SAFER WATER, BETTER HEALTH

Costs, benefits and sustainability of interventions to protect and promote health

Almost one tenth of the global disease burden could be prevented by improving water supply, sanitation, hygiene and management of water resources

Annette Prüss-Üstün, Robert Bos, Fiona Gore, Jamie Bartram

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WHO Library Cataloguing-in-Publication Data

Safer water, better health : costs, benefits and sustainability of interventions to protect and promote health / Annette Prüss-Üstün … [et al].

1.Gastrointestinal diseases - prevention and control. 2.Diarrhea - prevention and control. 3.Parasitic diseases - prevention and control. 4.Cost-benefit analysis. 5.Cost of illness. 6.Water - supply and distribution. 7.Sanitation. 8.Life expectancy. I. Prüss-Üstün, Annette. II.World Health Organization.

ISBN 978 92 4 159643 5 (NLM classification: WA 675)

Suggested citation

Prüss-Üstün A, Bos R, Gore F, Bartram J. Safer water, better health: costs, benefits and sustainability of interventions to protect and promote health. World Health Organization, Geneva, 2008.

Printed in Spain.

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Women collecting water from a public tap, India

PREFACE

Are targeted modifications of our environment sound actions for sustainable disease prevention? Do healthy environments alleviate the burden weighing on our health-care system in a cost-effective way? What investments and recurrent expenditures are needed? And what financing arrangements are effective?

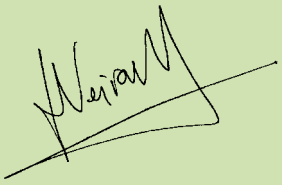
Answers to these questions help to build the case for integrating targeted environmental management action into a country's disease reduction and health-promoting strategies.

This document summarizes the evidence and information related to water and health in a broad sense - encompassing drinking-water supply, sanitation, hygiene, and the development and management of water resources. It collects the ingredients that support policy decisions, namely the disease burden at stake, the effectiveness of interventions, their costs and impacts, and implications for financing.

This summary is part of a larger effort to highlight the role that healthy environments can play in interrupting transmission pathways, preventing disease and reducing the disease burden, at the global, regional and country level. A more comprehensive estimate addressing the total environment suggests that about one quarter of the global disease burden could be prevented by healthier environments *(1)*. In this context, WHO has also developed 192 country profiles of environmental burden of disease to map out opportunities for preventive action *(2)*.

One tenth of the global disease burden is preventable by achievable improvements in the way we manage water. Cost-effective, resilient and sustainable solutions have proven to alleviate that burden. Action is required to ensure these are implemented and sustained world-wide and especially to the benefit of the most-affected population – children in developing countries.

Water-related improvements are crucial to meet the Millennium Development Goals, reduce child mortality, and improve health and nutritional status in a sustainable way. In addition, they induce multiple social and economic benefits, adding importantly to enhanced well-being.



Dr Maria Neira
Director
Public Health and Environment
World Health Organization

**Washing clothes,
Colombia**

Health education, Bangladesh.

INTRODUCTION

Ensuring poor people's access to safe drinking-water and adequate sanitation and encouraging personal, domestic and community hygiene will improve the quality of life of millions of individuals. Better managing water resources to reduce the transmission of vector-borne diseases (such as viral diseases carried by mosquitoes) and to make water bodies safe for recreational and other users can save many lives and has extensive direct and indirect economic benefits, from the micro-level of households to the macro-perspective of national economies. The global importance of water, sanitation and hygiene for development, poverty reduction and health is reflected in the United Nations Millennium Declaration, in particular its eight Millennium Development Goals, in the reports of the United Nations Commission on Sustainable Development and at many international fora.

Millennium Development Goal 7: Ensure environmental sustainability

Target 10: Reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation

Indicator 30: Proportion of the Population with Sustainable Access to an Improved Water Source

Indicator 31: Proportion of the Population with Access to Improved Sanitation

In 2002, the World Health Organization (WHO) published the first scientifically substantiated estimate of the global burden of disease related to water, sanitation and hygiene *(3,4)*. This complemented WHO's work, in cooperation with the United Nations Children's Fund (UNICEF), in monitoring the status of and trends in access to both improved drinking-water sources and basic sanitation *(5)*. Subsequently, WHO continued to develop this evidence base for policy and good practice. This has included systematic work on developing an understanding of the impact of interventions on disease incidence and on estimating the costs and benefits of those interventions. The tools being developed by WHO as part of this work are suitable for application at different levels, from local to national to global.

A clear understanding of the burden of disease and the effectiveness of alternative approaches to reduce this burden provides the basis for the development of effective intervention strategies. Estimating the costs and impacts of policy and technical options provides an objective basis from which to inform decision-making—especially important in an area where many different sectors and actors are involved. Understanding how interventions are financed enables us to advocate for their benefits.

This document summarizes the most recent water-related findings on global health impacts *(2)*; presents recent information on effective interventions *(6)*; summarizes information from economic evaluations *(7)*; and describes recent insights on financing *(8)*. The global health impacts presented are based on both rigorous assessments (for diarrhoea, trachoma, schistosomiasis and intestinal nematode infections) and reviews of expert opinion (all other addressed diseases). The scientific rigor of the estimates based on expert opinion is not at the same level as that of the estimates based on rigorous assessments; nevertheless, the opinion-based estimates are the best ones currently available.

WHO's mission in environmental health

WHO's mission in environmental health is to improve health by identifying, preventing and reducing environmental hazards and by assessing and managing associated risks.

Weighing of young patient at the Infant Clinic Simeon Contreras in Marcala, Honduras. Intestinal infections due to poor water, sanitation and hygiene may result in poor absorption of nutrients.

ESTIMATING THE DISEASE BURDEN RELATED TO WATER, SANITATION AND HYGIENE

An important share of the total burden of disease worldwide—around 10%—could be prevented by improvements related to drinking-water, sanitation, hygiene and water resource management. The following are examples of global disease burdens that are known to be preventable in this manner.

Diarrhoea

1.4 million preventable child deaths per year

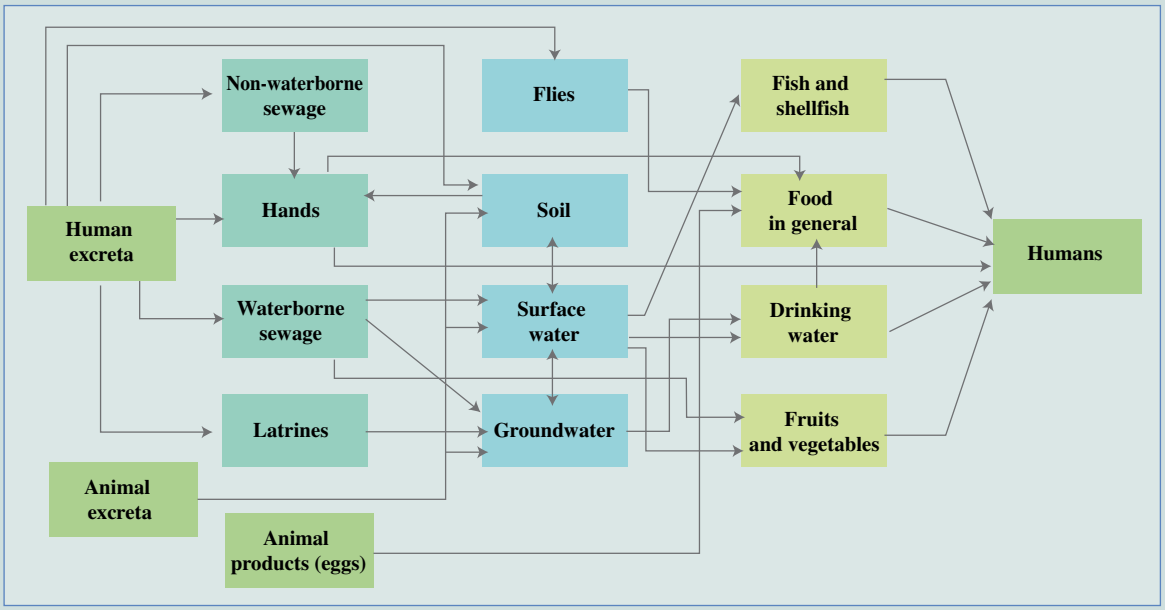
Diarrhoea is caused mainly by the ingestion of pathogens, especially in unsafe drinking-water, in contaminated food or from unclean hands. Inadequate sanitation and insufficient hygiene promote the transmission of these pathogens. Eighty-eight per cent of cases of diarrhoea worldwide are attributable to unsafe water, inadequate sanitation or insufficient hygiene. These cases result in 1.5 million deaths each year, most being the deaths of children. The category "diarrhoea" includes some more severe diseases, such as cholera, typhoid and dysentery—all of which have related "faecal–oral" transmission pathways.

Malnutrition

860 000 preventable child deaths per year

Childhood underweight causes about 35% of all deaths of children under the age of five years worldwide. An estimated 50%[1] of this underweight or malnutrition is associated with repeated diarrhoea or intestinal nematode infections as a result of unsafe water, inadequate sanitation or insufficient hygiene. Such underweight in children is directly responsible for some 70 000 deaths per year. Underweight children are also more vulnerable to almost all infectious diseases and have a lower prognosis for full recovery. The disease burden related to this indirect effect on deaths from infectious diseases is an order of magnitude higher than the disease burden related to the direct effects of malnutrition. The total number of deaths caused directly and indirectly by malnutrition induced by unsafe water, inadequate sanitation and insufficient hygiene is therefore 860 000 deaths per year in children under five years of age.

[1] Based on literature survey/expert opinion *(1)*



Intestinal nematode infections

2 billion infections—affecting one third of the world's population—that could be prevented

Transmission of intestinal nematode infections, such as ascariasis, trichuriasis and hookworm, occurs through soil contaminated with faeces. It is entirely preventable by adequate sanitation, and intervention outcomes are reinforced by good hygiene. In our estimates, the burden caused by intestinal nematode infections is, therefore, entirely attributable to inadequate sanitation facilities and related lack of hygiene.

Lymphatic filariasis

25 million seriously incapacitated people

In Asia and the Americas, lymphatic filariasis is transmitted by mosquito vectors breeding in water polluted by organic material, and its distribution is therefore linked to urban and periurban areas. In Africa, where *Anopheles* mosquitoes are the main vector, its distribution coincides in part with that of malaria and may be linked to irrigation development. Lymphatic filariasis also occurs in some of the Pacific island states. Globally, 66%[2] of the disease is attributable to unsafe water, inadequate sanitation or insufficient hygiene.

Patient with lymphatic filariasis. Pondicherry, India.

Trachoma

Visual impairments in 5 million people that could have been prevented

Trachoma is a contagious eye disease that can result in blindness. It is transmitted primarily as a result of inadequate hygiene, and transmission can be reduced by facial cleanliness, access to safe water, adequate sanitation facilities and fly control. In practice, the burden caused by blinding trachoma can be almost fully attributed to unsafe water, inadequate sanitation or insufficient hygiene.

Face hygiene prevents trachoma, a widespread cause of blindness.

Schistosomiasis

200 million people with preventable infections

Schistosomiasis is caused by contact with water bodies contaminated with the excreta of infected people and is therefore fully attributable to unsafe water, inadequate sanitation or insufficient hygiene. Its distribution is linked to the distribution of the aquatic snails that are the intermediate hosts of the parasitic trematode flatworms. Along with snail control, the provision of safe water and sanitary facilities would limit infective water contact and contamination of the environment and greatly reduce the incidence of this disease.

