-B1. The savings per capita per person for Intervention 2 are about three times those for Intervention 1.

Table 17: Productive days gained due to less diarrhoeal illness

| WHO sub-region | Region/Country | Population (million) | Productive days gained due to less diarrhoeal illness (million days), by intervention | | | | |
|----------------|----------------|----------------------|---|-------|-------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 75 | 229 | 333 | 905 | 1'153 |
| 5 | AMR-D | 93 | 12 | 35 | 49 | 182 | 239 |
| 11 | EUR-D | 223 | 1 | 4 | 8 | 148 | 210 |
| 15 | WPR-B1 | 1488 | 516 | 1'714 | 3'125 | 8'622 | 11'036 |
| WORLD | | 7183 | 919 | 3'225 | 5'600 | 17'043 | 22'059 |

The potential days of school attendance gained are presented in Table 18, assuming an average of three days off school per case of diarrhoea. The global gain is almost 80 million days per year for Intervention 1, most of which accrue to sub-Saharan Africa, Latin America, South-East Asia and the developing regions of the Western Pacific.

Table 18: School attendance days gained due to less diarrhoeal illness

| WHO sub-region | Region/Country | Population (million) | Days of school attendance gained due to less diarrhoeal illness ('000 days), by intervention | | | | |
|----------------|----------------|----------------------|--|---------|---------|-----------|-----------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 16'473 | 50'437 | 73'313 | 199'158 | 253'890 |
| 5 | AMR-D | 93 | 2'808 | 8'042 | 11'413 | 42'062 | 55'392 |
| 11 | EUR-D | 223 | 21 | 109 | 203 | 3'817 | 5'390 |
| 13 | SEAR-D | 1689 | 12'422 | 67'813 | 125'790 | 372'988 | 482'135 |
| 15 | WPR-B1 | 1488 | 15'101 | 50'204 | 91'513 | 252'485 | 323'174 |
| WORLD | | 7183 | 78'708 | 272'482 | 443'219 | 1'431'223 | 1'863'335 |

Table 19 shows the healthy baby/infant days gained – at a gain per average episode of five days of diarrhoea avoided. A global total of 413 million healthy baby/infant days gained for Intervention 1 rises to 1500 million for Intervention 2, and 2400 million for Intervention 3. With disinfected water, the global gains are three times higher than for Intervention 3, at over 7.5 billion baby/infant ill days avoided.

Table 19: Healthy baby/infant days gained due to less diarrhoeal illness

| WHO sub-region | Region/Country | Population (million) | Healthy baby/infant days gained due to less diarrhoeal illness (million days) , by intervention | | | | |
|----------------|----------------|----------------------|---|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 96 | 295 | 429 | 1'166 | 1'486 |
| 5 | AMR-D | 93 | 9 | 24 | 35 | 128 | 168 |
| 11 | EUR-D | 223 | 0 | 2 | 3 | 56 | 78 |
| 13 | SEAR-D | 1689 | 84 | 460 | 854 | 2'531 | 3'272 |
| 15 | WPR-B1 | 1488 | 43 | 143 | 261 | 720 | 922 |
| WORLD | | 7183 | 413 | 1'467 | 2'372 | 7'646 | 9'953 |

Figure 4 shows the distribution of days of illness avoided, by sub-region and by age group. The greatest benefits accrue to the adult population, especially in WPR-B1 and SEAR-D. This is largely because this age group has the largest number of adults in it compared to children and infants, especially in WPR-B1. The second greatest benefit is to babies and infants, mainly in AFR-D, AFR-E and SEAR-D, and this mainly because of the fact that diarrhoeal incidence in these age groups is considerably higher than for children and adults. WPR-B1 has a lower proportion of benefits in the 0-4 age group due to the relatively small proportion of the population in this age group compared to other developing sub-regions.

In the cost-benefit analysis, benefits were converted into monetary amounts using assumptions about the value of identified benefits such as productive days gained. Table 20 shows the value of productive days gained (15-49 age group) due to less diarrhoeal illness, using the minimum wage as the measure of value. The annual global value of adult days gained is US\$210 million for Intervention 1, rising to almost US\$750 million for intervention 2 and US\$1.23 billion for Intervention 3. Due to the huge marginal health impact of disinfecting water at the point of use, the value of productive days gained is over US\$4 billion for Intervention 4.

Figure 4: Days of illness avoided due to meeting water and sanitation MDGs

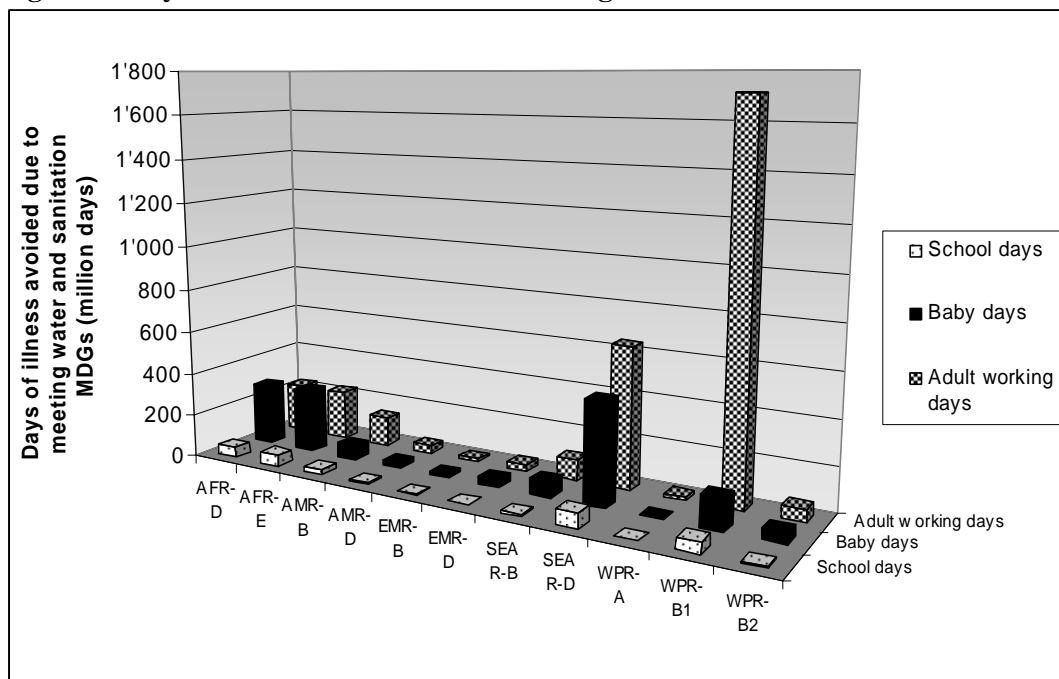


Table 20: Value of (adult) productive days gained due to less diarrhoeal illness

| WHO sub-region | Region/Country | Population (million) | Value of productive days gained due to less diarrhoeal illness (US\$ M), by intervention | | | | |
|----------------|----------------|----------------------|--|-----|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 21 | 65 | 95 | 256 | 327 |
| 5 | AMR-D | 93 | 4 | 11 | 16 | 56 | 73 |
| 11 | EUR-D | 223 | 0 | 1 | 2 | 33 | 46 |
| 13 | SEAR-D | 1689 | 26 | 124 | 223 | 648 | 835 |
| 15 | WPR-B1 | 1488 | 74 | 263 | 482 | 1'472 | 1'906 |
| WORLD | | 7183 | 210 | 737 | 1'252 | 4'212 | 5'508 |

Convenience time savings

Table 21 shows the annual time gain associated with the improved access to water and sanitation following from the five interventions.

Table 21: Annual time gain due to more convenient water supply and sanitation

| WHO sub-region | Region/Country | Population (million) | Annual time gain (million hours saved), by intervention | | | | |
|----------------|----------------|----------------------|---|---------|---------|---------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 4'925 | 26'034 | 52'202 | 52'202 | 106'603 |
| 5 | AMR-D | 93 | 483 | 2'553 | 6'261 | 6'261 | 14'042 |
| 11 | EUR-D | 223 | 104 | 550 | 3'040 | 3'040 | 12'916 |
| 13 | SEAR-D | 1689 | 4'640 | 24'525 | 205'016 | 205'016 | 292'445 |
| 15 | WPR-B1 | 1488 | 7'661 | 40'491 | 180'047 | 180'047 | 160'003 |
| WORLD | | 7183 | 29'522 | 156'045 | 594'695 | 594'695 | 992'634 |

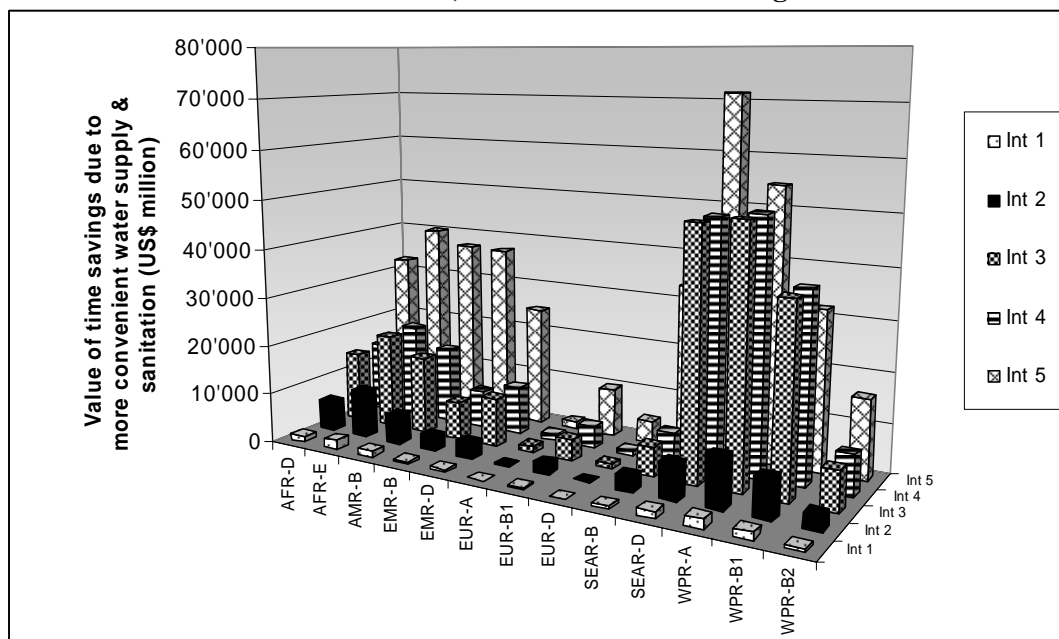
The annual number of hours gained from Intervention 1 is estimated at just under 30 billion hours (or about 4 billion working days), increasing to 156 billion for Intervention 2 (or about 20 billion working days). This shows that the greatest proportion of time gain is from sanitation interventions – i.e. the closer proximity of toilets or less waiting time for public facilities. For the developing regions that benefit the most, around 10 hours for the entire population are gained per capita per year from Intervention 1, and 50 hours per capita from intervention 2. Interventions 3 and 4 save around 100 hours per capita per year, spread over the entire population. There is another big gain for all developing regions when moving from Interventions 3 or 4 to Intervention 5, giving about 200 hours saved per capita per year.

Table 22 presents the annual value of these time savings, spread over the entire population, and using the minimum wage rate to measure the value of time. Intervention 1 gives a global annual value of US\$12 billion, spread relatively equally between six sub-regions – AFR-D, AFR-E, AMR-B, SEAR-D, WPR-A, and WPR-B1 (full data shown in Appendix Table A 2.16). Figure 5 illustrates where the gains are distributed in selected world sub-regions, for the five interventions.

Table 22: Annual value of time savings

| WHO sub-region | Region/Country | Population (million) | Annual value of time savings (US\$ M 2000) , by intervention | | | | |
|----------------|----------------|----------------------|--|--------|---------|---------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 1'820 | 9'619 | 19'558 | 19'558 | 39'798 |
| 5 | AMR-D | 93 | 212 | 1'122 | 2'649 | 2'649 | 5'825 |
| 11 | EUR-D | 223 | 42 | 224 | 901 | 901 | 4'418 |
| 13 | SEAR-D | 1689 | 1'330 | 7'028 | 49'128 | 49'128 | 71'531 |
| 15 | WPR-B1 | 1488 | 1'448 | 7'656 | 37'357 | 37'357 | 31'894 |
| WORLD | | 7183 | 12'022 | 63'547 | 229'158 | 229'158 | 405'457 |

Figure 5: Value of time savings due to more convenient water supply and sanitation for the five interventions, in selected world sub-regions



Value of avoided deaths

Based on the number of deaths avoided in each age group the value of avoiding these deaths was calculated using the discounted future earnings of people whose lives are saved from each intervention. The value of these avoided deaths is presented in Table 23.

Table 23: Value of avoided deaths per capita (based on predicted future earnings)

| WHO sub-region | Region/Country | Population (million) | Value of avoided deaths per capita (US\$m 2000), by intervention | | | | |
|----------------|----------------|----------------------|--|-------|-------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 326 | 990 | 1'433 | 3'818 | 4'855 |
| 5 | AMR-D | 93 | 12 | 35 | 52 | 176 | 231 |
| 11 | EUR-D | 223 | 0 | 0 | 0 | 40 | 58 |
| 13 | SEAR-D | 1689 | 205 | 1'023 | 1'826 | 5'149 | 6'615 |
| 15 | WPR-B1 | 1488 | 5 | 17 | 30 | 85 | 108 |
| WORLD | | 7183 | 1'035 | 3'560 | 5'585 | 17'566 | 22'803 |

Globally, the present value of these avoided deaths is US\$1 billion annually for Intervention 1. Intervention 2, due to the increased sanitation coverage, increases this gain to US\$3.5 billion, and full coverage of improved water supply and sanitation services gives a global economic benefit of US\$5.5 billion. A large proportion of these benefits (80%) accrue in AFR-D, AFR-E and SEAR-D. The sub-region WPR-B1 has much lower benefits due to the older average age of those whose lives are saved from the interventions, and the much lower annual minimum wage in China (US\$325) than in most other sub-regions where it was at least US\$700.