[2] Based on literature survey/expert opinion *(1)*

Malaria

Half a million preventable deaths annually

Water pond in Ethiopia where malaria-transmitting mosquitoes grow.

The transmission of malaria varies widely over space and time. In some places, where mosquito vectors have specific ecological breeding requirements, transmission of malaria can be interrupted by reducing vector habitats—mainly by eliminating stagnant water bodies, modifying the contours of reservoirs, introducing drainage or improving the management of irrigation schemes. Owing to the variations in vector habitats, the fraction of malaria that could be eliminated through managing the environment varies across regions, with a global average of 42%.[3]

Drowning

280 000 preventable deaths annually

Drowning can be avoided by improving the safety of water bodies or containers and their access, including through information, education and regulations. Improvements can be related to recreational environments, transportation on waterways, drinking-water storage, flood control, etc. It is estimated that 72%[3] of drownings could be avoided through environmental and behavioural modifications and regulations, equivalent to 280 000 deaths annually. "Near drowning" is a significant public health concern not reflected in these statistics.

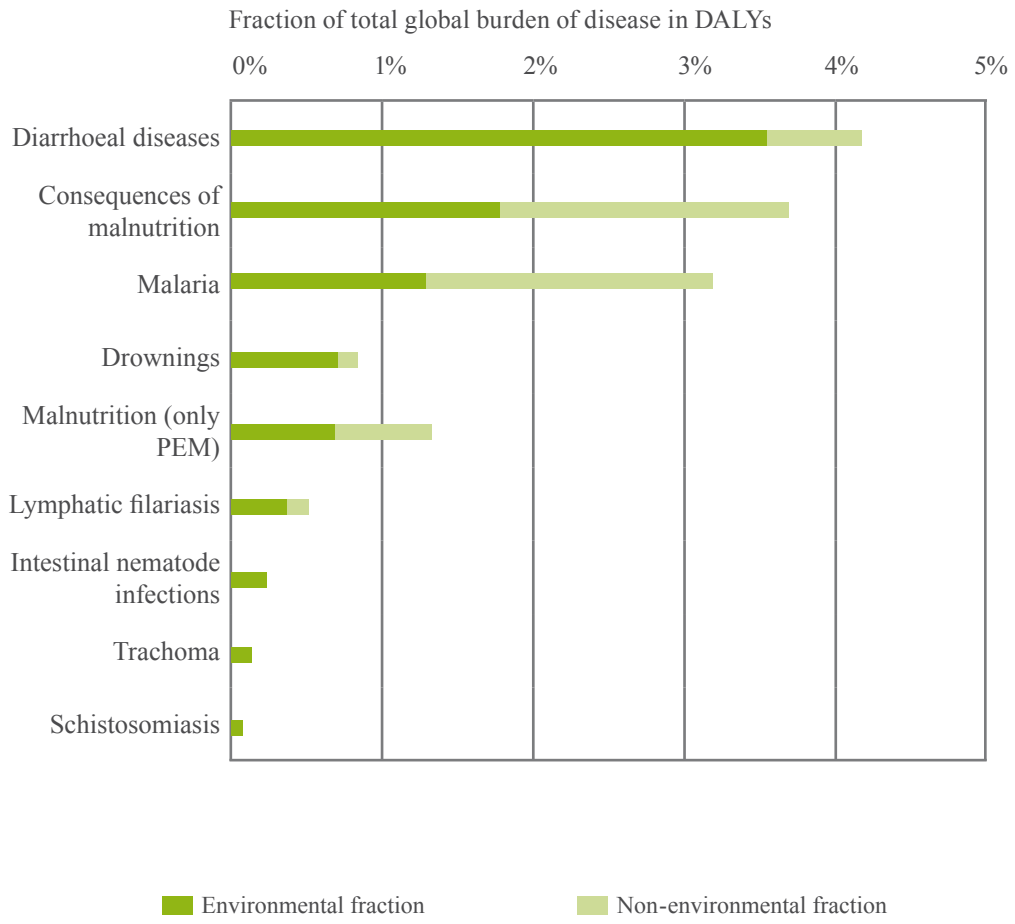
Bathing, Saudi Arabia.

Other quantifiable diseases

Dengue, Japanese encephalitis and onchocerciasis, also linked to water resource development and management, together cause 31 000 deaths per year worldwide. Dengue, which is an acute infectious disease caused by the dengue virus and transmitted by the bite of infected mosquitoes, can be reduced by eliminating small water collectors (including water containers, tanks and drums) and solid waste (such as old tyres) around the home and in the community. Japanese encephalitis, a viral disease that is transmitted by mosquitoes and in humans causes inflammation of the membranes around the brain, can be reduced by better irrigation, water management and eliminating access of mosquito vectors to pigs. The impact of water resource development and management on onchocerciasis—a disease caused by a parasitic worm and transmitted through the bites of infected blackflies—is more complex, as one would need to interfere with the natural environment, such as streams. The considered water resource development and management options are therefore limited to human-made hydraulic infrastructures such as barrages (similar to dams), upstream from the rapids where blackflies breed.

[3] Based on literature survey/expert opinion *(1)*

DISEASES WITH THE LARGEST WATER, SANITATION AND HYGIENE CONTRIBUTION, YEAR 2002

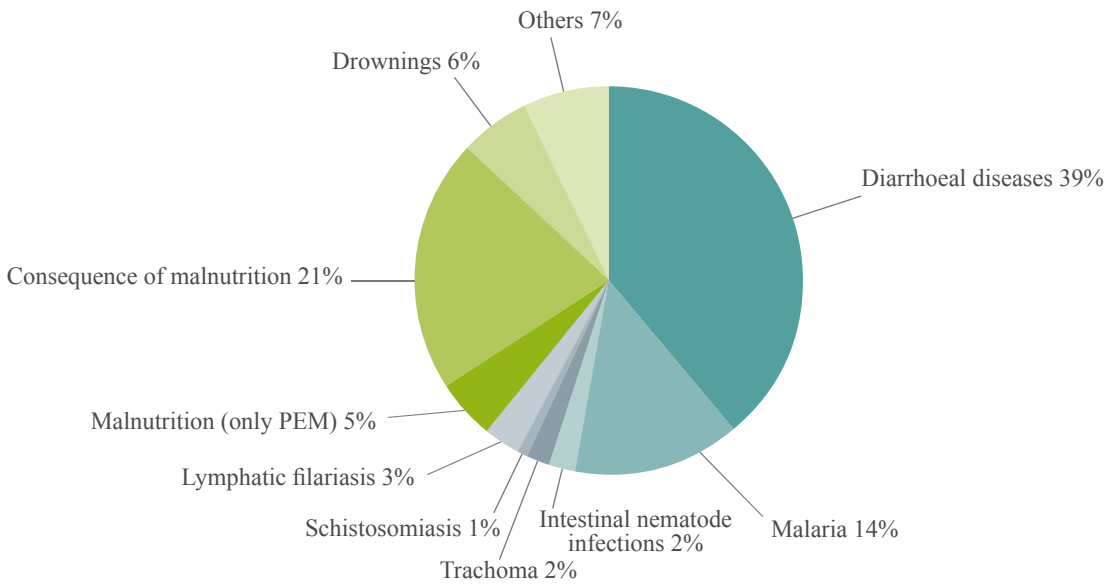


DALY: disability-adjusted life year (which measures the years of life lost to premature mortality and the years lost to disability); PEM: protein–energy malnutrition (which is malnutrition that develops in adults and children whose consumption of protein and energy is insufficient to satisfy the body's nutritional needs).

Water, sanitation, hygiene, health and disease – what do they add up to?

Globally, improving water, sanitation and hygiene has the potential to prevent at least 9.1% of the disease burden (in disability-adjusted life years or DALYs, a weighted measure of deaths and disability), or 6.3% of all deaths (Table 1). Children, particularly those in developing countries, suffer a disproportionate share of this burden, as the fraction of total deaths or DALYs attributable to unsafe water, inadequate sanitation or insufficient hygiene is more than 20% in children up to 14 years of age.

DISEASES CONTRIBUTING TO THE WATER-, SANITATION- AND HYGIENE-RELATED DISEASE BURDEN[a]



PEM: protein–energy malnutrition

[a] In disability-adjusted life years, or DALYs.

Nine per cent – a reliable overall estimate?

Several diseases related to water, sanitation and hygiene could not be specifically addressed here because of a lack of adequate evidence. This suggests that the 9.1% of the disease burden that is attributable to unsafe water, inadequate sanitation or insufficient hygiene may be an underestimate. Diseases that are unquantifiable include some that are likely to be significant at a global scale. These include infectious diseases, such as legionellosis, leptospirosis, conjunctivitis and otitis, which are mostly respiratory infections related to hygiene; injuries related to recreational water use, such as from falls; and adverse effects due to exposure to high concentrations of certain chemicals, such as fluoride, arsenic, lead and nitrate. Similarly, while unsafe injections are a significant contributor to the transmission of hepatitis B and C viruses and human immunodeficiency virus (HIV), the fraction of hepatitis B, hepatitis C and acquired immunodeficiency syndrome (AIDS) that could be prevented by safe injection waste disposal (i.e. sanitation) is not clear. We also have not included diseases for which the evidence for causality is still under discussion: for example, the beneficial role of water in adequate nutritional intake of calcium (bone health) and magnesium (cardiovascular health). In addition, the impacts of global climate change are likely to create upwards pressure on water-related disease through various mechanisms, including extreme events, such as floods and droughts.

Bathing, Bangladesh. Recreational activities in polluted water are a cause of gastrointestinal illness.

TABLE 1: SUMMARY STATISTICS ON DEATHS AND DISABILITY RELATED TO WATER, SANITATION AND HYGIENE IN 2002

DISEASE OR INJURY	DEATHS						DALYS[a]					
	Total		Children 0–14 years		Developed countries	Developing countries	Total		Children 0–14 years		Developed countries	Developing countries
Population ('000)	6 224 985		1 830 140		1 366 867	4 858 118	6 224 985		1 830 140		1 366 867	4 858 118
	('000)	%[b]	('000)	%[b]	('000)	('000)	('000)	%[b]	('000)	%[b]	('000)	('000)
Total deaths or DALYs	57 029		11 945		13 430	43 599	1 490 126		544 534		213 574	1 276 552
Total WSH-related	3 575		3 011		73	3 503	135 748		117 789		1 861	133 887
% of total deaths or DALYs	6.3%		25%		0.5%	8.0%	9.1%		22%		0.9%	10%
Diarrhoeal diseases[c]	1 523	42.6	1 370	45.5	15	1 507	52 460	38.6	48 830	41.5	648	51 812
Intestinal nematode infections[d]	12	0.3	8	0.3	0	12	2 948	2.2	2 884	2.4	3	2 945
Malnutrition (only PEM)[c,e]	71	2.0	71	2.4	0	71	7 104	5.2	7 104	6.0	83	7 021
Consequences of malnutrition[c,e]	792	22.1	792	26.3	9	783	28 475	21.0	28 475	24.2	181	28 294
Trachoma[d]	0	0.0	0	0.0	0	0	2 320	1.7	13	0.0	0	2 319
Schistosomiasis[d]	15	0.4	0	0.0	0	15	1 698	1.3	560	0.5	1	1 697
Lymphatic filariasis[d]	0	0.0	0	0.0	0	0	3 784	2.8	1 211	1.0	1	3 783
Subtotal water supply, sanitation and hygiene	2 413	67.5	2 241	74.4	24	2 389	98 789	72.8	89 077	75.6	918	97 871
Malaria[e]	526	14.7	482	16.0	0	526	19 241	14.2	17 984	15.3	11	19 230
Onchocerciasis[e]	0	0.0	0	0.0	0	0	51	0.0	10	0.0	0	51
Dengue[e]	18	0.5	14	0.5	0	18	586	0.4	512	0.4	0	586
Japanese encephalitis[e]	13	0.4	7	0.2	0	13	671	0.5	459	0.4	0	671
Subtotal water resource management	557	15.6	502	16.7	0	557	20 550	15.1	18 965	16.1	12	20 539
Drownings[e]	277	7.7	106	3.5	33	244	7 871	5.8	3 845	3.3	736	7 135
Subtotal safety of water environments	277	7.7	106	3.5	33	244	7 871	5. 8	3 845	3.3	736	7 135
Other infectious diseases[e,f]	328	9.2	162	5.4	15	312	8 538	6.3	5 902	5.0	196	8 343

DALY: disability-adjusted life year; PEM: protein–energy malnutrition; WSH: water, sanitation and hygiene. Note that numbers may not add up as a result of rounding.