Economic value of all benefits combined

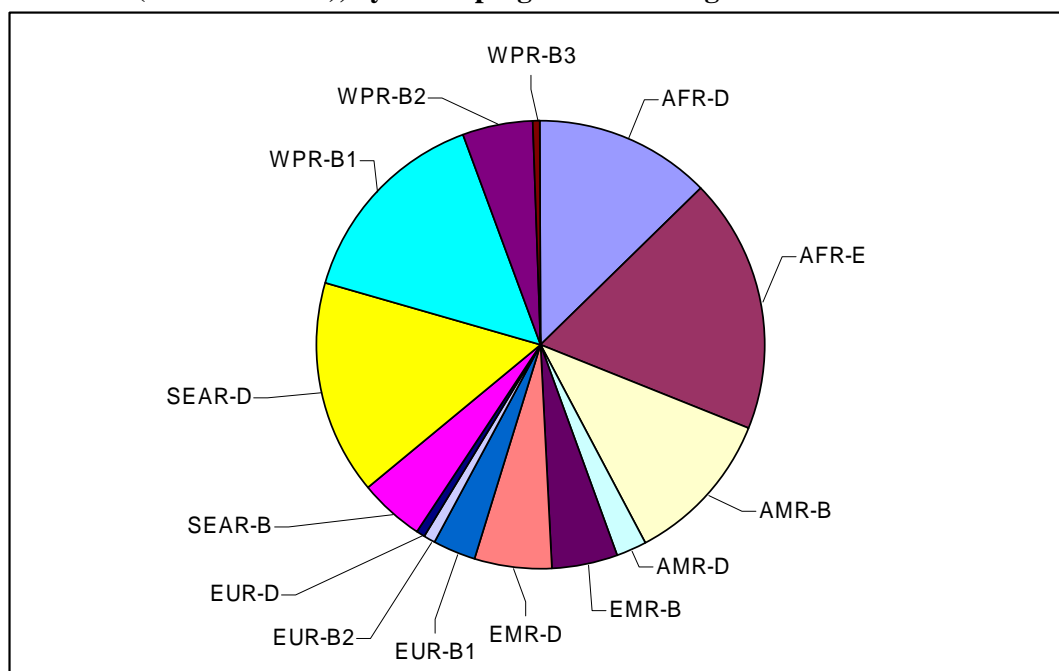
All the economic benefits presented above were summated to arrive at an overall value, which was then used for calculating the cost-benefit ratio. Table 24 presents the total annual economic value for selected sub-regions. The global value ranges from US\$18 billion for Intervention 1, to US\$84 billion for Intervention 2, and upwards of US\$250 billion for the other interventions.

Table 24: Total economic benefits of interventions

| WHO sub-region | Region/Country | Population (million) | Total economic benefits of interventions (US\$m year 2000) | | | | |
|----------------|----------------|----------------------|--|--------|---------|---------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 3'084 | 13'475 | 25'153 | 34'631 | 58'993 |
| 5 | AMR-D | 93 | 382 | 1'607 | 3'334 | 5'074 | 9'007 |
| 11 | EUR-D | 223 | 46 | 242 | 934 | 1'551 | 5'337 |
| 13 | SEAR-D | 1689 | 2'201 | 11'457 | 57'155 | 72'478 | 101'643 |
| 15 | WPR-B1 | 1488 | 2'436 | 11'013 | 43'487 | 54'885 | 54'426 |
| WORLD | | 7183 | 18'143 | 84'400 | 262'879 | 344'106 | 555'901 |

Figure 6 shows the distribution of global economic benefits from meeting combined water and sanitation MDGs, by world sub-region but excluding the three most developed sub-regions (AMR-A, EUR-A, and WPR-A). Over 72% of the benefits accrue to five world regions: WPR-B1, SEAR-D, AFR-D, AFR-E, and AMR-B. This is in line with expectations, as these five sub-regions account for 75% of the population from the developing regions.

Figure 6: Distribution (%) of global economic benefits from improved water and sanitation (Intervention 2), by developing world sub-region



Cost-benefit ratios

Table 25 shows the cost-benefit ratios for selected WHO regions, taking into account all the costs and benefits quantified in the analysis. Appendix Table A 2.20 shows the details for all world sub-regions.

Table 25: Cost-benefit ratios – all costs and all benefits included

| WHO sub-region | Region/Country | Population (million) | Cost-benefit ratio, by intervention | | | | |
|----------------|----------------|----------------------|-------------------------------------|-------|-------|-------|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 11.50 | 12.54 | 11.71 | 15.02 | 4.84 |
| 5 | AMR-D | 93 | 10.01 | 10.21 | 10.59 | 13.77 | 3.88 |
| 11 | EUR-D | 223 | 6.03 | 3.40 | 6.55 | 5.82 | 1.27 |
| 13 | SEAR-D | 1689 | 7.81 | 3.16 | 7.88 | 9.41 | 2.90 |
| 15 | WPR-B1 | 1488 | 5.24 | 3.36 | 6.63 | 7.89 | 1.93 |

The most important finding is that in all regions and for all five interventions, the cost-benefit ratio (CBR) is significantly greater than 1, recording values in developing regions of between 5 and 28 for Intervention 1, between 3 and 34 for Intervention 2, between 6 and 42 for Intervention 3, and between 5 and 60 for Intervention 4. In AFR-D and AFR-E the cost-benefit ratio for Interventions 1-4 ranges between 9.8 and 14.8, while in WPR-B1 and SEAR-D the cost-benefit ratios are lower at between 3.1 and 9.3. The cost-benefit ratio tends to be higher in the more developed regions, and

this is mainly because the cost estimates may be underestimated for these regions, thus overestimating the true cost-benefit ratio. The distribution of benefits between different types of benefit is presented in Figures 7 and 8 for two world sub-regions – AFR-D and WPR-B1.

Figure 7: Distribution of economic benefits by type of benefit in AFR-D

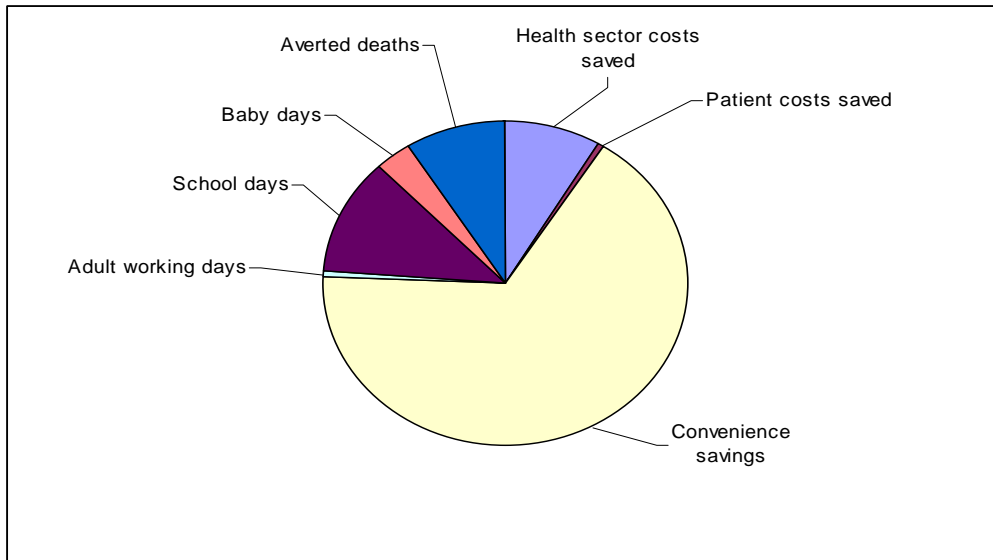
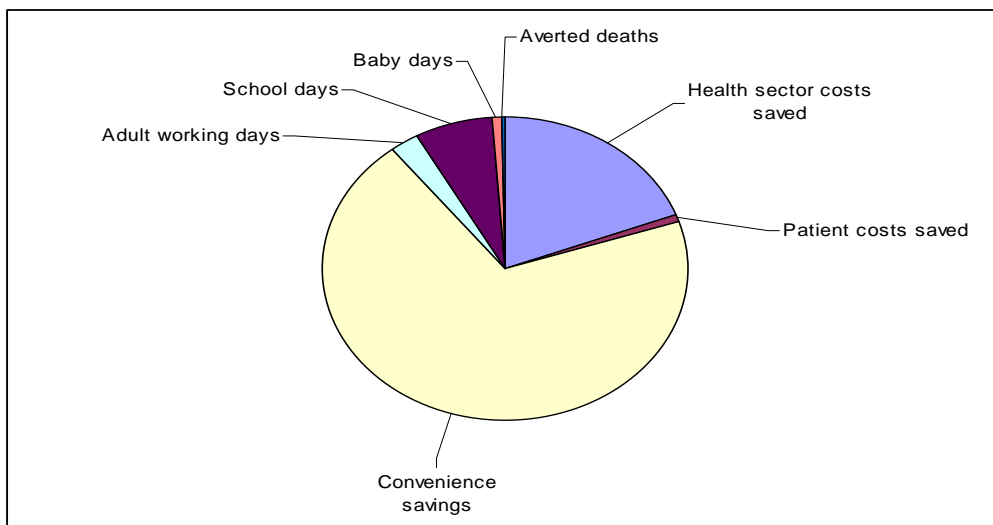


Figure 8: Distribution of economic benefits by type of benefit in WPR-B1



In both regions, the value of time savings due to more convenient services clearly dominates the other benefits, contributing to at least 65% of the economic benefits. The remaining share is, however, distributed differently between the two sub-regions

shown, with a proportionally higher value for avoided deaths and days of school absenteeism in AFR-D, and proportionally higher value for health sector costs saved and adult working days saved in WPR-B1.

The cost-benefit ratios were also recalculated including only the value of time savings. The details are presented in Appendix Table A 2.20. The results show that time savings alone will give cost-benefit ratios of at least 1 for all interventions and all world regions.

Sensitivity analysis

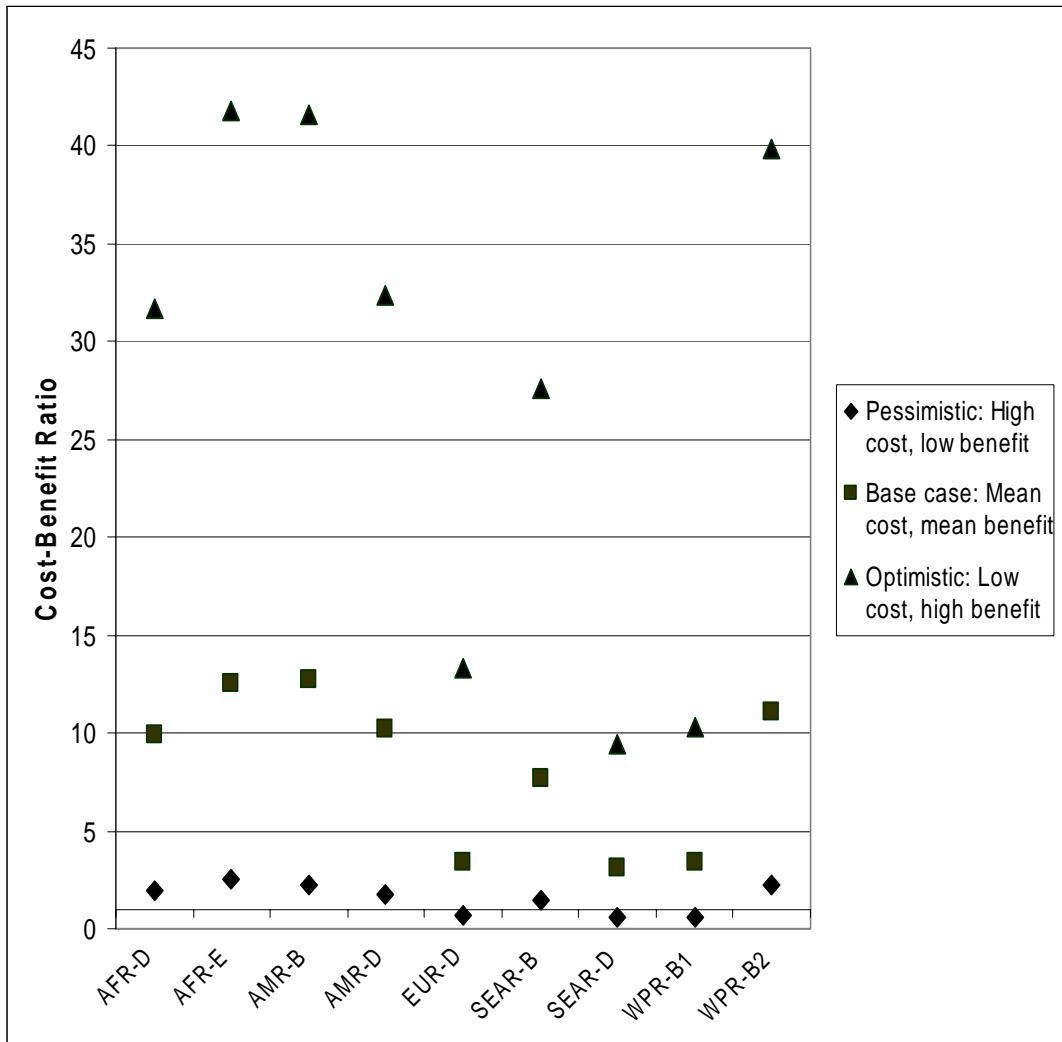
As the results reveal such a high benefit per cost investment, it is important to test the conclusions of the base case analysis by recalculating the cost-benefit ratios under different assumptions. For example, does the cost-benefit ratio remain above unity (1.0) when all the cost input data are given their upper bound and combining these with the lowest input values for all the benefit variables. The results of this analysis are presented in Table 26, which reveals that this operation reduces the ratios considerably compared to the base case results presented in Table 25. The impact is particularly significant for Interventions 1, 2 and 5 in EUR-D, SEAR-B, SEAR-D and WPR-B1, where the ratios in some cases fall below 1.0. Interventions 3 and 4 remain, however, cost-beneficial under the most pessimistic scenario in all sub-regions. In conclusion, the results are highly sensitive to changes in assumptions, but in the greater proportion of scenarios the interventions are still cost-beneficial. Appendix Table A 2.21 shows details for all sub-regions under pessimistic scenarios.

Table 26: Cost-benefit ratios under high cost and low benefit assumptions

| WHO sub-region | Region/Country | Population (million) | Cost-benefit ratio, by intervention | | | | |
|----------------|----------------|----------------------|-------------------------------------|------|------|------|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 2 | AFR-E | 481 | 1.75 | 2.50 | 2.39 | 2.93 | 1.13 |
| 5 | AMR-D | 93 | 1.17 | 1.75 | 1.97 | 2.15 | 0.76 |
| 11 | EUR-D | 223 | 0.93 | 0.71 | 1.43 | 1.18 | 0.29 |
| 13 | SEAR-D | 1689 | 1.16 | 0.63 | 1.75 | 1.97 | 0.66 |
| 15 | WPR-B1 | 1488 | 0.57 | 0.56 | 1.34 | 1.35 | 0.33 |

Figure 9 shows the cost-benefit results for Intervention 2 under most optimistic assumptions (*triangle*) as well as most pessimistic assumptions (*square*), around the base case cost-benefit ratios (*diamond*). The line drawn at a CBR of 1 shows that in EUR-D, SEAR-D and WPR-B1 the cost-benefit ratio falls below 1.

Figure 9: Range on mean cost-benefit ratio for Intervention 2 under different assumptions for selected sub-regions (line drawn at CBR = 1)



Discussion

Interpretation of main findings

The cost-benefit ratio of water and sanitation interventions is high when all benefits are included, standing at around between US\$5 and US\$11 economic benefit per US\$1 invested for most developing world sub-regions and for most interventions. In some cases the ratio is significantly higher than this, and in some cases it is lower. It may even fall below 1 for some regions when pessimistic assumptions are used for data inputs (i.e. high cost and low benefit assumptions). The main contributor to the cost of the interventions was found to be the investment cost for the low technology interventions. The main contributor to the overall economic benefits was the time saving associated with more convenient access to water supply and sanitation.