[a] DALYs are a weighted measure of deaths and disability.

[b] Percentage of all deaths/DALYs attributable to WSH-related risks.

[c] Data further validated by Comparative Risk Assessment methods *(4)*.

[d] Comparative Quantification of Health Risks *(4)*.

[e] Not a formal WHO estimate; data based on literature review and expert survey *(1, 9)*.

[f] Not attributable to one group alone.

Crowded beach and caravanning site, France.

Farmers in South Asia planting rice seedlings in their paddy fields, which are often breeding places for the mosquito vectors of Japanese encephalitis.

SAFER WATER, BETTER HEALTH

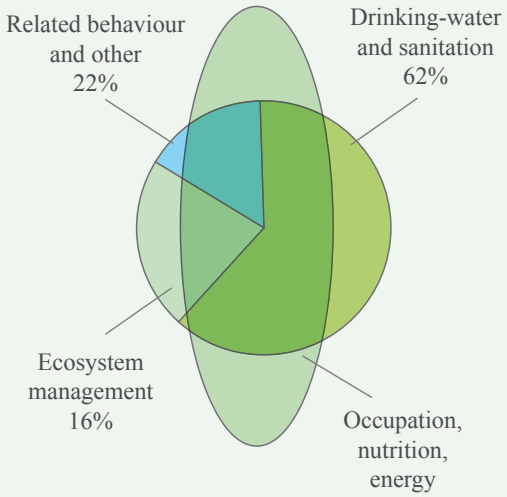
WATER, SANITATION AND HYGIENE – A COMPOSITE RISK FACTOR

Water, sanitation and hygiene include:

- a *medium* that can serve to transmit pathogens and toxic chemicals (drinking-water);
- *services* (drinking-water, sanitation, solid waste management and irrigation water management) that contribute to disease prevention and, conversely, the lack of which increases the risk of several diseases;
- *behaviours* such as, for example, personal and domestic hygiene and unsafe use of built environments; and
- *natural resources and ecosystems*, the development and management of which may increase or decrease disease risks.

Water, sanitation and hygiene are also often referred to as a sector or sectors. As such, they overlap with other sectors, such as occupation, energy and nutrition. To prevent that part of the global disease burden associated with water, sanitation and hygiene, these other sectors must be engaged to act, including both at policy level and on their specific activities. These sectors manage both determinants of health (e.g. operating dams) as well as their direct actions (e.g. safe water and sanitation in workplaces).

ATTRIBUTION OF DISEASE BURDEN FROM WATER, SANITATION AND HYGIENE TO AREAS/SECTORS[a]



[a] The circle refers to water, sanitation and hygiene, and the oval to other sectors. Fractions add up to 100%

WHO's next steps in estimating the disease burden

As a basis for informed decision-making, several factors related to water, sanitation and hygiene need to be further investigated. Examples include:

- water hardness, lack of which has been associated with cardiovascular disease;
- fluoride in drinking-water, high concentrations of which are associated with dental and skeletal impairments;
- arsenic content of drinking-water, which is associated with various cancers;
- spinal injury, which is a risk related to recreational water environments;
- legionellosis, which is associated with poorly maintained artificial water systems.

Some health impacts are small at a global level but may reach high local or national importance; assisting national-level analysis is therefore an important next step.

Water supply, Bangladesh.

EFFECTIVE INTERVENTIONS

To act effectively in preventing disease and promoting health, it is important to know not only how much disease is caused by factors related to water, sanitation and hygiene, but also how effectively changes in their management can improve health.

Drinking-water, sanitation and hygiene

"Pooling" results of good quality studies from different regions (meta-analysis) can provide useful insights into the overall impact of interventions. In a recent systematic review of the literature on diarrhoeal disease *(6)*, 2000 abstracts were screened, and then 50 studies were analysed; of these 50 studies, 38 were used in the meta-analysis. The overall results of the meta-analysis are summarized in Table 2.

TABLE 2: IMPACTS ON DIARRHOEAL DISEASE REDUCTION BY INTERVENTION AREA

Intervention area	Reduction in diarrhoea frequency
Hygiene	37%
Sanitation	32%
Water supply	25%
Water quality	31%
Multiple	33%

Adapted from *(6)*

These results are generally in line with those of earlier studies. However, the investigators detected a greater impact of intervention in drinking-water quality than had been detected in previous reviews. This likely arises from assessment of the actual quality of water consumed as opposed to the quality of the water at the source, as was commonly done in earlier studies.

Water, sanitation and hygiene interventions interact with one another, and available evidence indicates that the impact of each may vary widely according to local circumstances. Prioritizing should therefore be based on local conditions and evidence from implementation rather than from pooled data, such as the average impacts summarized in Table 2.

Sanitation reduces or prevents human faecal pollution of the environment, thereby reducing or eliminating transmission of diseases from that source (although other sources, such as animal excreta, may remain important). Effective sanitation isolates excreta and/or inactivates the pathogens within faeces. High-tech solutions are not necessarily the best: some simple latrines can be very effective, while untreated sewage distributes pathogens in the environment and can be the source of disease. Interventions that work in rural areas may be very different from those in urban areas. There has been increasing recent interest in "total sanitation"—i.e. achieving a level of overall sanitation in a community that will significantly reduce disease. The importance of sanitation extends to aspects of privacy, dignity and school attendance.

Improved drinking-water concerns access and use of water and its quality (safety).

Increasing access to water has incremental and multiple beneficial impacts on health *(10)*, (see Table 3).

TABLE 3: SUMMARY OF REQUIREMENT FOR WATER SERVICE LEVEL TO PROMOTE HEALTH

Service level	Access measure	Needs met	Level of health concern
No access (quantity collected often below 5 l/c/d)	More than 1000 m or 30 minutes total collection time	Consumption – cannot be ensured Hygiene – not possible (unless practised at source)	Very high
Basic access (average quantity unlikely to exceed 20 l/c/d)	Between 100 and 1000 m or 5 to 30 minutes total collection time	Consumption – should be ensured Hygiene – handwashing and basic food hygiene possible; laundry/ bathing difficult to ensure unless carried out at source	High
Intermediate access (average quantity about 50 l/c/d)	Water delivered through one tap on-plot (or within 100 m) or 5 minutes total collection time	Consumption – ensured Hygiene – all basic personal and food hygiene ensured; laundry and bathing should also be ensured	Low
Optimal access (average quantity 100 l/c/d and above)	Water supplied through multiple taps continuously	Consumption – all needs met Hygiene – all needs should be met	Very low

l/c/d: litres per person per day

Source: *(10)*

Improvements in drinking-water quality appear to be of significant benefit to health when improvement is secured close to the point of use—that is, in the household. In recent years, increasing evidence has become available that household water treatment and safe storage are associated with significant health gains where available water is contaminated *(11)*. The benefits of protected sources on water quality and health are limited unless safe transport and storage can be ensured. In community managed and piped water supplies, the value of focusing interventions on safe management in addition to end product testing, as described in the WHO Guidelines for Drinking-Water Quality *(12)*, is widely and increasingly recognized and applied.

The impact and sustainability of hygiene improvement interventions are less well studied than those of interventions in the areas of sanitation and drinking-water supply and quality, although improved hygiene behaviours have been shown to have a significant beneficial impact on the incidence of diarrhoeal and other diseases. Changed behaviours may be elicited more by factors such as perception of cleanliness and peer approval than by health messages. Targeting high-impact changes (such as hand washing with soap) is considered good practice. Changes may be most readily achieved when they are associated with other factors, such as increased availability of water for hygiene purposes or access to improved sanitation.

Wastewater treatment plant, Peru. Adequate treatment of wastewater prevents recirculation of pathogens in the environment.

Vector-borne diseases

Interventions to reduce vector-borne diseases will depend heavily on local conditions. The main management opportunities can be summarized as follows (for additional information, see reference *9)*:

- *Modification of the environment*: Permanent changes to land, water or vegetation to reduce vector habitats, often through infrastructure. Examples include drainage, levelling land, contouring reservoirs, modifying river boundaries and redesigning hydraulic structures.

- *Manipulation of the environment*: Creation of temporary, unfavourable conditions for vector propagation, which often needs to be repeated. Examples include removal of aquatic plants from water bodies where mosquito larvae may find shelter, alternate wetting and drying of irrigated paddy fields, synchronization of paddy fields, periodic flushing of natural and human-made waterways and the introduction of predators, such as larvivorous fish.

- *Modification or manipulation of human habitation or behaviour*: Reduction of contact between humans and vectors. Examples include the screening of doors and windows, the use of non-treated mosquito nets (the use of insecticide-treated mosquito nets is not considered an environmental intervention, but it is certainly a very beneficial intervention) and peri-domestic management to remove standing water.

A recent systematic review of the literature on reducing the burden of malaria with environmental management concluded that the risk ratio of malaria reduced by environmental modification and modification of human habitation (based on 16 and 8 studies, respectively) was reduced by 88.0%, (95% confidence interval [CI] 81.7–92.1) and 79.5%, (95% CI 67.4–87.2) respectively *(13)*. These results show that malaria control programmes that emphasize environmental management are highly effective in reducing morbidity and mortality and can lead to sustainable malaria control approaches.

WHO is currently developing a database on effective interventions and has been publishing extensive guidelines on "good practice" in effective interventions (see http://www.who.int/water_sanitation_health/en/index.html).

Next steps in building the evidence on effective interventions

Guide for estimating national disease burden

Understanding the preventable burden of disease associated with risk factors such as inadequate water sanitation and hygiene provides a basis for evidence-based decision-making. Global estimates such as those summarized here will need to be complemented with national- and even local/project-level data to inform local decision-making. WHO has developed a guide to assist in estimating the national burden of water-, sanitation- and hygiene-related disease (http://www.who.int/quantifying_ehimpacts/national/en/).

Online database of evidence

As a tool to support both researchers and practitioners, WHO is developing an online database of studies that have set out to investigate the association between environmental factors and human health. The database will be an important resource for those undertaking studies on assessing burden of disease.

Woman carrying water in a jar, Ethiopia.

COSTS AND BENEFITS OF INTERVENTIONS

Decision-making in environment and health in general, and in water, sanitation and hygiene in particular, involves the participation of many actors and different sectors. Competing demands from in situ (non-extractive) and extractive uses of water must be reconciled; industry, agriculture, domestic use and the environment itself all make legitimate demands. Even in a single area such as access to safe drinking-water, many players will interact—national and international financing institutions, the service providers, consumer representatives, water resource and land management entities and the health sector. Cost–benefit analysis provides objective information that can support improved policy-making and decision-taking, and assist dialogue and discussion. Such analysis may include simple but important facts such as the cost savings to poor households and to the health sector arising from improving services.