In interpreting the impressive cost-benefit ratios presented in this study, an important caveat needs to be taken into account. On the cost side, the costs are very tangible, requiring financial and time input upfront for the interventions to be put in place. On the benefit side, however, many of the benefits are not highly tangible, in that the benefits do not bring immediate money 'in the hand'. The benefits involve possible money savings from less health service use, accruing to both the health sector and the patient. The reduced number of days spent ill can lead to direct economic benefits, such as more time spent on income earning activities, or to other benefits such as more leisure time or more time spent at school, which do not have immediate economic implications. On the other hand, the benefits related to time savings due to less time spent collecting water or accessing sanitation services can also be argued to be valuable to household members, as it increases their time spent in productive activities.

Therefore, while this analysis attempted to make realistic assumptions about the economic value of these potential savings, it is recognised that the real economic benefits accruing to the population may not be financial in nature, nor will they be immediate. Also, the real benefits depend on a number of factors related to the individual or household, such as what activities are done instead when time is saved or illness avoided, and what health seeking behaviour does he/she engage in. Furthermore, the assumptions about the value of time may overestimate the actual economic value, due to the presence of unemployment, underemployment or seasonal labour, which all determine the income earned when more time is available for work. In some cases the changes in time uses will lead to income gains, but data from micro-economic studies to support the assumptions used in this study are limited.

Omission of variables

The omission of health impacts other than diarrhoeal disease will underestimate the cost-benefit ratios presented in this study. Also, some potential economic and non-economic benefits were left out of the analysis, as presented in Table 9. These benefits were left out for various reasons: (a) lack of research studies presenting the likely range of benefits per project or per person, (b) lack of valuation methods for estimating the monetary equivalent value of some benefits, such as, for example, the aesthetic value of a reservoir, and (c) some benefits were likely to be small in relation to others. On the other hand, some potential negative impacts of changes to water and sanitation technologies were also omitted, thus leading to the underestimate of cost. For example, a partial improvement such as a household sewer connection may mean

discharge of sewage into an open sewer, providing a habitat for vectors to breed, and the possibility of re-infection. Clearly all these omitted benefits and costs should be included for a comprehensive analysis, and a more accurate cost-benefit ratio, and future cost-benefit analyses should try and quantify their effects.

Financing considerations

While cost-benefit analysis can be carried out to identify clearly all the beneficiaries and the (potential) financers of development projects, the analysis does not provide answers to the question of who should pay. This represents a particular challenge to economic evaluation when health care interventions have non-health sector costs and benefits, as the objective of the health ministry – “to maximise health with a given budget” – may come into conflict with other societal objectives, including the maximisation of non-health related welfare. For this reason, the societal perspective is very rarely represented in a comprehensive way in the economic evaluation of health care programmes.

If all costs and benefits are included in a cost-benefit analysis, then a full analysis can be made of financing options. While this study did not include all the benefits, the most widespread benefits were included, which were generally the benefits where country and regional averages could be estimated. For example, benefits accruing to agriculture and industry are very setting-specific, and even estimating economic gains by country would be a challenging task. One of the problems associated with identifying beneficiaries in order to identify those willing to pay for the costs is that the main beneficiaries (patients and consumers) do not always understand the full benefits until well after the investment. Also, most costs are incurred in the first year of the intervention, while benefits accrue over time. These factors together lead to a type of market failure, and implies that many private consumers cannot be expected to finance the initial investment costs up-front. On the other hand, water supply improvements may in fact involve a lower annual cost than the current options, if water trucks, water vendors or bottled water are used. This means that certain groups could be convinced that a household water connection could be cheaper in the long-term, and therefore persuade them to finance water supply improvements privately.

With respect to the question whether the health sector would be interested in financing the interventions, it is clear from this analysis that in most regions and for most interventions there is little incentive for the health sector to make significant contributions to the costs, as the real savings to the sector are small in comparison to the annual intervention costs. Compared to the potential cost savings reported in this study, it is unlikely that the health sector will ever be able to recover these costs, as only a small proportion are marginal costs directly related to the treatment cost of the diarrhoeal episode. Most costs, such as personnel and infrastructure, are fixed costs that do not change with patient throughput in the short-term. On the other hand, the reduced burden to the health system due to less patients presenting with diarrhoea will free up capacity in the health system to treat other patients.

The implication of these arguments is that there should exist a variety of financing mechanisms for meeting the costs of water and sanitation improvements, depending on the income and asset base of the target populations, the availability of credit, the economic benefits perceived by the various stakeholders, the budget freedom of government ministries, and the presence of NGOs to promote and finance water and

sanitation improvements. One finding is clear though: the health sector, with the meagre budget it has at its disposal in most developing countries, cannot and should not be expected to fund water and sanitation improvements. On the other hand, it can play a key role in providing the 'software' (education for behaviour change) alongside 'hardware' interventions, involving both technical and limited financial contributions, and it can provide a strengthened knowledge base to repeat at the national level the type of analysis presented in this publication from a global perspective.

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Appendix A 1: WHO world sub-regions

Table A 1.1: Countries included in World Health Organization epidemiological sub-regions

| Region* | Mortality stratum** | Countries |
|---------|---------------------|--|
| AFR | D | Algeria, Angola, Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Comoros, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Madagascar, Mali, Mauritania, Mauritius, Niger, Nigeria, Sao Tome And Principe, Senegal, Seychelles, Sierra Leone, Togo |
| AFR | E | Botswana, Burundi, Central African Republic, Congo, Côte d'Ivoire, Democratic Republic Of The Congo, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, Swaziland, Uganda, United Republic of Tanzania, Zambia, Zimbabwe |
| AMR | B | Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, El Salvador, Grenada, Guyana, Honduras, Jamaica, Mexico, Panama, Paraguay, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela |
| AMR | D | Bolivia, Ecuador, Guatemala, Haiti, Nicaragua, Peru |
| EMR | B | Bahrain, Cyprus, Iran (Islamic Republic Of), Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia, United Arab Emirates |
| EMR | D | Afghanistan, Djibouti, Egypt, Iraq, Morocco, Pakistan, Somalia, Sudan, Yemen |
| EUR | B | Albania, Armenia, Azerbaijan, Bosnia And Herzegovina, Bulgaria, Georgia, Kyrgyzstan, Poland, Romania, Slovakia, Tajikistan, The Former Yugoslav Republic Of Macedonia, Turkey, Turkmenistan, Uzbekistan, Yugoslavia |
| EUR | C | Belarus, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Republic of Moldova, Russian Federation, Ukraine |
| SEAR | B | Indonesia, Sri Lanka, Thailand |
| SEAR | D | Bangladesh, Bhutan, Democratic People's Republic Of Korea, India, Maldives, Myanmar, Nepal |
| WPR | B | Cambodia, China, Lao People's Democratic Republic, Malaysia, Mongolia, Philippines, Republic Of Korea, Viet Nam |
| | | Cook Islands, Fiji, Kiribati, Marshall Islands, Micronesia (Federated States Of), Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu |

* AFR = Africa Region; AMR = Region of the Americas; EMR = Eastern Mediterranean Region; EUR = European Region; SEAR = South East Asian Region; WPR = Western Pacific Region

** B = low adult, low child mortality; C = high adult, low child mortality;

D = high adult, high child mortality; E = very high adult, high child mortality

Appendix A 2: Detailed cost-benefit results under projected population growth until 2015

**Table A 2.1: Number of people receiving improvements
(using predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Population (m) receiving interventions | | | | |
|-------------------------|--------------------|-------------------------|--|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 96 | 200 | 227 | 487 | 487 |
| 2 | AFR-E | 481 | 116 | 232 | 279 | 481 | 481 |
| 3 | AMR-A | 356 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 531 | 40 | 100 | 127 | 531 | 531 |
| 5 | AMR-D | 93 | 11 | 26 | 29 | 93 | 93 |
| 6 | EMR-B | 184 | 10 | 22 | 32 | 184 | 184 |
| 7 | EMR-D | 189 | 13 | 33 | 40 | 189 | 189 |
| 8 | EUR-A | 413 | 5 | 17 | 23 | 23 | 23 |
| 9 | EUR-B1 | 176 | 13 | 26 | 32 | 176 | 176 |
| 10 | EUR-B2 | 62 | 5 | 11 | 18 | 62 | 62 |
| 11 | EUR-D | 223 | 2 | 10 | 17 | 223 | 223 |
| 12 | SEAR-B | 473 | 47 | 102 | 123 | 473 | 473 |
| 13 | SEAR-D | 1689 | 109 | 645 | 1'073 | 1'689 | 1'689 |
| 14 | WPR-A | 154 | 7 | 28 | 41 | 41 | 41 |
| 15 | WPR-B1 | 1488 | 180 | 631 | 903 | 1'488 | 1'488 |
| 16 | WPR-B2 | 176 | 37 | 74 | 90 | 176 | 176 |
| 17 | WPR-B3 | 9 | 2 | 4 | 5 | 9 | 9 |
| WORLD | | 7183 | 693 | 2'161 | 3'060 | 6'326 | 6'326 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.2: Annual number of diarrhoeal cases averted
(predicted population growth until 2015)**

| Region Number | Region/Country | Pop. (m) | Cases diarrhoea (m) | Number of cases averted per year ('000s), by intervention | | | | |
|---------------|----------------|----------|---------------------|--|---------|---------|-----------|-----------|
| | | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 620 | 28'946 | 85'032 | 117'936 | 340'955 | 437'876 |
| 2 | AFR-E | 481 | 619 | 28'548 | 87'405 | 127'049 | 345'132 | 439'980 |
| 3 | AMR-A | 356 | 24 | 3 | 7 | 9 | 15 | 18 |
| 4 | AMR-B | 531 | 459 | 9'371 | 28'373 | 45'030 | 228'457 | 308'336 |
| 5 | AMR-D | 93 | 93 | 3'250 | 9'307 | 13'208 | 48'679 | 64'106 |
| 6 | EMR-B | 184 | 133 | 1'032 | 4'173 | 7'111 | 63'169 | 87'581 |
| 7 | EMR-D | 189 | 153 | 3'312 | 9'622 | 14'499 | 75'925 | 102'659 |
| 8 | EUR-A | 413 | 28 | 282 | 904 | 1'611 | 3'271 | 4'004 |
| 9 | EUR-B1 | 176 | 46 | 641 | 2'157 | 3'281 | 22'155 | 30'361 |
| 10 | EUR-B2 | 62 | 41 | 447 | 1'594 | 2'926 | 19'768 | 27'114 |
| 11 | EUR-D | 223 | 43 | 112 | 568 | 1'056 | 19'816 | 27'983 |
| 12 | SEAR-B | 473 | 304 | 7'707 | 22'559 | 32'854 | 153'143 | 205'467 |
| 13 | SEAR-D | 1689 | 1491 | 26'895 | 146'829 | 272'361 | 807'596 | 1'043'922 |
| 14 | WPR-A | 154 | 17 | 413 | 1'497 | 2'747 | 5'761 | 7'096 |
| 15 | WPR-B1 | 1488 | 1193 | 39'454 | 131'171 | 239'104 | 659'687 | 844'381 |
| 16 | WPR-B2 | 176 | 117 | 4'346 | 14'226 | 21'318 | 63'658 | 82'079 |
| 17 | WPR-B3 | 9 | 7 | 95 | 526 | 904 | 3'765 | 5'008 |
| WORLD | | 7183 | 5388 | 154'854 | 545'950 | 903'004 | 2'860'951 | 3'717'971 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.3: Annual number of diarrhoeal cases averted per capita
(predicted population growth until 2015)**

| Region Number | Region/Country | Pop. (m) | Number of cases averted per capita per year, by intervention | | | | |
|---------------|----------------|----------|--|------|------|------|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 0.09 | 0.26 | 0.36 | 1.05 | 1.35 |
| 2 | AFR-E | 481 | 0.08 | 0.24 | 0.34 | 0.94 | 1.19 |
| 3 | AMR-A | 356 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4 | AMR-B | 531 | 0.02 | 0.06 | 0.10 | 0.52 | 0.70 |
| 5 | AMR-D | 93 | 0.04 | 0.13 | 0.18 | 0.66 | 0.87 |
| 6 | EMR-B | 184 | 0.01 | 0.03 | 0.05 | 0.41 | 0.57 |
| 7 | EMR-D | 189 | 0.02 | 0.06 | 0.10 | 0.50 | 0.68 |
| 8 | EUR-A | 413 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 |
| 9 | EUR-B1 | 176 | 0.00 | 0.01 | 0.02 | 0.12 | 0.17 |
| 10 | EUR-B2 | 62 | 0.01 | 0.03 | 0.06 | 0.38 | 0.52 |
| 11 | EUR-D | 223 | 0.00 | 0.00 | 0.00 | 0.08 | 0.12 |
| 12 | SEAR-B | 473 | 0.02 | 0.06 | 0.08 | 0.37 | 0.50 |
| 13 | SEAR-D | 1689 | 0.02 | 0.12 | 0.22 | 0.67 | 0.86 |
| 14 | WPR-A | 154 | 0.00 | 0.01 | 0.02 | 0.04 | 0.05 |
| 15 | WPR-B1 | 1488 | 0.03 | 0.10 | 0.18 | 0.49 | 0.62 |
| 16 | WPR-B2 | 176 | 0.03 | 0.10 | 0.15 | 0.44 | 0.56 |
| 17 | WPR-B3 | 9 | 0.01 | 0.08 | 0.14 | 0.56 | 0.75 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.4: Total annual cost of interventions
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Total annual cost of interventions (US\$m Year 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|--|--------|--------|--------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 222 | 947 | 1'894 | 2'054 | 12'528 |
| 2 | AFR-E | 481 | 268 | 1'074 | 2'149 | 2'306 | 12'201 |
| 3 | AMR-A | 356 | 0 | 0 | 1 | 1 | 2 |
| 4 | AMR-B | 531 | 133 | 631 | 1'262 | 1'569 | 11'765 |
| 5 | AMR-D | 93 | 38 | 157 | 315 | 368 | 2'320 |
| 6 | EMR-B | 184 | 24 | 100 | 201 | 250 | 3'275 |
| 7 | EMR-D | 189 | 33 | 163 | 325 | 383 | 4'054 |
| 8 | EUR-A | 413 | 17 | 111 | 222 | 235 | 656 |
| 9 | EUR-B1 | 176 | 39 | 136 | 271 | 346 | 3'338 |
| 10 | EUR-B2 | 62 | 13 | 51 | 102 | 118 | 1'264 |
| 11 | EUR-D | 223 | 8 | 71 | 143 | 266 | 4'206 |
| 12 | SEAR-B | 473 | 121 | 466 | 933 | 1'058 | 12'164 |
| 13 | SEAR-D | 1689 | 282 | 3'628 | 7'257 | 7'704 | 35'074 |
| 14 | WPR-A | 154 | 19 | 147 | 294 | 304 | 900 |
| 15 | WPR-B1 | 1488 | 465 | 3'282 | 6'563 | 6'957 | 28'129 |
| 16 | WPR-B2 | 176 | 94 | 326 | 653 | 700 | 4'420 |
| 17 | WPR-B3 | 9 | 6 | 13 | 27 | 29 | 218 |
| WORLD | | 7183 | 1'784 | 11'305 | 22'609 | 24'649 | 136'515 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.5: Annual cost per person receiving interventions
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Cost per capita per year (US\$ Year 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|-----|------|------|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 2.3 | 4.7 | 8.4 | 4.2 | 25.7 |
| 2 | AFR-E | 481 | 2.3 | 4.6 | 7.7 | 4.8 | 25.4 |
| 3 | AMR-A | 356 | 3.4 | 5.8 | 11.6 | 12.2 | 28.7 |
| 4 | AMR-B | 531 | 3.4 | 6.3 | 10.0 | 3.0 | 22.2 |
| 5 | AMR-D | 93 | 3.4 | 6.1 | 10.7 | 4.0 | 25.0 |
| 6 | EMR-B | 184 | 2.6 | 4.6 | 6.2 | 1.4 | 17.8 |
| 7 | EMR-D | 189 | 2.5 | 4.9 | 8.1 | 2.0 | 21.5 |
| 8 | EUR-A | 413 | 3.3 | 6.6 | 9.5 | 10.0 | 28.1 |
| 9 | EUR-B1 | 176 | 2.9 | 5.2 | 8.4 | 2.0 | 19.0 |
| 10 | EUR-B2 | 62 | 2.6 | 4.5 | 5.6 | 1.9 | 20.4 |
| 11 | EUR-D | 223 | 3.1 | 7.0 | 8.5 | 1.2 | 18.9 |
| 12 | SEAR-B | 473 | 2.6 | 4.6 | 7.6 | 2.2 | 25.7 |
| 13 | SEAR-D | 1689 | 2.6 | 5.6 | 6.8 | 4.6 | 20.8 |
| 14 | WPR-A | 154 | 2.6 | 5.3 | 7.1 | 7.4 | 21.9 |
| 15 | WPR-B1 | 1488 | 2.6 | 5.2 | 7.3 | 4.7 | 18.9 |
| 16 | WPR-B2 | 176 | 2.6 | 4.4 | 7.2 | 4.0 | 25.2 |
| 17 | WPR-B3 | 9 | 2.6 | 3.8 | 5.3 | 3.2 | 23.6 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 2.6: Annual cost per capita (entire population) of interventions (predicted population growth until 2015)