Since 2000, WHO has been putting its efforts behind developing and applying approaches to cost–benefit analysis on issues of water, sanitation, hygiene and health. Findings from an initial study reported at the twelfth session of the United Nations Commission on Sustainable Development are summarized in Table 4 and the box. Since that time, the work has been repeated at the regional level in Europe and Asia, and from different perspectives at the global level, with similar general findings (additional information can be found at http://www.who.int/water_sanitation_health/economic/en/).

Investing in drinking-water and sanitation

The estimated economic benefits of investing in drinking-water and sanitation come in several forms*:

- health-care savings of US$ **7 billion** a year for health agencies and US$ **340 million** for individuals;
- 320 million productive days gained each year in the 15- to 59-year age group, an extra 272 million school attendance days a year, and an added 1.5 billion healthy days for children under five years of age, together representing productivity gains of US$ **9.9 billion** a year;
- time savings resulting from more convenient drinking-water and sanitation services, totalling 20 billion working days a year, giving a productivity payback of some US$ **63 billion** a year; and
- values of deaths averted, based on discounted future earnings, amounting to US$ **3.6 billion** a year.

The WHO study from which these figures are taken shows a total payback of US$ 84 billion a year from the US$ 11.3 billion per year investment needed to meet the drinking-water and sanitation target of the Millennium Development Goals.

*Source: Estimates at the global level *(7)*.

TABLE 4: BENEFIT–COST RATIO[a] BY INTERVENTION IN DEVELOPING REGIONS AND EURASIA

Intervention	Annual benefits in US$ millions	Benefit–cost ratio by intervention
Halving the proportion of people without access to improved water sources by 2015	18 143	9
Halving the proportion of people without access to improved water sources and improved sanitation by 2015	84 400	8
Universal access to improved water and sanitation services by 2015	262 879	10
Universal access to improved water and improved sanitation and water disinfected at the point of use by 2015	344 106	12
Universal access to a regulated piped water supply and sewage connection by 2015	555 901	4

[a] To calculate a benefit–cost ratio, the total benefits are divided by the total costs. Projects with a benefit–cost ratio greater than 1 have greater benefits than costs. The higher the ratio, the greater the benefits relative to the costs.

Source: *(7)*

Water and how it is managed also contribute to the production of ecosystem goods and services. Examples include fish, fuel, timber, food crops and pasture. Table 5 provides estimates of the value of aquatic ecosystems, including flood control, groundwater recharge, shoreline stabilization and shore protection, nutrition cycling and retention, water purification, preservation of biodiversity, and recreation and tourism.

TABLE 5: VALUE OF AQUATIC ECOSYSTEM SERVICES

Ecosystem types	Total value per hectare (US$ per year)	Total global flow value (US$ billion per year)
Tidal marsh/ mangroves	6 075	375
Swamps/ floodplains	9 990	1 648
Lakes/rivers	19 580	3 231
Total		**5 254**

Source: *(14)*

Next steps in economic evaluation of interventions

Work is now focusing on the development of methods appropriate for application at the country level to assist in analysis of the cost effectiveness and benefit–cost ratios of water, sanitation and hygiene interventions. Outcomes of the work will be released as they become available (on http://www.who.int/water_sanitation_health/economic).

Poster of the Urban Water Supply Project, Bhutan.

Children lining up for the bathroom, Nigeria

SAFER WATER, BETTER HEALTH

FINANCING EFFECTIVE INTERVENTIONS

Implementing interventions at a scale sufficient to have a national or global impact on health is informed by a proper understanding of the major components of their costs and their likely sources of funding.

Meeting the sanitation part of target 10 of the Millennium Development Goal on drinking-water and sanitation is estimated to require an annual investment of US$ 18 billion (more than for drinking-water because much less work has been done in this area). Maintaining provision of services to those who already have access is estimated to require an annual expenditure of US$ 54 billion (more for water because of the need to operate, maintain and replace the extensive infrastructure that already exists). The focus of spending to extend access is largely rural (64%), whereas the focus for maintaining access is urban (73%) *(8)*.

These figures update previous studies that have ignored the costs of maintaining coverage levels (cost of operating, maintaining, monitoring and replacing infrastructure and facilities). The importance of accounting for costs, including recurrent expenditure, increases as the global "stock" of infrastructure increases. This study also illustrates the beneficial impact of even small improvements in maximizing the working lives of systems. These numbers are most likely projections and vary between regions and according to, for example, whether high- or low-cost interventions are applied. Objectively assessing financing needs highlights important issues that may not otherwise be fully appreciated. Table 6, for example, shows that recurrent expenditure (84%) and spending to maintain existing coverage (88%) dominate water-related expenditure, with important implications for financing strategies.

TABLE 6: DISTRIBUTION OF TOTAL SPENDING IN DEVELOPING COUNTRIES TO MEET TARGET 10 OF THE MILLENNIUM DEVELOPMENT GOALS[a]

	Distribution of total spending			
Water supply[b]	Urban	68%	Rural	32%
	Recurrent	84%	Investment	16%
	Already covered	88%	New coverage	12%
Sanitation[c]	Urban	59%	Rural	41%
	Recurrent	57%	Investment	43%
	Already covered	60%	New coverage	40%

[a] Excluding programme costs. Total price tag $12 billion annually.
[b] Total spending: $36 billion annually on water.
[c] Total spending: $36 billion annually on sanitation.

Especially at the country level, spending on drinking-water and sanitation occurs in diverse sectors and settings. It involves formal water and sanitation service providers, water resource management authorities, local government and communities, as well as both health and environment sector institutions. Lack of "ownership" of drinking-water or—especially—sanitation is often cited as an underlying cause of inadequate policy attention and investment. Studies of financing needs can also assist in encouraging intersectoral cooperation. They can support, for example, the health sector's advocacy for actions and investments by other sectors that would yield substantive health benefits.

Next steps in understanding financing of effective water, sanitation and hygiene interventions

Improving the analyses of cost components and their likely sources of funding and applying them usefully at regional and country levels require improvements in certain data sources and will be the focus of attention in coming years.

Women collecting water from centuries old cistern in Yemeni town of Hababa

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Waste water use in horticultural plots.
Pikine, Dakar, Senegal

ANNEX:
COUNTRY DATA ON WATER-, SANITATION- AND HYGIENE-RELATED DISEASE BURDEN

This annex contains a first estimate of country-by-country data of disease burden attributable to unsafe water, inadequate sanitation, insufficient hygiene and inadequate management of water resources. Data are based on a combination of results from the Comparative Risk Assessment study, a review of the literature and an expert survey (1,4) and country guidance for estimating water, sanitation- and hygiene-related burden of disease (9). Such preliminary estimates can be used as an input to more refined estimates of a country's health impacts.

These estimates address the attributable burden of disease—i.e. the reduction of disease burden that could be achieved if the three main groups of risks within the area of water, sanitation and hygiene were reduced. It should be noted that, in principle, the preventable disease burdens from various intervention areas cannot necessarily be summed up, as there may be interactions between exposures and outcomes or joint effects. For the purpose of this estimate, to avoid an overestimate, the outcomes with a direct water, sanitation and hygiene component are excluded from the estimation of the burden from malnutrition and its consequences. Additional information on methods used can be found in (9). It is possible that the estimates of health impacts from this rather comprehensive risk factor are likely to underestimate the burden, as not all the diseases or risks could be quantified (see last paragraph in the section "Estimating the disease burden related to water, sanitation and hygiene").

Notes to annex table:

DALY: disability-adjusted life year; na: not available;
PEM: protein–energy malnutrition;
WSH: water, sanitation and hygiene.
Note that numbers may not add up as a result of rounding.

a Data further validated by Comparative Risk Assessment methods (4).
b Comparative Quantification of Health Risks (4).
c Not a formal WHO estimate; data based on (1) (literature review and expert survey) and (9).
d Not attributable to one disease group alone approximate estimate based on limited evidence.
e DALYs are a weighted measure of deaths and disability.

Figures have been computed by WHO to ensure comparability; thus they are not necessarily the official statistics of Member States, which may use alternative rigorous methods.

DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002

Disease or injury	Afghanistan	Albania	Algeria	Andorra	Angola	Antigua and Barbuda	Argentina	Armenia	Australia	Austria	Azerbaijan	Bahamas	Bahrain	Bangladesh	Barbados	Belarus
Population ('000)	22 930	3 141	31 266	69	13 184	73	37 981	3 072	19 544	8 111	8 297	310	709	143 809	269	9 940
Total deaths	484.5	22.1	173.3	0.6	306.6	0.6	281.4	26.1	126.6	70.4	64.2	1.8	2.3	1 106.8	2.3	143.6
Total WSH-related	**78.5**	**0.4**	**11.6**	**0.0**	**73.9**	**0.0**	**3.1**	**0.1**	**0.4**	**0.1**	**1.7**	**0.0**	**0.0**	**109.9**	**0.0**	**1.3**
% of total deaths	**16.2%**	**2.0%**	**6.7%**	**0.2%**	**24.1%**	**0.6%**	**1.1%**	**0.3%**	**0.3%**	**0.1%**	**2.6%**	**1.2%**	**0.6%**	**9.9%**	**0.9%**	**0.9%**
Diarrhoeal diseases[a]	36.8	0.3	7.0	0.0	43.5	0.0	0.4	0.0	0.0	0.0	0.8	0.0	0.0	60.3	0.0	0.0
Intestinal nematode infections[b]	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Malnutrition (only PEM)[a,c]	3.2	0.0	0.0	0.0	3.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Consequences of malnutrition[a,c]	19.5	0.1	0.9	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	26.0	0.0	0.0
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	0.0	0.1	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**59.6**	**0.4**	**8.1**	**0.0**	**58.2**	**0.0**	**0.5**	**0.0**	**0.0**	**0.0**	**1.5**	**0.0**	**0.0**	**87.5**	**0.0**	**0.0**
Malaria[c]	0.3	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Dengue[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Subtotal water resource management	**0.3**	**0.0**	**0.0**	**0.0**	**7.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**3.3**	**0.0**	**0.0**
Drownings[c]	1.7	0.0	0.9	0.0	1.7	0.0	0.7	0.0	0.1	0.0	0.0	0.0	0.0	6.1	0.0	1.3
Subtotal safety of water environments	**1.7**	**0.0**	**0.9**	**0.0**	**1.7**	**0.0**	**0.7**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**6.1**	**0.0**	**1.3**
Other infectious diseases[c,d]	16.8	0.0	2.7	0.0	6.5	0.0	1.9	0.0	0.3	0.0	0.1	0.0	0.0	13.0	0.0	0.1

Figures have been computed by WHO to ensure comparability; thus they are not necessarily the official statistics of Member States, which may use alternative rigorous methods.

DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002

Disease or injury	Afghanistan	Albania	Algeria	Andorra	Angola	Antigua and Barbuda	Argentina	Armenia	Australia	Austria	Azerbaijan	Bahamas	Bahrain	Bangladesh	Barbados	Belarus
Total DALYs	17 011.0	502.8	5 499.8	8.5	10 757.1	13.3	6 293.3	516.2	2 153.9	969.7	1 545.0	54.5	83.1	36 972.1	44.5	2 192.3
Total WSH-related	**2 691.8**	**5.8**	**520.0**	**0.0**	**2 593.0**	**0.2**	**96.4**	**5.7**	**9.5**	**2.1**	**67.6**	**0.8**	**na**	**4 058.1**	**0.5**	**35.5**
% of total DALYs	**15.8%**	**1.2%**	**9.5%**	**0.3%**	**24.1%**	**1.2%**	**1.5%**	**1.1%**	**0.4%**	**0.2%**	**4.4%**	**1.5%**	**na**	**11.0%**	**1.1%**	**1.6%**
Diarrhoeal diseases[a]	1 192.4	0.9	250.1	0.0	1 437.1	0.1	41.8	3.1	3.9	0.8	32.4	0.3	na	2 013.3	0.2	3.0
Intestinal nematode infections[b]	13.0	0.0	76.1	0.0	40.3	0.0	5.9	0.0	0.0	0.0	0.0	0.1	0.0	79.0	0.0	0.0
Malnutrition (only PEM)[a,c]	153.7	0.9	23.4	0.0	156.6	0.0	10.8	0.3	0.0	0.0	2.3	0.0	0.1	267.1	0.0	0.7
Consequences of malnutrition[a,c]	676.6	2.4	29.6	0.0	343.9	0.0	0.0	0.3	0.0	0.0	25.0	0.0	0.0	890.0	0.0	0.0
Trachoma[b]	5.3	0.0	0.0	0.0	4.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	16.5	0.0	0.0
Schistosomiasis[b]	0.0	0.0	65.5	0.0	47.8	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.9	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	17.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	142.8	0.0	0.0
Subtotal water supply, sanitation and hygiene	**2 041.1**	**4.3**	**444.7**	**0.0**	**2 047.6**	**0.1**	**58.5**	**3.6**	**4.0**	**0.8**	**59.8**	**0.4**	**0.1**	**3 409.7**	**0.2**	**3.6**
Malaria[c]	23.1	0.0	0.0	0.0	283.3	0.0	0.2	0.3	0.0	0.0	2.4	0.0	0.0	44.1	0.0	0.0
Dengue[c]	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	67.8	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.2	0.0	0.0
Subtotal water resource management	**24.1**	**0.0**	**0.1**	**0.0**	**283.6**	**0.0**	**0.2**	**0.3**	**0.1**	**0.0**	**2.4**	**0.0**	**0.0**	**135.0**	**0.0**	**0.0**
Drownings[c]	57.5	0.9	25.9	0.0	52.5	0.0	20.6	1.3	3.3	0.8	0.9	0.3	0.1	181.7	0.2	30.0
Subtotal safety of water environments	**57.5**	**0.9**	**25.9**	**0.0**	**52.5**	**0.0**	**20.6**	**1.3**	**3.3**	**0.8**	**0.9**	**0.3**	**0.1**	**181.7**	**0.2**	**30.0**
Other infectious diseases[c,d]	569.1	0.6	49.3	0.0	209.4	0.0	17.2	0.5	2.1	0.5	4.4	0.1	0.1	331.6	0.1	1.8

Figures have been computed by WHO to ensure comparability; thus they are not necessarily the official statistics of Member States, which may use alternative rigorous methods.

DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Belgium	Belize	Benin	Bhutan	Bolivia	Bosnia and Herzegovina	Botswana	Brazil	Brunei Darussalam	Bulgaria	Burkina Faso	Burundi	Cambodia	Cameroon	Canada	Cape Verde
Population ('000)	10 296	251	6 558	2 190	8 645	4 126	1 770	176 257	350	7 965	12 624	6 602	13 810	15 729	31 271	454
Total deaths	102.9	1.5	87.4	21.0	73.1	34.9	41.3	1 225.2	1.0	106.7	249.9	120.4	160.5	235.8	222.4	2.4
Total WSH-related	**0.2**	**0.1**	**16.6**	**1.9**	**5.5**	**0.2**	**0.6**	**28.7**	**0.0**	**0.2**	**49.8**	**17.1**	**21.0**	**29.7**	**0.5**	**0.1**
% of total deaths	**0.2%**	**3.4%**	**19.0%**	**9.2%**	**7.5%**	**0.6%**	**1.5%**	**2.3%**	**1.2%**	**0.2%**	**19.9%**	**14.2%**	**13.1%**	**12.6%**	**0.2%**	**4.7%**
Diarrhoeal diseases[a]	0.0	0.0	6.5	1.2	3.7	0.0	0.3	15.0	0.0	0.0	19.5	8.2	10.6	12.7	0.0	0.1
Intestinal nematode infections[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.3	0.1	0.0	0.0
Malnutrition (only PEM)[a,c]	0.0	0.0	0.4	0.0	0.5	0.0	0.0	1.8	0.0	0.0	0.8	0.2	0.6	0.5	0.0	0.0
Consequences of malnutrition[a,c]	0.0	0.0	2.5	0.3	0.3	0.0	0.0	0.4	0.0	0.0	12.8	3.3	3.8	5.2	0.0	0.0
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.8	0.4	0.0	0.6	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**0.0**	**0.0**	**9.8**	**1.5**	**4.5**	**0.0**	**0.4**	**18.2**	**0.0**	**0.0**	**34.0**	**12.2**	**15.3**	**19.0**	**0.0**	**0.1**
Malaria[c]	0.0	0.0	5.2	0.0	0.0	0.0	0.1	0.4	0.0	0.0	10.7	1.9	1.4	8.2	0.0	0.0
Dengue[c]	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.0**	**5.2**	**0.1**	**0.0**	**0.0**	**0.1**	**0.8**	**0.0**	**0.0**	**10.7**	**1.9**	**1.7**	**8.2**	**0.0**	**0.0**
Drownings[c]	0.0	0.0	0.4	0.1	0.4	0.2	0.1	5.6	0.0	0.1	0.9	0.5	1.0	0.9	0.2	0.0
Subtotal safety of water environments	**0.0**	**0.0**	**0.4**	**0.1**	**0.4**	**0.2**	**0.1**	**5.6**	**0.0**	**0.1**	**0.9**	**0.5**	**1.0**	**0.9**	**0.2**	**0.0**
Other infectious diseases[c,d]	0.2	0.0	1.3	0.3	0.6	0.0	0.1	4.0	0.0	0.1	4.1	2.5	3.1	1.6	0.4	0.0

Figures have been computed by WHO to ensure comparability; thus they are not necessarily the official statistics of Member States, which may use alternative rigorous methods.

DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Belgium	Belize	Benin	Bhutan	Bolivia	Bosnia and Herzegovina	Botswana	Brazil	Brunei Darussalam	Bulgaria	Burkina Faso	Burundi	Cambodia	Cameroon	Canada	Cape Verde
Total DALYs	1 357.9	46.2	3 050.1	644.1	2 337.8	649.4	1 267.0	36 522.1	45.1	1 464.4	8 709.5	4 051.7	5 309.9	7 615.3	3 692.6	78.3
Total WSH-related	**4.0**	**2.1**	**623.1**	**65.1**	**199.7**	**6.3**	**31.7**	**1 216.9**	**na**	**5.9**	**1 818.0**	**630.5**	**788.4**	**1 145.1**	**13.6**	**6.9**
% of total DALYs	**0.3%**	**4.5%**	**20.4%**	**10.1%**	**8.5%**	**1.0%**	**2.5%**	**3.3%**	**na**	**0.4%**	**20.9%**	**15.6%**	**14.8%**	**15.0%**	**0.4%**	**8.8%**
Diarrhoeal diseases[a]	2.1	1.1	216.4	39.4	129.7	1.2	11.7	634.5	na	1.6	643.8	270.7	345.2	424.7	6.3	3.2
Intestinal nematode infections[b]	0.0	0.0	19.6	1.5	9.0	0.0	1.9	30.3	0.3	0.0	40.2	8.2	49.2	45.6	0.1	1.3
Malnutrition (only PEM)[a,c]	0.0	0.3	24.7	3.7	19.1	0.2	2.1	89.6	0.3	0.4	61.8	22.3	61.5	42.0	0.0	0.4
Consequences of malnutrition[a,c]	0.0	0.0	87.4	8.7	10.9	0.0	1.5	14.7	0.0	0.0	442.4	114.0	128.8	178.5	0.0	0.0
Trachoma[b]	0.0	0.0	12.7	0.0	0.0	0.0	2.9	99.7	0.0	0.0	21.4	16.5	2.5	27.3	0.0	0.7
Schistosomiasis[b]	0.0	0.0	17.0	0.0	0.0	0.0	3.7	63.2	0.0	0.0	36.1	18.6	1.2	39.0	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	9.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	19.5	8.9	8.2	22.2	0.0	0.6
Subtotal water supply, sanitation and hygiene	**2.1**	**1.5**	**387.0**	**53.3**	**168.7**	**1.5**	**23.8**	**932.0**	**0.9**	**2.0**	**1 265.1**	**459.3**	**596.7**	**779.3**	**6.3**	**6.2**
Malaria[c]	0.0	0.1	187.1	0.4	1.8	0.0	2.4	26.5	0.0	0.0	385.6	76.5	51.2	301.4	0.0	0.0
Dengue[c]	0.0	0.0	0.0	2.0	0.1	0.0	0.0	13.9	0.0	0.0	0.1	0.0	5.8	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	2.4	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.1**	**187.1**	**3.1**	**2.0**	**0.0**	**2.4**	**40.5**	**0.0**	**0.0**	**385.6**	**76.9**	**61.2**	**303.8**	**0.0**	**0.0**
Drownings[c]	0.7	0.4	11.9	2.8	12.1	4.2	2.5	166.7	0.3	2.7	29.9	14.9	33.2	27.9	3.8	0.1
Subtotal safety of water environments	**0.7**	**0.4**	**11.9**	**2.8**	**12.1**	**4.2**	**2.5**	**166.7**	**0.3**	**2.7**	**29.9**	**14.9**	**33.2**	**27.9**	**3.8**	**0.1**
Other infectious diseases[c,d]	1.2	0.1	37.1	5.8	16.9	0.5	3.1	77.7	0.1	1.2	137.4	79.4	99.8	34.1	3.5	0.5

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DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Central African Republic	Chad	Chile	China	Colombia	Comoros	Congo	Cook Islands	Costa Rica	Côte d'Ivoire	Croatia	Cuba	Cyprus	Czech Republic	Democratic People's Republic of Korea	Democratic Republic of the Congo
Population ('000)	3 819	8 348	15 613	1 302 307	43 526	747	3 633	18	4 094	16 365	4 439	11 271	796	10 246	22 541	51 201
Total deaths	75.9	148.7	83.7	9 135.5	243.7	5.4	44.5	0.1	18.3	258.6	50.4	76.7	7.5	103.3	204.4	986.4
Total WSH-related	**9.5**	**27.5**	**0.7**	**200.2**	**5.4**	**0.8**	**5.0**	**0.0**	**0.3**	**35.7**	**0.1**	**0.5**	**0.0**	**0.1**	**7.1**	**201.3**
% of total deaths	**12.6%**	**18.5%**	**0.8%**	**2.2%**	**2.2%**	**14.5%**	**11.2%**	**3.6%**	**1.4%**	**13.8%**	**0.2%**	**0.6%**	**0.4%**	**0.1%**	**3.5%**	**20.4%**
Diarrhoeal diseases[a]	4.2	10.2	0.2	95.6	2.3	0.3	1.4	0.0	0.1	14.7	0.0	0.2	0.0	0.0	2.8	100.3
Intestinal nematode infections[b]	0.0	0.1	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4
Malnutrition (only PEM)[a,c]	0.1	0.6	0.0	0.8	0.4	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	3.2
Consequences of malnutrition[a,c]	2.0	6.9	0.0	10.5	0.2	0.1	0.9	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.6	28.5
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.1	0.5	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**6.4**	**18.3**	**0.2**	**110.8**	**2.9**	**0.4**	**2.3**	**0.0**	**0.1**	**21.2**	**0.0**	**0.2**	**0.0**	**0.0**	**3.6**	**132.3**
Malaria[c]	2.5	6.8	0.0	0.2	0.1	0.2	2.1	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	40.7
Dengue[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Subtotal water resource management	**2.5**	**6.8**	**0.0**	**2.6**	**0.2**	**0.2**	**2.1**	**0.0**	**0.0**	**10.4**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**40.7**
Drownings[c]	0.4	0.5	0.4	82.6	1.0	0.0	0.2	0.0	0.1	1.8	0.1	0.2	0.0	0.1	0.8	5.3
Subtotal safety of water environments	**0.4**	**0.5**	**0.4**	**82.6**	**1.0**	**0.0**	**0.2**	**0.0**	**0.1**	**1.8**	**0.1**	**0.2**	**0.0**	**0.1**	**0.8**	**5.3**
Other infectious diseases[c,d]	0.3	1.9	0.1	4.2	1.3	0.1	0.3	0.0	0.0	2.3	0.1	0.0	0.0	0.0	2.6	23.0