| WHO Region Number | Region/ Country | Population (million) | Annual cost per capita (entire population) (US\$ 2000), by intervention | | | | |
|-------------------|-----------------|----------------------|---|-----|-----|-----|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 0.5 | 1.9 | 3.9 | 4.2 | 25.7 |
| 2 | AFR-E | 481 | 0.6 | 2.2 | 4.5 | 4.8 | 25.4 |
| 3 | AMR-A | 356 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | AMR-B | 531 | 0.3 | 1.2 | 2.4 | 3.0 | 22.2 |
| 5 | AMR-D | 93 | 0.4 | 1.7 | 3.4 | 4.0 | 25.0 |
| 6 | EMR-B | 184 | 0.1 | 0.5 | 1.1 | 1.4 | 17.8 |
| 7 | EMR-D | 189 | 0.2 | 0.9 | 1.7 | 2.0 | 21.5 |
| 8 | EUR-A | 413 | 0.0 | 0.3 | 0.5 | 0.6 | 1.6 |
| 9 | EUR-B1 | 176 | 0.2 | 0.8 | 1.5 | 2.0 | 19.0 |
| 10 | EUR-B2 | 62 | 0.2 | 0.8 | 1.6 | 1.9 | 20.4 |
| 11 | EUR-D | 223 | 0.0 | 0.3 | 0.6 | 1.2 | 18.9 |
| 12 | SEAR-B | 473 | 0.3 | 1.0 | 2.0 | 2.2 | 25.7 |
| 13 | SEAR-D | 1689 | 0.2 | 2.1 | 4.3 | 4.6 | 20.8 |
| 14 | WPR-A | 154 | 0.1 | 1.0 | 1.9 | 2.0 | 5.9 |
| 15 | WPR-B1 | 1488 | 0.3 | 2.2 | 4.4 | 4.7 | 18.9 |
| 16 | WPR-B2 | 176 | 0.5 | 1.9 | 3.7 | 4.0 | 25.2 |
| 17 | WPR-B3 | 9 | 0.7 | 1.4 | 2.9 | 3.2 | 23.6 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.7: Annual health sector treatment costs saved
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Annual health sector treatment costs saved (US\$m 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|-------|--------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 276 | 812 | 1'126 | 3'255 | 4'180 |
| 2 | AFR-E | 481 | 288 | 883 | 1'284 | 3'487 | 4'445 |
| 3 | AMR-A | 356 | 0 | 0 | 0 | 1 | 1 |
| 4 | AMR-B | 531 | 212 | 643 | 1'020 | 5'177 | 6'987 |
| 5 | AMR-D | 93 | 45 | 128 | 181 | 668 | 879 |
| 6 | EMR-B | 184 | 23 | 95 | 161 | 1'434 | 1'988 |
| 7 | EMR-D | 189 | 40 | 117 | 177 | 927 | 1'254 |
| 8 | EUR-A | 413 | 12 | 40 | 71 | 145 | 177 |
| 9 | EUR-B1 | 176 | 12 | 41 | 62 | 421 | 577 |
| 10 | EUR-B2 | 62 | 9 | 30 | 56 | 376 | 516 |
| 11 | EUR-D | 223 | 2 | 12 | 22 | 419 | 591 |
| 12 | SEAR-B | 473 | 109 | 318 | 463 | 2'156 | 2'893 |
| 13 | SEAR-D | 1689 | 262 | 1'431 | 2'654 | 7'869 | 10'172 |
| 14 | WPR-A | 154 | 20 | 72 | 133 | 278 | 343 |
| 15 | WPR-B1 | 1488 | 636 | 2'115 | 3'855 | 10'636 | 13'614 |
| 16 | WPR-B2 | 176 | 70 | 229 | 344 | 1'026 | 1'323 |
| 17 | WPR-B3 | 9 | 2 | 8 | 15 | 61 | 81 |
| WORLD | | 7183 | 2'020 | 6'975 | 11'624 | 38'337 | 50'022 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.8: Annual health sector treatment costs saved per capita
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Annual health sector treatment costs saved per capita (US\$m 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|------|------|------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 0.57 | 1.67 | 2.31 | 6.68 | 8.58 |
| 2 | AFR-E | 481 | 0.60 | 1.84 | 2.67 | 7.25 | 9.24 |
| 3 | AMR-A | 356 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4 | AMR-B | 531 | 0.40 | 1.21 | 1.92 | 9.75 | 13.16 |
| 5 | AMR-D | 93 | 0.48 | 1.38 | 1.95 | 7.19 | 9.47 |
| 6 | EMR-B | 184 | 0.13 | 0.51 | 0.88 | 7.78 | 10.79 |
| 7 | EMR-D | 189 | 0.21 | 0.62 | 0.94 | 4.91 | 6.64 |
| 8 | EUR-A | 413 | 0.03 | 0.10 | 0.17 | 0.35 | 0.43 |
| 9 | EUR-B1 | 176 | 0.07 | 0.23 | 0.36 | 2.40 | 3.29 |
| 10 | EUR-B2 | 62 | 0.14 | 0.49 | 0.90 | 6.05 | 8.30 |
| 11 | EUR-D | 223 | 0.01 | 0.05 | 0.10 | 1.88 | 2.66 |
| 12 | SEAR-B | 473 | 0.23 | 0.67 | 0.98 | 4.56 | 6.12 |
| 13 | SEAR-D | 1689 | 0.16 | 0.85 | 1.57 | 4.66 | 6.02 |
| 14 | WPR-A | 154 | 0.13 | 0.47 | 0.86 | 1.81 | 2.23 |
| 15 | WPR-B1 | 1488 | 0.43 | 1.42 | 2.59 | 7.15 | 9.15 |
| 16 | WPR-B2 | 176 | 0.40 | 1.31 | 1.96 | 5.85 | 7.54 |
| 17 | WPR-B3 | 9 | 0.17 | 0.92 | 1.58 | 6.57 | 8.74 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.9: Annual patient treatment costs saved
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Annual patient treatment costs saved (US\$m 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|-----|-----|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 18 | 53 | 73 | 212 | 273 |
| 2 | AFR-E | 481 | 18 | 54 | 79 | 215 | 274 |
| 3 | AMR-A | 356 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 531 | 6 | 18 | 28 | 142 | 192 |
| 5 | AMR-D | 93 | 2 | 6 | 8 | 30 | 40 |
| 6 | EMR-B | 184 | 1 | 3 | 4 | 39 | 55 |
| 7 | EMR-D | 189 | 2 | 6 | 9 | 47 | 64 |
| 8 | EUR-A | 413 | 0 | 1 | 2 | 4 | 4 |
| 9 | EUR-B1 | 176 | 0 | 1 | 2 | 14 | 19 |
| 10 | EUR-B2 | 62 | 0 | 1 | 2 | 12 | 17 |
| 11 | EUR-D | 223 | 0 | 0 | 1 | 12 | 17 |
| 12 | SEAR-B | 473 | 5 | 14 | 20 | 95 | 128 |
| 13 | SEAR-D | 1689 | 17 | 91 | 170 | 503 | 650 |
| 14 | WPR-A | 154 | 0 | 2 | 3 | 6 | 8 |
| 15 | WPR-B1 | 1488 | 25 | 82 | 149 | 411 | 526 |
| 16 | WPR-B2 | 176 | 3 | 9 | 13 | 40 | 51 |
| 17 | WPR-B3 | 9 | 0 | 0 | 1 | 2 | 3 |
| WORLD | | 7183 | 97 | 341 | 565 | 1'787 | 2'322 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.10: Annual patient treatment costs saved per capita
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Annual patient treatment costs saved per capita (US\$ 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|------|------|------|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 0.04 | 0.11 | 0.15 | 0.44 | 0.56 |
| 2 | AFR-E | 481 | 0.04 | 0.11 | 0.16 | 0.45 | 0.57 |
| 3 | AMR-A | 356 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4 | AMR-B | 531 | 0.01 | 0.03 | 0.05 | 0.27 | 0.36 |
| 5 | AMR-D | 93 | 0.02 | 0.06 | 0.09 | 0.33 | 0.43 |
| 6 | EMR-B | 184 | 0.00 | 0.01 | 0.02 | 0.21 | 0.30 |
| 7 | EMR-D | 189 | 0.01 | 0.03 | 0.05 | 0.25 | 0.34 |
| 8 | EUR-A | 413 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 |
| 9 | EUR-B1 | 176 | 0.00 | 0.01 | 0.01 | 0.08 | 0.11 |
| 10 | EUR-B2 | 62 | 0.00 | 0.02 | 0.03 | 0.20 | 0.27 |
| 11 | EUR-D | 223 | 0.00 | 0.00 | 0.00 | 0.06 | 0.08 |
| 12 | SEAR-B | 473 | 0.01 | 0.03 | 0.04 | 0.20 | 0.27 |
| 13 | SEAR-D | 1689 | 0.01 | 0.05 | 0.10 | 0.30 | 0.39 |
| 14 | WPR-A | 154 | 0.00 | 0.01 | 0.02 | 0.04 | 0.05 |
| 15 | WPR-B1 | 1488 | 0.02 | 0.05 | 0.10 | 0.28 | 0.35 |
| 16 | WPR-B2 | 176 | 0.02 | 0.05 | 0.08 | 0.23 | 0.29 |
| 17 | WPR-B3 | 9 | 0.01 | 0.04 | 0.06 | 0.25 | 0.34 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.11: Productive days gained due to less diarrhoeal illness
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Productive days gained due to less diarrhoeal illness (million days), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|-------|-------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 77 | 227 | 314 | 908 | 1'167 |
| 2 | AFR-E | 481 | 75 | 229 | 333 | 905 | 1'153 |
| 3 | AMR-A | 356 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 531 | 45 | 136 | 216 | 1'098 | 1'482 |
| 5 | AMR-D | 93 | 12 | 35 | 49 | 182 | 239 |
| 6 | EMR-B | 184 | 4 | 14 | 24 | 217 | 301 |
| 7 | EMR-D | 189 | 10 | 30 | 45 | 233 | 315 |
| 8 | EUR-A | 413 | 2 | 8 | 14 | 29 | 35 |
| 9 | EUR-B1 | 176 | 4 | 13 | 19 | 129 | 177 |
| 10 | EUR-B2 | 62 | 2 | 6 | 12 | 78 | 107 |
| 11 | EUR-D | 223 | 1 | 4 | 8 | 148 | 210 |
| 12 | SEAR-B | 473 | 33 | 96 | 140 | 654 | 878 |
| 13 | SEAR-D | 1689 | 117 | 641 | 1'189 | 3'525 | 4'557 |
| 14 | WPR-A | 154 | 4 | 13 | 25 | 52 | 64 |
| 15 | WPR-B1 | 1488 | 516 | 1'714 | 3'125 | 8'622 | 11'036 |
| 16 | WPR-B2 | 176 | 17 | 56 | 84 | 251 | 323 |
| 17 | WPR-B3 | 9 | 0 | 2 | 3 | 11 | 15 |
| WORLD | | 7183 | 919 | 3'225 | 5'600 | 17'043 | 22'059 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 2.12: Value of productive days gained due to less diarrhoeal illness