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DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Central African Republic	Chad	Chile	China	Colombia	Comoros	Congo	Cook Islands	Costa Rica	Côte d'Ivoire	Croatia	Cuba	Cyprus	Czech Republic	Democratic People's Republic of Korea	Democratic Republic of the Congo
Total DALYs	2 379.6	5 079.1	2 187.9	200 273.1	8 412.4	201.0	1 502.3	3.0	556.0	8 597.0	709.4	1 587.8	108.5	1 474.3	4 801.2	33 956.5
Total WSH-related	**342.2**	**1 018.8**	**30.1**	**8 707.1**	**251.4**	**33.8**	**192.3**	**0.1**	**10.3**	**1 296.4**	**2.7**	**20.4**	**0.9**	**3.9**	**243.8**	**7 182.4**
% of total DALYs	**14.4%**	**20.1%**	**1.4%**	**4.3%**	**3.0%**	**16.8%**	**12.8%**	**4.1%**	**1.9%**	**15.1%**	**0.4%**	**1.3%**	**0.8%**	**0.3%**	**5.1%**	**21.2%**
Diarrhoeal diseases[a]	133.7	333.9	15.6	3 906.9	130.6	11.9	47.2	0.0	4.1	474.6	0.9	11.3	0.4	1.0	112.7	3 276.9
Intestinal nematode infections[b]	4.4	25.8	2.5	596.1	9.0	2.1	4.2	0.0	0.7	18.7	0.0	1.5	0.0	0.0	12.1	65.3
Malnutrition (only PEM)[a,c]	9.3	44.7	0.6	507.6	24.3	2.1	6.1	0.0	0.5	26.0	0.0	0.4	0.0	0.0	16.9	222.8
Consequences of malnutrition[a,c]	68.5	236.8	0.0	358.3	7.5	4.2	30.3	0.0	0.1	210.6	0.0	0.1	0.0	0.0	21.1	979.1
Trachoma[b]	6.6	21.0	0.0	381.1	0.3	1.5	0.0	0.0	0.0	19.7	0.0	0.0	0.0	0.0	0.0	88.3
Schistosomiasis[b]	8.2	23.1	0.0	48.7	0.0	0.0	7.0	0.0	0.0	33.1	0.0	0.0	0.0	0.0	1.8	98.2
Lymphatic filariasis[b]	5.1	11.4	0.0	0.0	0.0	1.1	4.9	0.0	0.0	23.0	0.0	0.0	0.0	0.0	0.0	68.8
Subtotal water supply, sanitation and hygiene	**235.8**	**696.7**	**18.7**	**5 798.7**	**171.6**	**22.9**	**99.7**	**0.1**	**5.4**	**805.7**	**0.9**	**13.3**	**0.4**	**1.0**	**164.6**	**4 799.5**
Malaria[c]	90.0	248.2	0.0	30.3	14.2	8.0	76.9	0.0	0.9	380.5	0.0	0.0	0.0	0.0	1.0	1 510.5
Dengue[c]	0.0	0.0	0.0	0.1	1.3	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	1.0
Onchocerciasis[c]	1.0	1.8	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	265.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0
Subtotal water resource management	**91.0**	**250.1**	**0.0**	**296.3**	**15.5**	**8.0**	**77.0**	**0.0**	**0.9**	**381.0**	**0.0**	**0.1**	**0.0**	**0.0**	**6.9**	**1 511.5**
Drownings[c]	10.4	16.6	9.2	2 466.0	30.2	0.7	7.1	0.0	3.5	51.3	1.2	5.7	0.3	2.3	23.3	152.3
Subtotal safety of water environments	**10.4**	**16.6**	**9.2**	**2 466.0**	**30.2**	**0.7**	**7.1**	**0.0**	**3.5**	**51.3**	**1.2**	**5.7**	**0.3**	**2.3**	**23.3**	**152.3**
Other infectious diseases[c,d]	4.9	55.5	2.1	147.6	34.2	2.2	8.5	0.0	0.5	58.4	0.6	1.3	0.1	0.6	49.0	719.2

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DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Denmark	Djibouti	Dominica	Dominican Republic	Ecuador	Egypt	El Salvador	Equatorial Guinea	Eritrea	Estonia	Ethiopia	Fiji	Finland	France	Gabon	Gambia
Population ('000)	5 351	693	78	8 616	12 810	70 507	6 415	481	3 991	1 338	68 961	831	5 197	59 850	1 306	1 388
Total deaths	57.4	8.5	0.5	56.8	76.8	495.2	41.2	7.6	41.2	18.2	1 060.2	5.3	48.6	499.0	14.9	15.6
Total WSH-related	**0.1**	**1.2**	**0.0**	**1.7**	**2.6**	**25.1**	**1.6**	**1.0**	**6.0**	**0.1**	**158.7**	**0.2**	**0.1**	**1.0**	**1.2**	**2.1**
% of total deaths	**0.1%**	**13.9%**	**2.1%**	**3.0%**	**3.4%**	**5.1%**	**3.8%**	**13.5%**	**14.5%**	**0.6%**	**15.0%**	**3.4%**	**0.2%**	**0.2%**	**8.0%**	**13.4%**
Diarrhoeal diseases[a]	0.0	0.7	0.0	1.1	1.7	11.4	0.8	0.4	2.3	0.0	57.0	0.0	0.0	0.0	0.4	0.8
Intestinal nematode infections[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
Malnutrition (only PEM)[a,c]	0.0	0.0	0.0	0.2	0.1	0.2	0.1	0.0	0.1	0.0	6.5	0.0	0.0	0.0	0.0	0.0
Consequences of malnutrition[a,c]	0.0	0.3	0.0	0.0	0.2	1.0	0.1	0.1	1.9	0.0	43.0	0.0	0.0	0.0	0.2	0.3
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	0.0	0.0	0.0	0.0	8.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**0.0**	**1.0**	**0.0**	**1.3**	**2.0**	**20.6**	**1.0**	**0.6**	**4.2**	**0.0**	**112.3**	**0.0**	**0.0**	**0.0**	**0.6**	**1.2**
Malaria[c]	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.4	1.0	0.0	13.3	0.0	0.0	0.0	0.5	0.5
Dengue[c]	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.0**	**0.0**	**0.2**	**0.0**	**1.8**	**0.1**	**0.4**	**1.0**	**0.0**	**13.3**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**
Drownings[c]	0.0	0.0	0.0	0.0	0.4	2.3	0.2	0.0	0.3	0.1	2.7	0.0	0.1	0.3	0.1	0.1
Subtotal safety of water environments	**0.0**	**0.0**	**0.0**	**0.0**	**0.4**	**2.3**	**0.2**	**0.0**	**0.3**	**0.1**	**2.7**	**0.0**	**0.1**	**0.3**	**0.1**	**0.1**
Other infectious diseases[c,d]	0.0	0.1	0.0	0.2	0.2	0.5	0.3	0.1	0.5	0.0	30.4	0.1	0.0	0.7	0.1	0.3

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DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Denmark	Djibouti	Dominica	Dominican Republic	Ecuador	Egypt	El Salvador	Equatorial Guinea	Eritrea	Estonia	Ethiopia	Fiji	Finland	France	Gabon	Gambia
Total DALYs	750.2	285.6	13.7	1 672.6	2 364.1	13 692.2	1 310.5	253.4	1 482.1	264.2	36 287.4	162.6	667.7	7 406.5	462.2	515.4
Total WSH-related	**2.0**	**45.9**	**0.3**	**68.1**	**110.4**	**890.0**	**56.7**	**39.4**	**232.9**	**2.6**	**5 926.7**	**5.9**	**2.9**	**na**	**49.6**	**80.0**
% of total DALYs	**0.3%**	**16.1%**	**2.3%**	**4.1%**	**4.7%**	**6.5%**	**4.3%**	**15.5%**	**15.7%**	**1.0%**	**16.3%**	**3.6%**	**0.4%**	**na**	**10.7%**	**15.5%**
Diarrhoeal diseases[a]	1.1	24.2	0.1	43.1	64.1	423.0	32.1	13.0	79.8	0.3	1 930.9	1.7	1.0	na	13.1	26.4
Intestinal nematode infections[b]	0.0	1.9	0.0	1.5	11.0	8.2	1.2	1.4	4.7	0.0	108.2	0.8	0.0	0.0	3.7	3.8
Malnutrition (only PEM)[a,c]	0.0	1.8	0.0	7.6	10.1	62.8	7.2	1.9	8.7	0.1	426.4	0.1	0.0	0.0	2.6	3.1
Consequences of malnutrition[a,c]	0.0	8.8	0.0	0.8	5.7	35.4	2.3	4.9	64.2	0.0	1 469.4	0.0	0.0	0.0	5.2	10.8
Trachoma[b]	0.0	1.1	0.0	0.0	0.0	123.7	0.0	0.7	8.5	0.0	183.9	0.0	0.0	0.0	0.0	0.6
Schistosomiasis[b]	0.0	1.3	0.0	2.4	0.0	88.4	0.0	0.9	7.8	0.0	203.3	0.0	0.0	0.0	2.6	3.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.7	0.0	0.0	93.0	0.5	0.0	0.0	1.8	1.9
Subtotal water supply, sanitation and hygiene	**1.1**	**39.3**	**0.1**	**55.4**	**90.8**	**742.7**	**42.8**	**23.6**	**173.8**	**0.4**	**4 415.1**	**3.1**	**1.0**	**0.0**	**29.0**	**49.5**
Malaria[c]	0.0	0.3	0.0	1.1	4.5	56.1	0.3	12.7	40.1	0.0	520.6	0.0	0.0	0.2	17.9	19.5
Dengue[c]	0.0	0.0	0.0	7.3	0.0	0.0	1.9	0.0	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	4.1	0.0	0.0	0.0	0.1	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.3**	**0.0**	**8.4**	**4.5**	**56.1**	**2.2**	**12.8**	**40.2**	**0.0**	**525.3**	**0.2**	**0.0**	**0.2**	**18.0**	**19.5**
Drownings[c]	0.5	1.6	0.1	0.9	11.6	71.8	7.2	0.8	7.5	2.0	83.1	1.2	1.4	6.0	1.6	2.2
Subtotal safety of water environments	**0.5**	**1.6**	**0.1**	**0.9**	**11.6**	**71.8**	**7.2**	**0.8**	**7.5**	**2.0**	**83.1**	**1.2**	**1.4**	**6.0**	**1.6**	**2.2**
Other infectious diseases[c,d]	0.4	4.7	0.0	3.4	3.5	19.4	4.5	2.2	11.5	0.2	903.1	1.4	0.4	5.9	1.0	8.8