(predicted population growth until 2015)

| WHO Region Number | Region/ Country | Population (million) | Value of productive days gained due to less diarrhoeal illness (US\$m), by intervention | | | | |
|-------------------|-----------------|----------------------|---|-----|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 17 | 51 | 73 | 216 | 278 |
| 2 | AFR-E | 481 | 21 | 65 | 95 | 256 | 327 |
| 3 | AMR-A | 356 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 531 | 22 | 66 | 103 | 536 | 725 |
| 5 | AMR-D | 93 | 4 | 11 | 16 | 56 | 73 |
| 6 | EMR-B | 184 | 4 | 15 | 27 | 245 | 340 |
| 7 | EMR-D | 189 | 9 | 25 | 39 | 153 | 202 |
| 8 | EUR-A | 413 | 0 | 2 | 3 | 6 | 7 |
| 9 | EUR-B1 | 176 | 2 | 7 | 11 | 67 | 92 |
| 10 | EUR-B2 | 62 | 1 | 2 | 4 | 27 | 37 |
| 11 | EUR-D | 223 | 0 | 1 | 2 | 33 | 46 |
| 12 | SEAR-B | 473 | 6 | 17 | 26 | 169 | 231 |
| 13 | SEAR-D | 1689 | 26 | 124 | 223 | 648 | 835 |
| 14 | WPR-A | 154 | 17 | 63 | 116 | 244 | 301 |
| 15 | WPR-B1 | 1488 | 74 | 263 | 482 | 1'472 | 1'906 |
| 16 | WPR-B2 | 176 | 7 | 20 | 30 | 78 | 99 |
| 17 | WPR-B3 | 9 | 0 | 1 | 2 | 6 | 8 |
| WORLD | | 7183 | 210 | 737 | 1'252 | 4'212 | 5'508 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.13: School days gained due to less diarrhoeal illness
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Pop. (m) | School days gained due to less diarrhoeal illness (‘000 days), by intervention | | | | |
|-------------------------|--------------------|-------------|---|---------|---------|-----------|-----------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 16'541 | 48'591 | 67'394 | 194'837 | 250'223 |
| 2 | AFR-E | 481 | 16'473 | 50'437 | 73'313 | 199'158 | 253'890 |
| 3 | AMR-A | 356 | 1 | 1 | 2 | 3 | 4 |
| 4 | AMR-B | 531 | 7'951 | 24'074 | 38'208 | 193'843 | 261'619 |
| 5 | AMR-D | 93 | 2'808 | 8'042 | 11'413 | 42'062 | 55'392 |
| 6 | EMR-B | 184 | 547 | 2'214 | 3'773 | 33'514 | 46'465 |
| 7 | EMR-D | 189 | 1'511 | 4'389 | 6'614 | 34'636 | 46'831 |
| 8 | EUR-A | 413 | 52 | 166 | 297 | 602 | 737 |
| 9 | EUR-B1 | 176 | 118 | 398 | 605 | 4'087 | 5'600 |
| 10 | EUR-B2 | 62 | 244 | 869 | 1'594 | 10'772 | 14'775 |
| 11 | EUR-D | 223 | 21 | 109 | 203 | 3'817 | 5'390 |
| 12 | SEAR-B | 473 | 2'975 | 8'708 | 12'682 | 59'116 | 79'314 |
| 13 | SEAR-D | 1689 | 12'422 | 67'813 | 125'790 | 372'988 | 482'135 |
| 14 | WPR-A | 154 | 70 | 252 | 463 | 970 | 1'195 |
| 15 | WPR-B1 | 1488 | 15'101 | 50'204 | 91'513 | 252'485 | 323'174 |
| 16 | WPR-B2 | 176 | 1'838 | 6'015 | 9'014 | 26'916 | 34'705 |
| 17 | WPR-B3 | 9 | 36 | 198 | 340 | 1'418 | 1'886 |
| WORLD | | 7183 | 78'708 | 272'482 | 443'219 | 1'431'223 | 1'863'335 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.14: Baby days gained due to less diarrhoeal illness
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Baby days gained due to less diarrhoeal illness (million days) , by intervention | | | | |
|-------------------------|--------------------|-------------------------|--|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 98 | 287 | 398 | 1'151 | 1'478 |
| 2 | AFR-E | 481 | 96 | 295 | 429 | 1'166 | 1'486 |
| 3 | AMR-A | 356 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 531 | 22 | 68 | 107 | 544 | 734 |
| 5 | AMR-D | 93 | 9 | 24 | 35 | 128 | 168 |
| 6 | EMR-B | 184 | 3 | 14 | 23 | 205 | 285 |
| 7 | EMR-D | 189 | 11 | 33 | 50 | 263 | 356 |
| 8 | EUR-A | 413 | 1 | 2 | 4 | 8 | 10 |
| 9 | EUR-B1 | 176 | 2 | 7 | 11 | 71 | 98 |
| 10 | EUR-B2 | 62 | 1 | 5 | 9 | 61 | 84 |
| 11 | EUR-D | 223 | 0 | 2 | 3 | 56 | 78 |
| 12 | SEAR-B | 473 | 25 | 74 | 108 | 503 | 675 |
| 13 | SEAR-D | 1689 | 84 | 460 | 854 | 2'531 | 3'272 |
| 14 | WPR-A | 154 | 1 | 4 | 7 | 14 | 18 |
| 15 | WPR-B1 | 1488 | 43 | 143 | 261 | 720 | 922 |
| 16 | WPR-B2 | 176 | 14 | 47 | 70 | 210 | 271 |
| 17 | WPR-B3 | 9 | 0 | 2 | 3 | 14 | 18 |
| WORLD | | 7183 | 413 | 1'467 | 2'372 | 7'646 | 9'953 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 2.15: Annual time gain due to more convenient water supply and sanitation facilities

(predicted population growth until 2015)

| WHO Region Number | Region/ Country | Population (million) | Annual time gain (million hours saved) , by intervention | | | | |
|-------------------|-----------------|----------------------|---|---------|---------|---------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 4'085 | 21'593 | 46'242 | 46'242 | 107'853 |
| 2 | AFR-E | 481 | 4'925 | 26'034 | 52'202 | 52'202 | 106'603 |
| 3 | AMR-A | 356 | 2 | 9 | 18 | 18 | 22 |
| 4 | AMR-B | 531 | 1'688 | 8'924 | 25'470 | 25'470 | 57'345 |
| 5 | AMR-D | 93 | 483 | 2'553 | 6'261 | 6'261 | 14'042 |
| 6 | EMR-B | 184 | 405 | 2'140 | 5'248 | 5'248 | 25'061 |
| 7 | EMR-D | 189 | 565 | 2'986 | 8'423 | 8'423 | 30'593 |
| 8 | EUR-A | 413 | 216 | 1'142 | 4'697 | 4'697 | 5'191 |
| 9 | EUR-B1 | 176 | 567 | 2'995 | 5'811 | 5'811 | 14'661 |
| 10 | EUR-B2 | 62 | 220 | 1'164 | 2'628 | 2'628 | 9'883 |
| 11 | EUR-D | 223 | 104 | 550 | 3'040 | 3'040 | 12'916 |
| 12 | SEAR-B | 473 | 1'997 | 10'558 | 24'177 | 24'177 | 105'983 |
| 13 | SEAR-D | 1689 | 4'640 | 24'525 | 205'016 | 205'016 | 292'445 |
| 14 | WPR-A | 154 | 308 | 1'627 | 8'107 | 8'107 | 8'810 |
| 15 | WPR-B1 | 1488 | 7'661 | 40'491 | 180'047 | 180'047 | 160'003 |
| 16 | WPR-B2 | 176 | 1'556 | 8'223 | 16'682 | 16'682 | 39'496 |
| 17 | WPR-B3 | 9 | 100 | 531 | 626 | 626 | 1'728 |
| WORLD | | 7183 | 29'522 | 156'045 | 594'695 | 594'695 | 992'634 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.16: Annual value of time savings
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Annual value of time savings per capita (US\$m 2000) , by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|--------|---------|---------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 1'184 | 6'258 | 14'414 | 14'414 | 32'495 |
| 2 | AFR-E | 481 | 1'820 | 9'619 | 19'558 | 19'558 | 39'798 |
| 3 | AMR-A | 356 | 7 | 35 | 71 | 71 | 86 |
| 4 | AMR-B | 531 | 1'117 | 5'902 | 15'859 | 15'859 | 36'987 |
| 5 | AMR-D | 93 | 212 | 1'122 | 2'649 | 2'649 | 5'825 |
| 6 | EMR-B | 184 | 571 | 3'017 | 7'677 | 7'677 | 36'807 |
| 7 | EMR-D | 189 | 632 | 3'343 | 9'899 | 9'899 | 24'783 |
| 8 | EUR-A | 413 | 51 | 268 | 1'328 | 1'328 | 1'444 |
| 9 | EUR-B1 | 176 | 419 | 2'213 | 4'367 | 4'367 | 9'831 |
| 10 | EUR-B2 | 62 | 95 | 500 | 1'260 | 1'260 | 4'430 |
| 11 | EUR-D | 223 | 42 | 224 | 901 | 901 | 4'418 |
| 12 | SEAR-B | 473 | 563 | 2'977 | 5'966 | 5'966 | 33'338 |
| 13 | SEAR-D | 1689 | 1'330 | 7'028 | 49'128 | 49'128 | 71'531 |
| 14 | WPR-A | 154 | 1'903 | 10'058 | 50'256 | 50'256 | 54'606 |
| 15 | WPR-B1 | 1488 | 1'448 | 7'656 | 37'357 | 37'357 | 31'894 |
| 16 | WPR-B2 | 176 | 555 | 2'936 | 8'007 | 8'007 | 15'914 |
| 17 | WPR-B3 | 9 | 74 | 391 | 461 | 461 | 1'272 |
| WORLD | | 7183 | 12'022 | 63'547 | 229'158 | 229'158 | 405'457 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 2.17: Value of averted deaths per capita (predicted future earnings)

(predicted population growth until 2015)

| WHO Region Number | Region/ Country | Population (million) | Value of averted deaths per capita (US\$m 2000) , by intervention | | | | |
|-------------------|-----------------|----------------------|---|-------|-------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 279 | 830 | 1'174 | 3'496 | 4'505 |
| 2 | AFR-E | 481 | 326 | 990 | 1'433 | 3'818 | 4'855 |
| 3 | AMR-A | 356 | 5 | 15 | 26 | 109 | 146 |
| 4 | AMR-B | 531 | 22 | 67 | 105 | 549 | 743 |
| 5 | AMR-D | 93 | 12 | 35 | 52 | 176 | 231 |
| 6 | EMR-B | 184 | 19 | 72 | 119 | 1'009 | 1'396 |
| 7 | EMR-D | 189 | 39 | 113 | 165 | 882 | 1'193 |
| 8 | EUR-A | 413 | 41 | 123 | 200 | 546 | 698 |
| 9 | EUR-B1 | 176 | 7 | 22 | 32 | 192 | 262 |
| 10 | EUR-B2 | 62 | 2 | 7 | 13 | 49 | 64 |
| 11 | EUR-D | 223 | 0 | 0 | 0 | 40 | 58 |
| 12 | SEAR-B | 473 | 10 | 28 | 40 | 224 | 304 |
| 13 | SEAR-D | 1689 | 205 | 1'023 | 1'826 | 5'149 | 6'615 |
| 14 | WPR-A | 154 | 27 | 108 | 200 | 798 | 1'060 |
| 15 | WPR-B1 | 1488 | 5 | 17 | 30 | 85 | 108 |
| 16 | WPR-B2 | 176 | 36 | 108 | 164 | 420 | 532 |
| 17 | WPR-B3 | 9 | 1 | 3 | 6 | 25 | 33 |
| WORLD | | 7183 | 1'035 | 3'560 | 5'585 | 17'566 | 22'803 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.18: Total economic benefits of interventions
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Total economic benefits of interventions (US\$m 2000) , by intervention | | | | |
|-------------------------|--------------------|-------------------------|--|--------|---------|---------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 2'256 | 9'433 | 18'883 | 27'583 | 49'448 |
| 2 | AFR-E | 481 | 3'084 | 13'475 | 25'153 | 34'631 | 58'993 |
| 3 | AMR-A | 356 | 12 | 51 | 99 | 183 | 235 |
| 4 | AMR-B | 531 | 1'817 | 8'028 | 19'198 | 33'055 | 60'216 |
| 5 | AMR-D | 93 | 382 | 1'607 | 3'334 | 5'074 | 9'007 |
| 6 | EMR-B | 184 | 688 | 3'505 | 8'523 | 15'355 | 47'461 |
| 7 | EMR-D | 189 | 900 | 4'125 | 11'093 | 15'036 | 31'637 |
| 8 | EUR-A | 413 | 107 | 439 | 1'614 | 2'050 | 2'357 |
| 9 | EUR-B1 | 176 | 454 | 2'329 | 4'540 | 5'459 | 11'323 |
| 10 | EUR-B2 | 62 | 118 | 582 | 1'410 | 2'199 | 5'714 |
| 11 | EUR-D | 223 | 46 | 242 | 934 | 1'551 | 5'337 |
| 12 | SEAR-B | 473 | 767 | 3'579 | 6'846 | 10'785 | 39'869 |
| 13 | SEAR-D | 1689 | 2'201 | 11'457 | 57'155 | 72'478 | 101'643 |
| 14 | WPR-A | 154 | 2'024 | 10'509 | 51'086 | 52'375 | 57'292 |
| 15 | WPR-B1 | 1488 | 2'436 | 11'013 | 43'487 | 54'885 | 54'426 |
| 16 | WPR-B2 | 176 | 772 | 3'604 | 9'012 | 10'735 | 19'393 |
| 17 | WPR-B3 | 9 | 79 | 420 | 512 | 672 | 1'553 |
| WORLD | | 7183 | 18'143 | 84'400 | 262'879 | 344'106 | 555'901 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.19: Cost-benefit ratios – all costs and all benefits
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Cost-benefit ratio, by intervention | | | | |
|-------------------------|--------------------|-------------------------|-------------------------------------|--------|--------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 10.14 | 9.96 | 9.97 | 13.43 | 3.95 |
| 2 | AFR-E | 481 | 11.50 | 12.54 | 11.71 | 15.02 | 4.84 |
| 3 | AMR-A | 356 | 90.09 | 112.67 | 107.99 | 191.05 | 104.16 |
| 4 | AMR-B | 531 | 13.63 | 12.72 | 15.21 | 21.07 | 5.12 |
| 5 | AMR-D | 93 | 10.01 | 10.21 | 10.59 | 13.77 | 3.88 |
| 6 | EMR-B | 184 | 28.30 | 34.95 | 42.50 | 61.47 | 14.49 |
| 7 | EMR-D | 189 | 27.45 | 25.36 | 34.10 | 39.27 | 7.80 |
| 8 | EUR-A | 413 | 6.36 | 3.96 | 7.28 | 8.74 | 3.59 |
| 9 | EUR-B1 | 176 | 11.61 | 17.18 | 16.74 | 15.76 | 3.39 |
| 10 | EUR-B2 | 62 | 8.79 | 11.46 | 13.89 | 18.64 | 4.52 |
| 11 | EUR-D | 223 | 6.03 | 3.40 | 6.55 | 5.82 | 1.27 |
| 12 | SEAR-B | 473 | 6.32 | 7.67 | 7.34 | 10.19 | 3.28 |
| 13 | SEAR-D | 1689 | 7.81 | 3.16 | 7.88 | 9.41 | 2.90 |
| 14 | WPR-A | 154 | 108.29 | 71.61 | 174.04 | 172.05 | 63.64 |
| 15 | WPR-B1 | 1488 | 5.24 | 3.36 | 6.63 | 7.89 | 1.93 |
| 16 | WPR-B2 | 176 | 8.17 | 11.04 | 13.80 | 15.35 | 4.39 |
| 17 | WPR-B3 | 9 | 12.99 | 31.43 | 19.13 | 23.02 | 7.12 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 2.20: Cost-benefit ratios – all costs, time saving benefits only
(predicted population growth until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Cost-benefit ratio, by intervention | | | | |
|-------------------------|--------------------|-------------------------|-------------------------------------|-------|--------|--------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 5.32 | 6.61 | 7.61 | 7.02 | 2.59 |
| 2 | AFR-E | 481 | 6.79 | 8.95 | 9.10 | 8.48 | 3.26 |
| 3 | AMR-A | 356 | 50.63 | 77.65 | 77.65 | 73.96 | 38.16 |
| 4 | AMR-B | 531 | 8.38 | 9.35 | 12.57 | 10.11 | 3.14 |
| 5 | AMR-D | 93 | 5.56 | 7.12 | 8.41 | 7.19 | 2.51 |
| 6 | EMR-B | 184 | 23.48 | 30.09 | 38.28 | 30.73 | 11.24 |
| 7 | EMR-D | 189 | 19.28 | 20.55 | 30.44 | 25.85 | 6.11 |
| 8 | EUR-A | 413 | 3.02 | 2.42 | 5.99 | 5.66 | 2.20 |
| 9 | EUR-B1 | 176 | 10.71 | 16.32 | 16.10 | 12.61 | 2.95 |
| 10 | EUR-B2 | 62 | 7.07 | 9.84 | 12.40 | 10.68 | 3.51 |
| 11 | EUR-D | 223 | 5.54 | 3.14 | 6.32 | 3.38 | 1.05 |
| 12 | SEAR-B | 473 | 4.64 | 6.38 | 6.40 | 5.64 | 2.74 |
| 13 | SEAR-D | 1689 | 4.72 | 1.94 | 6.77 | 6.38 | 2.04 |
| 14 | WPR-A | 154 | 101.80 | 68.53 | 171.21 | 165.09 | 60.66 |
| 15 | WPR-B1 | 1488 | 3.11 | 2.33 | 5.69 | 5.37 | 1.13 |
| 16 | WPR-B2 | 176 | 5.88 | 8.99 | 12.26 | 11.45 | 3.60 |
| 17 | WPR-B3 | 9 | 12.12 | 29.22 | 17.23 | 15.78 | 5.83 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 2.21: Cost-benefit ratios - high cost and low benefit assumptions