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DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Georgia	Germany	Ghana	Greece	Grenada	Guatemala	Guinea	Guinea-Bissau	Guyana	Haiti	Honduras	Hungary	Iceland	India	Indonesia	Iran (Islamic Republic of)
Population ('000)	5 177	82 414	20 471	10 970	80	12 036	8 359	1 449	764	8 218	6 781	9 923	287	1 049 550	217 131	68 070
Total deaths	61.3	815.4	209.0	114.0	0.8	81.9	114.4	26.6	7.3	112.3	41.8	122.2	1.9	10 378.5	1 626.1	384.5
Total WSH-related	**0.1**	**1.7**	**25.5**	**0.3**	**0.0**	**8.1**	**20.2**	**4.5**	**0.4**	**10.7**	**2.5**	**0.2**	**0.0**	**782.0**	**57.3**	**na**
% of total deaths	**0.1%**	**0.2%**	**12.2%**	**0.3%**	**2.0%**	**9.9%**	**17.7%**	**17.0%**	**5.5%**	**9.5%**	**6.0%**	**0.2%**	**0.1%**	**7.5%**	**3.5%**	**na**
Diarrhoeal diseases[a]	0.0	0.0	8.6	0.0	0.0	2.9	8.5	1.4	0.3	5.0	1.5	0.0	0.0	402.2	31.2	na
Intestinal nematode infections[b]	0.0	0.0	0.1	0.0	0.0	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0
Malnutrition (only PEM)[a,c]	0.0	0.0	0.4	0.0	0.0	0.4	0.4	0.0	0.0	0.4	0.4	0.0	0.0	8.7	1.7	1.0
Consequences of malnutrition[a,c]	0.0	0.0	2.5	0.0	0.0	1.1	2.6	1.1	0.0	2.1	0.1	0.0	0.0	217.0	5.8	0.4
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	0.0	1.3	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**0.0**	**0.0**	**12.8**	**0.0**	**0.0**	**5.5**	**12.0**	**2.6**	**0.3**	**7.5**	**2.1**	**0.0**	**0.0**	**631.2**	**38.8**	**1.3**
Malaria[c]	0.0	0.0	9.7	0.0	0.0	0.1	7.0	1.0	0.0	0.1	0.1	0.0	0.0	3.4	2.9	0.3
Dengue[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.1	0.0	0.0	5.2	0.5	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	0.0	0.0
Subtotal water resource management	**0.0**	**0.0**	**9.7**	**0.0**	**0.0**	**0.1**	**7.0**	**1.0**	**0.0**	**1.1**	**0.2**	**0.0**	**0.0**	**15.1**	**3.4**	**0.3**
Drownings[c]	0.0	0.3	0.9	0.2	0.0	0.1	0.5	0.1	0.0	0.0	0.2	0.2	0.0	50.4	7.6	1.6
Subtotal safety of water environments	**0.0**	**0.3**	**0.9**	**0.2**	**0.0**	**0.1**	**0.5**	**0.1**	**0.0**	**0.0**	**0.2**	**0.2**	**0.0**	**50.4**	**7.6**	**1.6**
Other infectious diseases[c,d]	0.0	1.4	2.0	0.1	0.0	2.3	0.8	0.8	0.0	2.1	0.1	0.0	0.0	85.3	7.5	0.5

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DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Georgia	Germany	Ghana	Greece	Grenada	Guatemala	Guinea	Guinea-Bissau	Guyana	Haiti	Honduras	Hungary	Iceland	India	Indonesia	Iran (Islamic Republic of)
Total DALYs	892.2	10 414.4	7 093.0	1 393.1	17.4	2 822.7	3 994.8	897.7	210.7	3 489.8	1 421.9	1 778.9	28.3	299 909.8	46 385.0	12 679.0
Total WSH-related	**6.7**	**25.7**	**1 018.8**	**na**	**0.5**	**266.4**	**750.8**	**165.2**	**11.4**	**356.3**	**106.3**	**6.8**	**0.1**	**28 213.3**	**2 394.4**	**na**
% of total DALYs	**0.8%**	**0.2%**	**14.4%**	**na**	**2.6%**	**9.4%**	**18.8%**	**18.4%**	**5.4%**	**10.2%**	**7.5%**	**0.4%**	**0.4%**	**9.4%**	**5.2%**	**na**
Diarrhoeal diseases[a]	1.6	8.2	286.6	na	0.2	108.3	275.8	47.8	7.6	164.4	54.2	2.0	0.1	13 644.2	1 085.7	na
Intestinal nematode infections[b]	0.0	0.0	56.6	0.0	0.0	46.2	24.7	4.4	0.2	8.2	2.7	0.0	0.0	594.8	191.1	0.2
Malnutrition (only PEM)[a,c]	0.5	0.0	39.7	0.0	0.0	24.3	28.5	3.9	1.2	16.0	20.5	0.2	0.0	1 493.2	286.7	47.0
Consequences of malnutrition[a,c]	0.2	0.0	85.6	0.0	0.0	36.3	90.2	37.1	0.3	73.4	5.0	0.0	0.0	7 421.2	202.4	12.3
Trachoma[b]	0.0	0.0	35.1	0.0	0.0	1.9	11.6	3.5	0.0	0.0	0.0	0.0	0.0	138.1	0.1	45.6
Schistosomiasis[b]	0.0	0.0	56.8	0.0	0.0	0.0	21.5	4.3	0.0	0.0	0.0	0.0	0.0	0.0	2.5	7.7
Lymphatic filariasis[b]	0.0	0.0	29.5	0.0	0.0	0.0	11.8	2.0	0.0	0.0	0.0	0.0	0.0	1 011.4	141.6	0.0
Subtotal water supply, sanitation and hygiene	**2.3**	**8.2**	**589.9**	**0.0**	**0.2**	**217.0**	**464.2**	**103.0**	**9.3**	**261.9**	**82.5**	**2.2**	**0.1**	**24 302.9**	**1 910.1**	**112.7**
Malaria[c]	3.1	0.1	358.3	0.0	0.0	5.3	250.6	36.8	0.9	5.9	11.7	0.0	0.0	303.7	148.6	24.3
Dengue[c]	0.0	0.0	0.0	0.0	0.0	1.5	0.1	0.0	0.0	31.7	3.7	0.0	0.0	175.4	17.7	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	214.1	0.0	0.0
Subtotal water resource management	**3.1**	**0.1**	**358.3**	**0.0**	**0.0**	**6.9**	**251.0**	**36.9**	**0.9**	**37.6**	**15.4**	**0.0**	**0.0**	**693.2**	**166.3**	**24.3**
Drownings[c]	1.0	5.5	29.0	3.4	0.2	3.2	14.4	2.3	0.8	0.4	5.5	3.5	0.0	1 392.2	210.1	50.4
Subtotal safety of water environments	**1.0**	**5.5**	**29.0**	**3.4**	**0.2**	**3.2**	**14.4**	**2.3**	**0.8**	**0.4**	**5.5**	**3.5**	**0.0**	**1 392.2**	**210.1**	**50.4**
Other infectious diseases[c,d]	0.3	11.9	41.6	0.8	0.1	39.3	21.2	23.1	0.3	56.4	3.0	1.0	0.0	1 825.0	108.1	15.0

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DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Iraq	Ireland	Israel	Italy	Jamaica	Japan	Jordan	Kazakhstan	Kenya	Kiribati	Kuwait	Kyrgyzstan	Lao People's Democratic Republic	Latvia	Lebanon	Lesotho
Population ('000)	24 510	3 911	6 304	57 482	2 627	127 478	5 329	15 469	31 540	87	2 443	5 067	5 529	2 329	3 596	1 800
Total deaths	213.2	31.2	35.4	570.7	19.7	973.2	23.3	184.1	406.9	0.7	4.7	45.3	67.5	33.5	24.1	46.3
Total WSH-related	**22.8**	**0.1**	**na**	**0.5**	**0.2**	**4.8**	**0.9**	**1.6**	**40.1**	**0.0**	**0.0**	**1.4**	**9.4**	**0.3**	**0.4**	**1.9**
% of total deaths	**10.7%**	**0.2%**	**na**	**0.1%**	**1.0%**	**0.5%**	**3.9%**	**0.9%**	**9.9%**	**6.6%**	**0.5%**	**3.0%**	**13.9%**	**0.8%**	**1.7%**	**4.2%**
Diarrhoeal diseases[a]	12.2	0.0	na	0.0	0.1	0.0	0.6	0.3	21.8	0.0	0.0	0.6	4.9	0.0	0.2	1.3
Intestinal nematode infections[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Malnutrition (only PEM)[a,c]	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.4	0.0	0.0	0.1
Consequences of malnutrition[a,c]	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1	5.5	0.0	0.0	0.2	1.6	0.0	0.0	0.2
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**18.5**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.6**	**0.4**	**28.5**	**0.0**	**0.0**	**0.8**	**7.0**	**0.0**	**0.2**	**1.6**
Malaria[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Dengue[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**7.5**	**0.0**	**0.0**	**0.0**	**0.8**	**0.0**	**0.0**	**0.0**
Drownings[c]	1.2	0.0	0.0	0.2	0.0	3.2	0.0	1.1	1.0	0.0	0.0	0.3	0.5	0.2	0.1	0.1
Subtotal safety of water environments	**1.2**	**0.0**	**0.0**	**0.2**	**0.0**	**3.2**	**0.0**	**1.1**	**1.0**	**0.0**	**0.0**	**0.3**	**0.5**	**0.2**	**0.1**	**0.1**
Other infectious diseases[c,d]	3.1	0.0	0.1	0.3	0.0	1.5	0.2	0.1	3.0	0.0	0.0	0.2	1.1	0.0	0.1	0.3

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DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Iraq	Ireland	Israel	Italy	Jamaica	Japan	Jordan	Kazakhstan	Kenya	Kiribati	Kuwait	Kyrgyzstan	Lao People's Democratic Republic	Latvia	Lebanon	Lesotho
Total DALYs	8 279.1	487.6	658.7	6 789.3	386.5	13 296.2	843.0	3 752.1	13 298.0	23.7	259.2	1 141.2	2 229.6	482.2	652.5	1 348.2
Total WSH-related	**822.5**	**na**	**na**	**na**	**8.0**	**68.8**	**33.3**	**55.0**	**1 574.0**	**1.6**	**na**	**51.1**	**340.4**	**6.6**	**13.6**	**70.7**
% of total DALYs	**9.9%**	**na**	**na**	**na**	**2.1%**	**0.5%**	**4.0%**	**1.5%**	**11.8%**	**6.7%**	**na**	**4.5%**	**15.3%**	**1.4%**	**2.1%**	**5.2%**
Diarrhoeal diseases[a]	416.7	na	na	na	5.3	25.5	21.3	15.5	725.4	0.9	na	25.3	154.8	0.7	7.2	43.2
Intestinal nematode infections[b]	3.1	0.0	0.0	0.0	0.5	0.0	0.0	0.0	36.6	0.1	0.0	0.1	17.5	0.0	0.0	2.0
Malnutrition (only PEM)[a,c]	78.1	0.0	0.0	0.0	0.7	0.0	0.9	2.2	56.2	0.3	0.1	2.0	30.3	0.1	0.7	4.7
Consequences of malnutrition[a,c]	161.9	0.0	0.0	0.0	0.1	0.0	1.0	3.3	187.0	0.0	0.0	7.9	56.1	0.0	0.8	7.3
Trachoma[b]	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.5	0.0	0.0	0.0	0.9	0.0	0.0	0.0
Schistosomiasis[b]	4.3	0.0	0.0	0.0	0.0	0.0	1.9	0.0	71.1	0.0	0.0	0.0	0.3	0.0	0.0	3.5
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.6	0.1	0.0	0.0	3.3	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**677.1**	**0.0**	**0.0**	**0.0**	**6.4**	**25.5**	**25.2**	**21.0**	**1 158.4**	**1.3**	**0.2**	**35.2**	**263.3**	**0.8**	**8.7**	**60.8**
Malaria[c]	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	289.5	0.0	0.0	0.1	19.3	0.0	0.0	0.1
Dengue[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	5.9	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0
Subtotal water resource management	**1.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**289.7**	**0.0**	**0.0**	**0.1**	**29.6**	**0.0**	**0.0**	**0.1**
Drownings[c]	38.8	0.8	0.4	3.5	1.0	30.0	1.3	29.8	33.4	0.0	0.4	10.0	15.1	5.3	2.7	3.3
Subtotal safety of water environments	**38.8**	**0.8**	**0.4**	**3.5**	**1.0**	**30.0**	**1.3**	**29.8**	**33.4**	**0.0**	**0.4**	**10.0**	**15.1**	**5.3**	**2.7**	**3.3**
Other infectious diseases[c,d]	104.7	0.3	1.0	3.7	0.5	13.3	6.9	4.2	92.5	0.3	0.3	5.8	33.4	0.4	2.1	6.6