(predicted population growth until 2015)

| WHO Region Number | Region/ Country | Population (million) | Cost-benefit ratio, by intervention | | | | |
|-------------------|-----------------|----------------------|-------------------------------------|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 487 | 1.52 | 1.96 | 2.04 | 2.63 | 0.92 |
| 2 | AFR-E | 481 | 1.75 | 2.50 | 2.39 | 2.93 | 1.13 |
| 3 | AMR-A | 356 | 22.47 | 31.05 | 29.34 | 67.84 | 43.90 |
| 4 | AMR-B | 531 | 1.60 | 2.20 | 2.88 | 3.05 | 0.93 |
| 5 | AMR-D | 93 | 1.17 | 1.75 | 1.97 | 2.15 | 0.76 |
| 6 | EMR-B | 184 | 4.39 | 7.24 | 9.02 | 11.23 | 3.33 |
| 7 | EMR-D | 189 | 4.10 | 5.20 | 7.30 | 8.13 | 1.85 |
| 8 | EUR-A | 413 | 1.45 | 1.05 | 1.76 | 2.40 | 1.14 |
| 9 | EUR-B1 | 176 | 1.88 | 3.64 | 3.56 | 3.50 | 0.83 |
| 10 | EUR-B2 | 62 | 1.29 | 2.30 | 2.87 | 3.05 | 0.98 |
| 11 | EUR-D | 223 | 0.93 | 0.71 | 1.43 | 1.18 | 0.29 |
| 12 | SEAR-B | 473 | 0.85 | 1.49 | 1.47 | 1.64 | 0.75 |
| 13 | SEAR-D | 1689 | 1.16 | 0.63 | 1.75 | 1.97 | 0.66 |
| 14 | WPR-A | 154 | 17.86 | 16.21 | 40.16 | 40.43 | 16.61 |
| 15 | WPR-B1 | 1488 | 0.57 | 0.56 | 1.34 | 1.35 | 0.33 |
| 16 | WPR-B2 | 176 | 1.21 | 2.21 | 2.89 | 3.04 | 1.03 |
| 17 | WPR-B3 | 9 | 2.08 | 6.39 | 3.76 | 4.19 | 1.68 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Appendix A 3: Detailed cost-benefit results under constant population size from year 2000 until 2015

**Table A 3.1: Number of people receiving improvements
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Population (m) receiving interventions | | | | |
|-------------------|-----------------|----------------------|--|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 65 | 135 | 153 | 335 | 335 |
| 2 | AFR-E | 346 | 80 | 160 | 193 | 346 | 346 |
| 3 | AMR-A | 314 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 442 | 33 | 83 | 105 | 442 | 442 |
| 5 | AMR-D | 71 | 9 | 20 | 23 | 71 | 71 |
| 6 | EMR-B | 139 | 7 | 17 | 25 | 139 | 139 |
| 7 | EMR-D | 139 | 9 | 22 | 27 | 139 | 139 |
| 8 | EUR-A | 412 | 5 | 17 | 23 | 23 | 23 |
| 9 | EUR-B1 | 166 | 12 | 25 | 31 | 166 | 166 |
| 10 | EUR-B2 | 52 | 4 | 10 | 15 | 52 | 52 |
| 11 | EUR-D | 243 | 3 | 11 | 18 | 243 | 243 |
| 12 | SEAR-B | 396 | 40 | 86 | 103 | 396 | 396 |
| 13 | SEAR-D | 1335 | 84 | 511 | 854 | 1'335 | 1'335 |
| 14 | WPR-A | 150 | 7 | 28 | 41 | 41 | 41 |
| 15 | WPR-B1 | 1354 | 164 | 574 | 821 | 1'354 | 1'354 |
| 16 | WPR-B2 | 144 | 30 | 60 | 74 | 144 | 144 |
| 17 | WPR-B3 | 7 | 2 | 3 | 4 | 7 | 7 |
| WORLD | | 6045 | 553 | 1'761 | 2'510 | 5'233 | 5'233 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.2: Annual number of diarrhoeal cases averted
(population remains stable from year 2000 until 2015)**

| Region Number | Region/Country | Pop. (m) | Cases diarrhoea (m) | Number of cases averted per year ('000s), by intervention | | | | |
|---------------|----------------|----------|---------------------|---|---------|---------|-----------|-----------|
| | | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 424 | 19'359 | 57'033 | 79'196 | 232'362 | 298'931 |
| 2 | AFR-E | 346 | 440 | 19'666 | 60'208 | 87'369 | 243'994 | 312'106 |
| 3 | AMR-A | 314 | 21 | 2 | 6 | 8 | 14 | 16 |
| 4 | AMR-B | 442 | 382 | 7'815 | 23'649 | 37'503 | 190'199 | 256'695 |
| 5 | AMR-D | 71 | 72 | 2'544 | 7'276 | 10'304 | 37'533 | 49'376 |
| 6 | EMR-B | 139 | 101 | 832 | 3'314 | 5'630 | 47'934 | 66'359 |
| 7 | EMR-D | 139 | 112 | 2'259 | 6'539 | 9'751 | 55'015 | 74'710 |
| 8 | EUR-A | 412 | 28 | 279 | 893 | 1'590 | 3'226 | 3'948 |
| 9 | EUR-B1 | 166 | 43 | 643 | 2'117 | 3'204 | 21'046 | 28'804 |
| 10 | EUR-B2 | 52 | 35 | 391 | 1'394 | 2'558 | 16'785 | 22'991 |
| 11 | EUR-D | 243 | 47 | 125 | 627 | 1'165 | 21'657 | 30'578 |
| 12 | SEAR-B | 396 | 254 | 6'468 | 18'941 | 27'586 | 128'308 | 172'119 |
| 13 | SEAR-D | 1335 | 1178 | 20'746 | 115'610 | 215'662 | 638'486 | 825'233 |
| 14 | WPR-A | 150 | 16 | 411 | 1'491 | 2'737 | 5'739 | 7'069 |
| 15 | WPR-B1 | 1354 | 1085 | 35'874 | 119'284 | 217'446 | 600'062 | 768'083 |
| 16 | WPR-B2 | 144 | 96 | 3'501 | 11'491 | 17'276 | 52'063 | 67'198 |
| 17 | WPR-B3 | 7 | 5 | 76 | 400 | 675 | 2'787 | 3'704 |
| WORLD | | 6045 | 4342 | 120'991 | 430'275 | 719'660 | 2'297'209 | 2'987'920 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.3: Annual number of diarrhoeal cases averted per capita
(population remains stable from year 2000 until 2015)**

| Region Number | Region/Country | Pop. (m) | Number of cases averted per capita per year, by intervention | | | | |
|---------------|----------------|----------|--|------|------|------|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 0.06 | 0.17 | 0.24 | 0.69 | 0.89 |
| 2 | AFR-E | 346 | 0.06 | 0.17 | 0.25 | 0.71 | 0.90 |
| 3 | AMR-A | 314 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4 | AMR-B | 442 | 0.02 | 0.05 | 0.08 | 0.43 | 0.58 |
| 5 | AMR-D | 71 | 0.04 | 0.10 | 0.14 | 0.53 | 0.69 |
| 6 | EMR-B | 139 | 0.01 | 0.02 | 0.04 | 0.34 | 0.48 |
| 7 | EMR-D | 139 | 0.02 | 0.05 | 0.07 | 0.40 | 0.54 |
| 8 | EUR-A | 412 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 |
| 9 | EUR-B1 | 166 | 0.00 | 0.01 | 0.02 | 0.13 | 0.17 |
| 10 | EUR-B2 | 52 | 0.01 | 0.03 | 0.05 | 0.32 | 0.44 |
| 11 | EUR-D | 243 | 0.00 | 0.00 | 0.00 | 0.09 | 0.13 |
| 12 | SEAR-B | 396 | 0.02 | 0.05 | 0.07 | 0.32 | 0.43 |
| 13 | SEAR-D | 1335 | 0.02 | 0.09 | 0.16 | 0.48 | 0.62 |
| 14 | WPR-A | 150 | 0.00 | 0.01 | 0.02 | 0.04 | 0.05 |
| 15 | WPR-B1 | 1354 | 0.03 | 0.09 | 0.16 | 0.44 | 0.57 |
| 16 | WPR-B2 | 144 | 0.02 | 0.08 | 0.12 | 0.36 | 0.47 |
| 17 | WPR-B3 | 7 | 0.01 | 0.06 | 0.10 | 0.41 | 0.54 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.4: Total annual cost of interventions
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Total annual cost of interventions (US\$m Year 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|--|-------|--------|--------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 150 | 637 | 1'275 | 1'384 | 8'567 |
| 2 | AFR-E | 346 | 186 | 739 | 1'478 | 1'591 | 8'809 |
| 3 | AMR-A | 314 | 0 | 0 | 1 | 1 | 2 |
| 4 | AMR-B | 442 | 111 | 525 | 1'050 | 1'306 | 9'792 |
| 5 | AMR-D | 71 | 30 | 123 | 245 | 286 | 1'774 |
| 6 | EMR-B | 139 | 18 | 78 | 157 | 194 | 2'480 |
| 7 | EMR-D | 139 | 22 | 109 | 219 | 261 | 2'994 |
| 8 | EUR-A | 412 | 17 | 110 | 220 | 232 | 649 |
| 9 | EUR-B1 | 166 | 37 | 133 | 265 | 339 | 3'195 |
| 10 | EUR-B2 | 52 | 11 | 44 | 88 | 102 | 1'064 |
| 11 | EUR-D | 243 | 8 | 78 | 157 | 292 | 4'594 |
| 12 | SEAR-B | 396 | 102 | 392 | 784 | 889 | 10'206 |
| 13 | SEAR-D | 1335 | 217 | 2'882 | 5'765 | 6'118 | 27'658 |
| 14 | WPR-A | 150 | 19 | 146 | 292 | 303 | 897 |
| 15 | WPR-B1 | 1354 | 423 | 2'984 | 5'969 | 6'327 | 25'587 |
| 16 | WPR-B2 | 144 | 77 | 265 | 530 | 568 | 3'640 |
| 17 | WPR-B3 | 7 | 4 | 10 | 20 | 22 | 160 |
| WORLD | | 6045 | 1'432 | 9'257 | 18'514 | 20'217 | 112'069 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.5: Annual cost per person receiving interventions
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Cost per capita per year (US\$ Year 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|-----|------|------|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 2.3 | 4.7 | 8.3 | 4.1 | 25.6 |
| 2 | AFR-E | 346 | 2.3 | 4.6 | 7.7 | 4.6 | 25.5 |
| 3 | AMR-A | 314 | 3.4 | 5.8 | 11.6 | 12.2 | 28.7 |
| 4 | AMR-B | 442 | 3.4 | 6.3 | 10.0 | 3.0 | 22.1 |
| 5 | AMR-D | 71 | 3.4 | 6.1 | 10.8 | 4.0 | 24.9 |
| 6 | EMR-B | 139 | 2.6 | 4.7 | 6.3 | 1.4 | 17.8 |
| 7 | EMR-D | 139 | 2.5 | 4.9 | 8.2 | 1.9 | 21.5 |
| 8 | EUR-A | 412 | 3.3 | 6.6 | 9.5 | 10.1 | 28.2 |
| 9 | EUR-B1 | 166 | 3.0 | 5.3 | 8.6 | 2.0 | 19.2 |
| 10 | EUR-B2 | 52 | 2.6 | 4.6 | 5.7 | 1.9 | 20.3 |
| 11 | EUR-D | 243 | 3.1 | 7.0 | 8.5 | 1.2 | 18.9 |
| 12 | SEAR-B | 396 | 2.6 | 4.6 | 7.6 | 2.2 | 25.8 |
| 13 | SEAR-D | 1335 | 2.6 | 5.6 | 6.7 | 4.6 | 20.7 |
| 14 | WPR-A | 150 | 2.6 | 5.3 | 7.1 | 7.4 | 21.9 |
| 15 | WPR-B1 | 1354 | 2.6 | 5.2 | 7.3 | 4.7 | 18.9 |
| 16 | WPR-B2 | 144 | 2.6 | 4.4 | 7.2 | 3.9 | 25.2 |
| 17 | WPR-B3 | 7 | 2.6 | 3.8 | 5.4 | 3.2 | 23.5 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 3.6: Annual cost per capita (entire population) of interventions (population remains stable from year 2000 until 2015)

| WHO Region Number | Region/ Country | Population (million) | Annual cost per capita (entire population) (US\$ 2000), by intervention | | | | |
|-------------------|-----------------|----------------------|---|-----|-----|-----|------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 6.3 | 0.4 | 1.9 | 3.8 | 4.1 | 25.6 |
| 2 | AFR-E | 30.7 | 0.5 | 2.1 | 4.3 | 4.6 | 25.5 |
| 3 | AMR-A | 30.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4 | AMR-B | 98.9 | 0.3 | 1.2 | 2.4 | 3.0 | 22.1 |
| 5 | AMR-D | 12.6 | 0.4 | 1.7 | 3.4 | 4.0 | 24.9 |
| 6 | EMR-B | 3.5 | 0.1 | 0.6 | 1.1 | 1.4 | 17.8 |
| 7 | EMR-D | 67.9 | 0.2 | 0.8 | 1.6 | 1.9 | 21.5 |
| 8 | EUR-A | 15.9 | 0.0 | 0.3 | 0.5 | 0.6 | 1.6 |
| 9 | EUR-B1 | 38.6 | 0.2 | 0.8 | 1.6 | 2.0 | 19.2 |
| 10 | EUR-B2 | 4.9 | 0.2 | 0.8 | 1.7 | 1.9 | 20.3 |
| 11 | EUR-D | 145.5 | 0.0 | 0.3 | 0.6 | 1.2 | 18.9 |
| 12 | SEAR-B | 62.8 | 0.3 | 1.0 | 2.0 | 2.2 | 25.8 |
| 13 | SEAR-D | 23.0 | 0.2 | 2.2 | 4.3 | 4.6 | 20.7 |
| 14 | WPR-A | 3.8 | 0.1 | 1.0 | 1.9 | 2.0 | 6.0 |
| 15 | WPR-B1 | 1'282.4 | 0.3 | 2.2 | 4.4 | 4.7 | 18.9 |
| 16 | WPR-B2 | 78.1 | 0.5 | 1.8 | 3.7 | 3.9 | 25.2 |
| 17 | WPR-B3 | 4.8 | 0.7 | 1.4 | 2.9 | 3.2 | 23.5 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.7: Annual patient treatment costs saved
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Annual patient treatment costs saved per capita (US\$m 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|-----|-----|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 12 | 36 | 49 | 145 | 186 |
| 2 | AFR-E | 346 | 12 | 38 | 54 | 152 | 194 |
| 3 | AMR-A | 314 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 442 | 5 | 15 | 23 | 118 | 160 |
| 5 | AMR-D | 71 | 2 | 5 | 6 | 23 | 31 |
| 6 | EMR-B | 139 | 1 | 2 | 4 | 30 | 41 |
| 7 | EMR-D | 139 | 1 | 4 | 6 | 34 | 47 |
| 8 | EUR-A | 412 | 0 | 1 | 2 | 4 | 4 |
| 9 | EUR-B1 | 166 | 0 | 1 | 2 | 13 | 18 |
| 10 | EUR-B2 | 52 | 0 | 1 | 2 | 10 | 14 |
| 11 | EUR-D | 243 | 0 | 0 | 1 | 13 | 19 |
| 12 | SEAR-B | 396 | 4 | 12 | 17 | 80 | 107 |
| 13 | SEAR-D | 1335 | 13 | 72 | 134 | 398 | 514 |
| 14 | WPR-A | 150 | 0 | 2 | 3 | 6 | 8 |
| 15 | WPR-B1 | 1354 | 22 | 74 | 135 | 374 | 479 |
| 16 | WPR-B2 | 144 | 2 | 7 | 11 | 32 | 42 |
| 17 | WPR-B3 | 7 | 0 | 0 | 0 | 2 | 2 |
| WORLD | | 6045 | 76 | 269 | 450 | 1'436 | 1'867 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.8: Annual health sector treatment costs saved
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Annual health sector treatment costs saved (US\$m Year 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|-------|-------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 185 | 544 | 756 | 2'218 | 2'854 |
| 2 | AFR-E | 346 | 199 | 608 | 883 | 2'465 | 3'153 |
| 3 | AMR-A | 314 | 0 | 0 | 0 | 1 | 1 |
| 4 | AMR-B | 442 | 177 | 536 | 850 | 4'310 | 5'817 |
| 5 | AMR-D | 71 | 35 | 100 | 141 | 515 | 677 |
| 6 | EMR-B | 139 | 19 | 75 | 128 | 1'088 | 1'506 |
| 7 | EMR-D | 139 | 28 | 80 | 119 | 672 | 912 |
| 8 | EUR-A | 412 | 12 | 39 | 70 | 143 | 175 |
| 9 | EUR-B1 | 166 | 12 | 40 | 61 | 400 | 548 |
| 10 | EUR-B2 | 52 | 7 | 27 | 49 | 319 | 437 |
| 11 | EUR-D | 243 | 3 | 13 | 25 | 458 | 646 |
| 12 | SEAR-B | 396 | 91 | 267 | 388 | 1'807 | 2'424 |
| 13 | SEAR-D | 1335 | 202 | 1'127 | 2'101 | 6'221 | 8'041 |
| 14 | WPR-A | 150 | 20 | 72 | 132 | 277 | 342 |
| 15 | WPR-B1 | 1354 | 578 | 1'923 | 3'506 | 9'675 | 12'384 |
| 16 | WPR-B2 | 144 | 56 | 185 | 279 | 839 | 1'083 |
| 17 | WPR-B3 | 7 | 1 | 6 | 11 | 45 | 60 |
| WORLD | | 6045 | 1'626 | 5'644 | 9'499 | 31'453 | 41'060 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.9: Annual health sector treatment costs saved per capita
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Annual health sector treatment costs saved per capita (US\$ 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|--|------|------|------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 0.55 | 1.63 | 2.26 | 6.63 | 8.53 |
| 2 | AFR-E | 346 | 0.58 | 1.76 | 2.55 | 7.14 | 9.13 |
| 3 | AMR-A | 314 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4 | AMR-B | 442 | 0.40 | 1.21 | 1.92 | 9.75 | 13.16 |
| 5 | AMR-D | 71 | 0.49 | 1.40 | 1.98 | 7.23 | 9.51 |
| 6 | EMR-B | 139 | 0.14 | 0.54 | 0.92 | 7.82 | 10.83 |
| 7 | EMR-D | 139 | 0.20 | 0.57 | 0.86 | 4.83 | 6.56 |
| 8 | EUR-A | 412 | 0.03 | 0.10 | 0.17 | 0.35 | 0.42 |
| 9 | EUR-B1 | 166 | 0.07 | 0.24 | 0.37 | 2.41 | 3.30 |
| 10 | EUR-B2 | 52 | 0.14 | 0.51 | 0.93 | 6.08 | 8.33 |
| 11 | EUR-D | 243 | 0.01 | 0.05 | 0.10 | 1.88 | 2.66 |
| 12 | SEAR-B | 396 | 0.23 | 0.67 | 0.98 | 4.56 | 6.12 |
| 13 | SEAR-D | 1335 | 0.15 | 0.84 | 1.57 | 4.66 | 6.02 |
| 14 | WPR-A | 150 | 0.13 | 0.48 | 0.88 | 1.85 | 2.28 |
| 15 | WPR-B1 | 1354 | 0.43 | 1.42 | 2.59 | 7.15 | 9.15 |
| 16 | WPR-B2 | 144 | 0.39 | 1.28 | 1.93 | 5.82 | 7.51 |
| 17 | WPR-B3 | 7 | 0.18 | 0.95 | 1.60 | 6.59 | 8.76 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.10: Annual patient treatment costs saved
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Annual patient treatment costs saved (US\$ 2000), by intervention | | | | |
|-------------------------|--------------------|-------------------------|--|----|-----|-----|-----|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 12 | 36 | 49 | 145 | 186 |
| 2 | AFR-E | 346 | 12 | 38 | 54 | 152 | 194 |
| 3 | AMR-A | 314 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 442 | 5 | 15 | 23 | 118 | 160 |
| 5 | AMR-D | 71 | 2 | 5 | 6 | 23 | 31 |
| 6 | EMR-B | 139 | 1 | 2 | 4 | 30 | 41 |
| 7 | EMR-D | 139 | 1 | 4 | 6 | 34 | 47 |
| 8 | EUR-A | 412 | 0 | 1 | 2 | 4 | 4 |
| 9 | EUR-B1 | 166 | 0 | 1 | 2 | 13 | 18 |
| 10 | EUR-B2 | 52 | 0 | 1 | 2 | 10 | 14 |
| 11 | EUR-D | 243 | 0 | 0 | 1 | 13 | 19 |
| 12 | SEAR-B | 396 | 4 | 12 | 17 | 80 | 107 |
| 13 | SEAR-D | 1335 | 13 | 72 | 134 | 398 | 514 |
| 14 | WPR-A | 150 | 0 | 2 | 3 | 6 | 8 |
| 15 | WPR-B1 | 1354 | 22 | 74 | 135 | 374 | 479 |
| 16 | WPR-B2 | 144 | 2 | 7 | 11 | 32 | 42 |
| 17 | WPR-B3 | 7 | 0 | 0 | 0 | 2 | 2 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.11: Productive days gained due to less diarrhoeal illness
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Productive days gained due to less diarrhoeal illness (million days), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|-------|-------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 52 | 152 | 211 | 619 | 796 |
| 2 | AFR-E | 346 | 52 | 158 | 229 | 640 | 818 |
| 3 | AMR-A | 314 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 442 | 38 | 114 | 180 | 914 | 1'234 |
| 5 | AMR-D | 71 | 9 | 27 | 38 | 140 | 184 |
| 6 | EMR-B | 139 | 3 | 11 | 19 | 165 | 228 |
| 7 | EMR-D | 139 | 7 | 20 | 30 | 169 | 230 |
| 8 | EUR-A | 412 | 2 | 8 | 14 | 28 | 35 |
| 9 | EUR-B1 | 166 | 4 | 12 | 19 | 123 | 168 |
| 10 | EUR-B2 | 52 | 2 | 6 | 10 | 66 | 91 |
| 11 | EUR-D | 243 | 1 | 5 | 9 | 162 | 229 |
| 12 | SEAR-B | 396 | 28 | 81 | 118 | 548 | 735 |
| 13 | SEAR-D | 1335 | 91 | 505 | 941 | 2'787 | 3'602 |
| 14 | WPR-A | 150 | 4 | 13 | 25 | 52 | 64 |
| 15 | WPR-B1 | 1354 | 469 | 1'559 | 2'842 | 7'843 | 10'038 |
| 16 | WPR-B2 | 144 | 14 | 45 | 68 | 205 | 265 |
| 17 | WPR-B3 | 7 | 0 | 1 | 2 | 8 | 11 |
| WORLD | | 6045 | 773 | 2'717 | 4'755 | 14'469 | 18'729 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 3.12: Value of productive days gained due to less diarrhoeal illness

(population remains stable from year 2000 until 2015)

| WHO Region Number | Region/Country | Population (million) | Value of productive days gained due to less diarrhoeal illness (US\$m), by intervention | | | | |
|-------------------|----------------|----------------------|---|-----|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 12 | 34 | 49 | 148 | 192 |
| 2 | AFR-E | 346 | 15 | 45 | 65 | 181 | 231 |
| 3 | AMR-A | 314 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 442 | 18 | 55 | 86 | 448 | 605 |
| 5 | AMR-D | 71 | 3 | 9 | 13 | 44 | 57 |
| 6 | EMR-B | 139 | 3 | 12 | 21 | 185 | 256 |
| 7 | EMR-D | 139 | 6 | 16 | 25 | 102 | 135 |
| 8 | EUR-A | 412 | 0 | 1 | 2 | 5 | 6 |
| 9 | EUR-B1 | 166 | 2 | 7 | 11 | 64 | 87 |
| 10 | EUR-B2 | 52 | 1 | 2 | 4 | 23 | 31 |
| 11 | EUR-D | 243 | 0 | 1 | 2 | 36 | 51 |
| 12 | SEAR-B | 396 | 5 | 14 | 21 | 139 | 190 |
| 13 | SEAR-D | 1335 | 19 | 95 | 172 | 501 | 647 |
| 14 | WPR-A | 150 | 17 | 63 | 116 | 243 | 299 |
| 15 | WPR-B1 | 1354 | 67 | 240 | 439 | 1'343 | 1'739 |
| 16 | WPR-B2 | 144 | 5 | 16 | 24 | 63 | 80 |
| 17 | WPR-B3 | 7 | 0 | 1 | 1 | 5 | 6 |
| WORLD | | 6045 | 173 | 613 | 1'052 | 3'529 | 4'614 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.13: School days gained due to less diarrhoeal illness
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | School days gained due to less diarrhoeal illness (‘000 days), by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|---------|---------|-----------|-----------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 11'063 | 32'591 | 45'256 | 132'783 | 170'823 |
| 2 | AFR-E | 346 | 11'348 | 34'743 | 50'416 | 140'796 | 180'100 |
| 3 | AMR-A | 314 | 0 | 1 | 2 | 3 | 3 |
| 4 | AMR-B | 442 | 6'631 | 20'066 | 31'821 | 161'381 | 217'801 |
| 5 | AMR-D | 71 | 2'198 | 6'287 | 8'904 | 32'431 | 42'664 |
| 6 | EMR-B | 139 | 441 | 1'758 | 2'987 | 25'431 | 35'206 |
| 7 | EMR-D | 139 | 1'030 | 2'983 | 4'448 | 25'097 | 34'082 |
| 8 | EUR-A | 412 | 51 | 164 | 293 | 594 | 727 |
| 9 | EUR-B1 | 166 | 119 | 390 | 591 | 3'882 | 5'313 |
| 10 | EUR-B2 | 52 | 213 | 760 | 1'394 | 9'146 | 12'528 |
| 11 | EUR-D | 243 | 24 | 121 | 224 | 4'171 | 5'890 |
| 12 | SEAR-B | 396 | 2'497 | 7'312 | 10'649 | 49'529 | 66'441 |
| 13 | SEAR-D | 1335 | 9'582 | 53'394 | 99'603 | 294'885 | 381'133 |
| 14 | WPR-A | 150 | 69 | 251 | 461 | 967 | 1'191 |
| 15 | WPR-B1 | 1354 | 13'730 | 45'654 | 83'224 | 229'664 | 293'972 |
| 16 | WPR-B2 | 144 | 1'480 | 4'859 | 7'305 | 22'013 | 28'413 |
| 17 | WPR-B3 | 7 | 29 | 151 | 254 | 1'050 | 1'395 |
| WORLD | | 6045 | 60'506 | 211'487 | 347'832 | 1'133'823 | 1'477'683 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.14: Baby days gained due to less diarrhoeal illness
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Baby days gained due to less diarrhoeal illness (million days) , by intervention | | | | |
|-------------------------|--------------------|-------------------------|--|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 65 | 193 | 267 | 785 | 1'009 |
| 2 | AFR-E | 346 | 66 | 203 | 295 | 824 | 1'054 |
| 3 | AMR-A | 314 | 0 | 0 | 0 | 0 | 0 |
| 4 | AMR-B | 442 | 19 | 56 | 89 | 453 | 611 |
| 5 | AMR-D | 71 | 7 | 19 | 27 | 98 | 129 |
| 6 | EMR-B | 139 | 3 | 11 | 18 | 156 | 216 |
| 7 | EMR-D | 139 | 8 | 23 | 34 | 191 | 259 |
| 8 | EUR-A | 412 | 1 | 2 | 4 | 8 | 10 |
| 9 | EUR-B1 | 166 | 2 | 7 | 10 | 68 | 93 |
| 10 | EUR-B2 | 52 | 1 | 4 | 8 | 52 | 71 |
| 11 | EUR-D | 243 | 0 | 2 | 3 | 61 | 86 |
| 12 | SEAR-B | 396 | 21 | 62 | 91 | 421 | 565 |
| 13 | SEAR-D | 1335 | 65 | 362 | 676 | 2'001 | 2'586 |
| 14 | WPR-A | 150 | 1 | 4 | 7 | 14 | 17 |
| 15 | WPR-B1 | 1354 | 39 | 130 | 237 | 655 | 839 |
| 16 | WPR-B2 | 144 | 12 | 38 | 57 | 172 | 222 |
| 17 | WPR-B3 | 7 | 0 | 1 | 2 | 10 | 13 |
| WORLD | | 6045 | 310 | 1'118 | 1'827 | 5'969 | 7'782 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 3.15: Annual time gain due to more convenient water supply and sanitation facilities

(population remains stable from year 2000 until 2015)

| WHO Region Number | Region/ Country | Population (million) | Annual time gain (million hours saved) , by intervention | | | | |
|-------------------|-----------------|----------------------|---|---------|---------|---------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 2'749 | 14'529 | 31'116 | 31'116 | 73'293 |
| 2 | AFR-E | 346 | 3'412 | 18'037 | 35'885 | 35'885 | 76'213 |
| 3 | AMR-A | 314 | 1 | 8 | 16 | 16 | 19 |
| 4 | AMR-B | 442 | 1'405 | 7'425 | 21'199 | 21'199 | 47'818 |
| 5 | AMR-D | 71 | 377 | 1'994 | 4'877 | 4'877 | 10'729 |
| 6 | EMR-B | 139 | 299 | 1'579 | 4'128 | 4'128 | 19'316 |
| 7 | EMR-D | 139 | 385 | 2'036 | 5'624 | 5'624 | 22'223 |
| 8 | EUR-A | 412 | 214 | 1'131 | 4'630 | 4'630 | 5'119 |
| 9 | EUR-B1 | 166 | 531 | 2'806 | 5'659 | 5'659 | 14'033 |
| 10 | EUR-B2 | 52 | 186 | 981 | 2'284 | 2'284 | 8'331 |
| 11 | EUR-D | 243 | 113 | 598 | 3'341 | 3'341 | 14'024 |
| 12 | SEAR-B | 396 | 1'685 | 8'905 | 20'309 | 20'309 | 89'044 |
| 13 | SEAR-D | 1335 | 3'578 | 18'914 | 163'043 | 163'043 | 230'530 |
| 14 | WPR-A | 150 | 306 | 1'619 | 8'076 | 8'076 | 8'776 |
| 15 | WPR-B1 | 1354 | 6'965 | 36'817 | 163'748 | 163'748 | 145'501 |
| 16 | WPR-B2 | 144 | 1'266 | 6'689 | 13'539 | 13'539 | 32'445 |
| 17 | WPR-B3 | 7 | 74 | 391 | 463 | 463 | 1'273 |
| WORLD | | 6045 | 23'546 | 124'460 | 487'937 | 487'937 | 798'689 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 3.16: Annual value of time savings
(population remains stable from year 2000 until 2015)

| WHO Region Number | Region/ Country | Population (million) | Annual value of time savings per capita (US\$m 2000) , by intervention | | | | |
|-------------------------|--------------------|-------------------------|---|--------|---------|---------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 795 | 4'200 | 9'740 | 9'740 | 22'184 |
| 2 | AFR-E | 346 | 1'259 | 6'652 | 13'441 | 13'441 | 28'438 |
| 3 | AMR-A | 314 | 6 | 32 | 63 | 63 | 77 |
| 4 | AMR-B | 442 | 932 | 4'927 | 13'226 | 13'226 | 30'932 |
| 5 | AMR-D | 71 | 166 | 879 | 2'077 | 2'077 | 4'490 |
| 6 | EMR-B | 139 | 416 | 2'197 | 5'978 | 5'978 | 28'185 |
| 7 | EMR-D | 139 | 406 | 2'147 | 6'252 | 6'252 | 16'399 |
| 8 | EUR-A | 412 | 41 | 219 | 1'075 | 1'075 | 1'170 |
| 9 | EUR-B1 | 166 | 399 | 2'108 | 4'301 | 4'301 | 9'437 |
| 10 | EUR-B2 | 52 | 80 | 421 | 1'096 | 1'096 | 3'734 |
| 11 | EUR-D | 243 | 46 | 244 | 994 | 994 | 4'786 |
| 12 | SEAR-B | 396 | 468 | 2'475 | 4'899 | 4'899 | 27'513 |
| 13 | SEAR-D | 1335 | 977 | 5'163 | 38'229 | 38'229 | 55'176 |
| 14 | WPR-A | 150 | 1'895 | 10'015 | 50'073 | 50'073 | 54'404 |
| 15 | WPR-B1 | 1354 | 1'318 | 6'966 | 34'044 | 34'044 | 29'045 |
| 16 | WPR-B2 | 144 | 444 | 2'344 | 6'430 | 6'430 | 12'992 |
| 17 | WPR-B3 | 7 | 54 | 288 | 341 | 341 | 937 |
| WORLD | | 6045 | 9'701 | 51'276 | 192'259 | 192'259 | 329'901 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

Table A 3.17: Value of averted deaths per capita (predicted future earnings)

(population remains stable from year 2000 until 2015)

| WHO Region Number | Region/ Country | Population (million) | Value of averted deaths per capita (US\$m 2000) , by intervention | | | | |
|-------------------|-----------------|----------------------|---|-------|-------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 186 | 556 | 789 | 2'405 | 3'108 |
| 2 | AFR-E | 346 | 224 | 681 | 983 | 2'689 | 3'431 |
| 3 | AMR-A | 314 | 4 | 11 | 20 | 84 | 112 |
| 4 | AMR-B | 442 | 19 | 56 | 88 | 461 | 623 |
| 5 | AMR-D | 71 | 9 | 27 | 40 | 135 | 176 |
| 6 | EMR-B | 139 | 15 | 56 | 93 | 764 | 1'056 |
| 7 | EMR-D | 139 | 29 | 84 | 122 | 653 | 884 |
| 8 | EUR-A | 412 | 23 | 68 | 111 | 303 | 386 |
| 9 | EUR-B1 | 166 | 7 | 22 | 32 | 183 | 249 |
| 10 | EUR-B2 | 52 | 2 | 6 | 11 | 44 | 58 |
| 11 | EUR-D | 243 | 0 | 0 | 0 | 35 | 49 |
| 12 | SEAR-B | 396 | 8 | 23 | 33 | 183 | 248 |
| 13 | SEAR-D | 1335 | 152 | 787 | 1'424 | 4'055 | 5'217 |
| 14 | WPR-A | 150 | 18 | 75 | 138 | 552 | 733 |
| 15 | WPR-B1 | 1354 | 5 | 15 | 28 | 77 | 98 |
| 16 | WPR-B2 | 144 | 29 | 86 | 132 | 343 | 435 |
| 17 | WPR-B3 | 7 | 0 | 3 | 4 | 18 | 24 |
| WORLD | | 6045 | 729 | 2'556 | 4'049 | 12'982 | 16'889 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.18: Total economic benefits of interventions
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Value of averted deaths per capita (US\$m 2000) , by intervention | | | | |
|-------------------------|--------------------|-------------------------|--|--------|---------|---------|---------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 1'510 | 6'328 | 12'744 | 18'777 | 33'846 |
| 2 | AFR-E | 346 | 2'130 | 9'308 | 17'286 | 24'083 | 42'037 |
| 3 | AMR-A | 314 | 10 | 44 | 85 | 150 | 192 |
| 4 | AMR-B | 442 | 1'517 | 6'702 | 16'011 | 27'569 | 50'307 |
| 5 | AMR-D | 71 | 299 | 1'260 | 2'612 | 3'954 | 6'952 |
| 6 | EMR-B | 139 | 509 | 2'581 | 6'642 | 11'777 | 36'221 |
| 7 | EMR-D | 139 | 584 | 2'663 | 7'034 | 9'800 | 21'151 |
| 8 | EUR-A | 412 | 79 | 334 | 1'269 | 1'546 | 1'763 |
| 9 | EUR-B1 | 166 | 434 | 2'222 | 4'472 | 5'341 | 10'856 |
| 10 | EUR-B2 | 52 | 100 | 493 | 1'228 | 1'896 | 4'827 |
| 11 | EUR-D | 243 | 50 | 264 | 1'031 | 1'695 | 5'776 |
| 12 | SEAR-B | 396 | 637 | 2'975 | 5'629 | 8'895 | 32'930 |
| 13 | SEAR-D | 1335 | 1'628 | 8'584 | 44'492 | 56'510 | 78'763 |
| 14 | WPR-A | 150 | 2'007 | 10'431 | 50'839 | 51'941 | 56'758 |
| 15 | WPR-B1 | 1354 | 2'216 | 10'020 | 39'623 | 50'005 | 49'564 |
| 16 | WPR-B2 | 144 | 616 | 2'880 | 7'239 | 8'651 | 15'829 |
| 17 | WPR-B3 | 7 | 59 | 310 | 379 | 497 | 1'145 |
| WORLD | | 6045 | 14'386 | 67'398 | 218'614 | 283'090 | 448'916 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.29: Cost-benefit ratios – all costs and all benefits
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Cost-benefit ratio, by intervention | | | | |
|-------------------------|--------------------|-------------------------|-------------------------------------|--------|--------|--------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 10.09 | 9.93 | 10.00 | 13.56 | 3.95 |
| 2 | AFR-E | 346 | 11.47 | 12.60 | 11.70 | 15.14 | 4.77 |
| 3 | AMR-A | 314 | 85.16 | 108.25 | 104.08 | 175.44 | 95.34 |
| 4 | AMR-B | 442 | 13.68 | 12.76 | 15.24 | 21.11 | 5.14 |
| 5 | AMR-D | 71 | 10.05 | 10.27 | 10.65 | 13.80 | 3.92 |
| 6 | EMR-B | 139 | 28.38 | 32.94 | 42.38 | 60.75 | 14.60 |
| 7 | EMR-D | 139 | 26.30 | 24.37 | 32.18 | 37.48 | 7.06 |
| 8 | EUR-A | 412 | 4.71 | 3.04 | 5.78 | 6.65 | 2.71 |
| 9 | EUR-B1 | 166 | 11.71 | 16.75 | 16.85 | 15.77 | 3.40 |
| 10 | EUR-B2 | 52 | 8.86 | 11.21 | 13.96 | 18.62 | 4.54 |
| 11 | EUR-D | 243 | 6.01 | 3.36 | 6.58 | 5.80 | 1.26 |
| 12 | SEAR-B | 396 | 6.23 | 7.59 | 7.18 | 10.01 | 3.23 |
| 13 | SEAR-D | 1335 | 7.49 | 2.98 | 7.72 | 9.24 | 2.85 |
| 14 | WPR-A | 150 | 107.90 | 71.35 | 173.86 | 171.27 | 63.29 |
| 15 | WPR-B1 | 1354 | 5.24 | 3.36 | 6.64 | 7.90 | 1.94 |
| 16 | WPR-B2 | 144 | 8.02 | 10.86 | 13.66 | 15.22 | 4.35 |
| 17 | WPR-B3 | 7 | 13.06 | 31.39 | 19.16 | 23.05 | 7.14 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.20: Cost-benefit ratios – all costs, time saving benefits only
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Cost-benefit ratio, by intervention | | | | |
|-------------------------|--------------------|-------------------------|-------------------------------------|-------|--------|--------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 5.31 | 6.59 | 7.64 | 7.04 | 2.59 |
| 2 | AFR-E | 346 | 6.77 | 9.00 | 9.09 | 8.45 | 3.23 |
| 3 | AMR-A | 314 | 50.63 | 77.65 | 77.65 | 73.96 | 38.16 |
| 4 | AMR-B | 442 | 8.41 | 9.38 | 12.59 | 10.13 | 3.16 |
| 5 | AMR-D | 71 | 5.59 | 7.17 | 8.47 | 7.25 | 2.53 |
| 6 | EMR-B | 139 | 23.17 | 28.04 | 38.14 | 30.83 | 11.36 |
| 7 | EMR-D | 139 | 18.30 | 19.65 | 28.61 | 23.91 | 5.48 |
| 8 | EUR-A | 412 | 2.49 | 2.00 | 4.90 | 4.63 | 1.80 |
| 9 | EUR-B1 | 166 | 10.75 | 15.89 | 16.21 | 12.70 | 2.95 |
| 10 | EUR-B2 | 52 | 7.07 | 9.58 | 12.45 | 10.76 | 3.51 |
| 11 | EUR-D | 243 | 5.51 | 3.11 | 6.34 | 3.40 | 1.04 |
| 12 | SEAR-B | 396 | 4.58 | 6.32 | 6.25 | 5.51 | 2.70 |
| 13 | SEAR-D | 1335 | 4.49 | 1.79 | 6.63 | 6.25 | 1.99 |
| 14 | WPR-A | 150 | 101.84 | 68.50 | 171.24 | 165.11 | 60.67 |
| 15 | WPR-B1 | 1354 | 3.12 | 2.33 | 5.70 | 5.38 | 1.14 |
| 16 | WPR-B2 | 144 | 5.77 | 8.84 | 12.13 | 11.31 | 3.57 |
| 17 | WPR-B3 | 7 | 12.12 | 29.12 | 17.24 | 15.80 | 5.84 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses

**Table A 3.21: Cost-benefit ratios - high cost and low benefit assumptions
(population remains stable from year 2000 until 2015)**

| WHO Region Number | Region/ Country | Population (million) | Cost-benefit ratio, by intervention | | | | |
|-------------------------|--------------------|-------------------------|-------------------------------------|-------|-------|-------|-------|
| | | | 1 | 2 | 3 | 4 | 5 |
| 1 | AFR-D | 335 | 1.51 | 1.96 | 2.04 | 2.65 | 0.92 |
| 2 | AFR-E | 346 | 1.75 | 2.51 | 2.38 | 2.95 | 1.11 |
| 3 | AMR-A | 314 | 20.57 | 29.11 | 27.62 | 60.82 | 39.28 |
| 4 | AMR-B | 442 | 1.61 | 2.21 | 2.89 | 3.05 | 0.94 |
| 5 | AMR-D | 71 | 1.18 | 1.76 | 1.98 | 2.16 | 0.77 |
| 6 | EMR-B | 139 | 4.38 | 6.81 | 9.03 | 11.17 | 3.36 |
| 7 | EMR-D | 139 | 3.96 | 5.00 | 6.88 | 7.77 | 1.67 |
| 8 | EUR-A | 412 | 0.95 | 0.73 | 1.33 | 1.68 | 0.79 |
| 9 | EUR-B1 | 166 | 1.90 | 3.55 | 3.59 | 3.52 | 0.84 |
| 10 | EUR-B2 | 52 | 1.29 | 2.24 | 2.89 | 3.08 | 0.98 |
| 11 | EUR-D | 243 | 0.93 | 0.70 | 1.44 | 1.17 | 0.28 |
| 12 | SEAR-B | 396 | 0.84 | 1.47 | 1.43 | 1.60 | 0.74 |
| 13 | SEAR-D | 1335 | 1.11 | 0.59 | 1.72 | 1.94 | 0.65 |
| 14 | WPR-A | 150 | 17.69 | 16.09 | 40.07 | 40.05 | 16.43 |
| 15 | WPR-B1 | 1354 | 0.57 | 0.56 | 1.34 | 1.36 | 0.33 |
| 16 | WPR-B2 | 144 | 1.19 | 2.17 | 2.85 | 3.01 | 1.02 |
| 17 | WPR-B3 | 7 | 2.09 | 6.38 | 3.77 | 4.20 | 1.68 |

Interventions: by the year 2015 -

Intervention 1: Halving the proportion of people without access to improved water sources

Intervention 2: Halving the proportion of people without access to improved water sources and sanitation

Intervention 3: Everyone has access to improved water and improved sanitation services

Intervention 4: Intervention 3 + everyone has a minimum of water disinfected at the point of use

Intervention 5: Everyone has access to a regulated piped water supply & sewage connection in their houses