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DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Liberia	Libyan Arab Jamahiriya	Lithuania	Luxembourg	Madagascar	Malawi	Malaysia	Maldives	Mali	Malta	Marshall Islands	Mauritania	Mauritius	Mexico	Micronesia (Federated States of)	Monaco
Population ('000)	3 239	5 445	3 465	447	16 916	11 871	23 965	309	12 623	393	52	2 807	1 210	101 965	108	34
Total deaths	69.4	23.3	41.1	3.4	201.1	257.5	119.2	2.1	242.8	3.0	0.5	40.2	7.8	469.9	0.7	0.3
Total WSH-related	**12.4**	**na**	**0.4**	**0.0**	**39.6**	**37.0**	**2.2**	**0.1**	**50.8**	**0.0**	**0.0**	**7.1**	**0.1**	**9.0**	**0.1**	**0.0**
% of total deaths	**17.8%**	**na**	**0.9%**	**0.2%**	**19.7%**	**14.4%**	**1.9%**	**6.0%**	**20.9%**	**0.2%**	**4.7%**	**17.7%**	**0.7%**	**1.9%**	**8.0%**	**0.2%**
Diarrhoeal diseases[a]	4.3	na	0.0	0.0	16.9	17.1	0.3	0.0	20.2	0.0	0.0	3.2	0.0	4.8	0.0	0.0
Intestinal nematode infections[b]	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Malnutrition (only PEM)[a,c]	0.3	0.0	0.0	0.0	1.2	1.1	0.0	0.0	2.7	0.0	0.0	0.1	0.0	0.9	0.0	0.0
Consequences of malnutrition[a,c]	2.7	0.0	0.0	0.0	8.9	4.8	0.1	0.0	9.1	0.0	0.0	1.7	0.0	0.2	0.0	0.0
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.1	0.2	0.0	0.0	0.7	0.8	0.0	0.0	0.8	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**7.4**	**0.2**	**0.0**	**0.0**	**27.8**	**23.9**	**0.5**	**0.1**	**33.0**	**0.0**	**0.0**	**5.1**	**0.0**	**5.9**	**0.0**	**0.0**
Malaria[c]	2.8	0.0	0.0	0.0	9.3	8.3	0.0	0.0	9.4	0.0	0.0	1.1	0.0	0.0	0.0	0.0
Dengue[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water resource management	**2.8**	**0.0**	**0.0**	**0.0**	**9.3**	**8.3**	**0.1**	**0.0**	**9.4**	**0.0**	**0.0**	**1.1**	**0.0**	**0.0**	**0.0**	**0.0**
Drownings[c]	0.3	0.1	0.3	0.0	0.9	1.4	0.6	0.0	1.1	0.0	0.0	0.2	0.0	2.0	0.0	0.0
Subtotal safety of water environments	**0.3**	**0.1**	**0.3**	**0.0**	**0.9**	**1.4**	**0.6**	**0.0**	**1.1**	**0.0**	**0.0**	**0.2**	**0.0**	**2.0**	**0.0**	**0.0**
Other infectious diseases[c,d]	1.9	0.0	0.0	0.0	1.6	3.3	1.0	0.0	7.3	0.0	0.0	0.7	0.0	1.1	0.0	0.0

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DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Liberia	Libyan Arab Jamahiriya	Lithuania	Luxembourg	Madagascar	Malawi	Malaysia	Maldives	Mali	Malta	Marshall Islands	Mauritania	Mauritius	Mexico	Micronesia (Federated States of)	Monaco
Total DALYs	2 455.1	779.7	625.2	55.1	6 991.4	8 279.2	3 505.1	59.7	8 641.1	43.5	12.7	1 362.9	220.6	15 386.6	21.8	3.9
Total WSH-related	**444.2**	**14.1**	**na**	**0.2**	**1 482.8**	**1 337.8**	**123.0**	**4.5**	**1 864.5**	**na**	**0.7**	**261.1**	**14.5**	**444.1**	**2.0**	**0.0**
% of total DALYs	**18.1%**	**1.8%**	**na**	**0.3%**	**21.2%**	**16.2%**	**3.5%**	**7.5%**	**21.6%**	**na**	**5.2%**	**19.2%**	**6.6%**	**2.9%**	**9.0%**	**0.3%**
Diarrhoeal diseases[a]	142.5	na	na	0.1	558.2	557.9	24.0	1.5	669.0	na	0.3	106.7	1.2	203.9	1.1	0.0
Intestinal nematode infections[b]	9.7	0.0	0.0	0.0	50.9	15.7	22.0	0.2	42.7	0.0	0.0	8.0	2.3	19.6	0.1	0.0
Malnutrition (only PEM)[a,c]	15.9	1.6	0.3	0.0	94.2	65.4	19.0	0.5	121.1	0.0	0.0	9.6	0.4	64.0	0.2	0.0
Consequences of malnutrition[a,c]	92.4	0.0	0.0	0.0	306.4	163.5	2.9	0.7	311.9	0.0	0.0	57.5	0.0	6.6	0.0	0.0
Trachoma[b]	0.0	4.7	0.0	0.0	0.0	34.2	0.1	0.0	39.1	0.0	0.0	4.8	5.5	59.8	0.0	0.0
Schistosomiasis[b]	8.7	3.9	0.0	0.0	42.7	33.9	0.5	0.0	37.6	0.0	0.0	8.0	2.4	0.0	0.0	0.0
Lymphatic filariasis[b]	4.5	0.0	0.0	0.0	23.5	15.7	15.5	0.3	17.4	0.0	0.0	0.0	1.8	0.0	0.1	0.0
Subtotal water supply, sanitation and hygiene	**273.8**	**10.2**	**0.3**	**0.1**	**1 075.9**	**886.3**	**83.9**	**3.2**	**1 238.9**	**0.0**	**0.4**	**194.5**	**13.5**	**353.9**	**1.5**	**0.0**
Malaria[c]	98.5	0.0	0.0	0.0	341.7	305.4	2.8	0.1	343.7	0.0	0.0	41.7	0.0	3.3	0.0	0.0
Dengue[c]	0.0	0.0	0.0	0.0	0.0	0.3	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Onchocerciasis[c]	0.7	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water resource management	**99.1**	**0.0**	**0.0**	**0.0**	**341.7**	**306.6**	**8.8**	**0.2**	**343.7**	**0.0**	**0.0**	**41.7**	**0.0**	**3.6**	**0.0**	**0.0**
Drownings[c]	8.6	2.9	7.2	0.0	27.5	41.0	17.2	0.2	33.3	0.1	0.1	5.4	0.6	60.3	0.2	0.0
Subtotal safety of water environments	**8.6**	**2.9**	**7.2**	**0.0**	**27.5**	**41.0**	**17.2**	**0.2**	**33.3**	**0.1**	**0.1**	**5.4**	**0.6**	**60.3**	**0.2**	**0.0**
Other infectious diseases[c,d]	62.6	1.0	0.5	0.0	37.6	104.0	13.3	0.9	248.6	0.0	0.1	19.5	0.3	26.2	0.3	0.0

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DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Mongolia	Morocco	Mozambique	Myanmar	Namibia	Nauru	Nepal	Netherlands	New Zealand	Nicaragua	Niger	Nigeria	Niue	Norway	Oman	Pakistan
Population ('000)	2 559	30 072	18 537	48 852	1 961	13	24 609	16 067	3 846	5 335	11 544	120 911	2	4 514	2 768	149 911
Total deaths	19.4	153.8	385.3	519.9	28.3	0.1	233.3	139.4	27.3	25.7	244.6	2 006.1	0.0	45.2	8.3	1 386.4
Total WSH-related	**1.0**	**8.1**	**62.5**	**44.0**	**1.3**	**0.0**	**24.7**	**0.3**	**0.0**	**1.9**	**56.2**	**335.2**	**0.0**	**0.1**	**0.2**	**187.9**
% of total deaths	**5.2%**	**5.3%**	**16.2%**	**8.5%**	**4.7%**	**2.6%**	**10.6%**	**0.2%**	**0.2%**	**7.5%**	**23.0%**	**16.7%**	**3.3%**	**0.2%**	**1.9%**	**13.6%**
Diarrhoeal diseases[a]	0.8	6.0	26.9	21.7	0.7	0.0	14.7	0.0	0.0	1.2	22.7	119.7	0.0	0.0	0.0	103.3
Intestinal nematode infections[b]	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.8
Malnutrition (only PEM)[a,c]	0.0	0.1	1.6	0.7	0.0	0.0	0.5	0.0	0.0	0.3	0.6	4.8	0.0	0.0	0.0	2.5
Consequences of malnutrition[a,c]	0.1	1.1	6.4	7.9	0.1	0.0	4.3	0.0	0.0	0.2	13.3	75.2	0.0	0.0	0.1	51.7
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	0.0	2.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	1.4	6.8	0.0	0.0	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**0.9**	**7.1**	**37.0**	**30.5**	**0.9**	**0.0**	**19.7**	**0.0**	**0.0**	**1.6**	**38.1**	**206.9**	**0.0**	**0.0**	**0.1**	**158.3**
Malaria[c]	0.0	0.0	14.2	2.6	0.3	0.0	0.0	0.0	0.0	0.0	9.8	91.0	0.0	0.0	0.0	0.6
Dengue[c]	0.0	0.0	0.0	0.8	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.5
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3
Subtotal water resource management	**0.0**	**0.0**	**14.2**	**3.7**	**0.3**	**0.0**	**0.4**	**0.0**	**0.0**	**0.1**	**9.8**	**91.0**	**0.0**	**0.0**	**0.0**	**3.4**
Drownings[c]	0.1	0.8	0.5	2.5	0.0	0.0	1.3	0.1	0.0	0.2	1.1	14.8	0.0	0.0	0.1	5.9
Subtotal safety of water environments	**0.1**	**0.8**	**0.5**	**2.5**	**0.0**	**0.0**	**1.3**	**0.1**	**0.0**	**0.2**	**1.1**	**14.8**	**0.0**	**0.0**	**0.1**	**5.9**
Other infectious diseases[c,d]	0.0	0.2	10.8	7.4	0.1	0.0	3.4	0.2	0.0	0.0	7.2	22.5	0.0	0.1	0.0	20.3

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DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Mongolia	Morocco	Mozambique	Myanmar	Namibia	Nauru	Nepal	Netherlands	New Zealand	Nicaragua	Niger	Nigeria	Niue	Norway	Oman	Pakistan
Total DALYs	580.5	5 198.0	12 437.7	14 522.8	880.6	3.1	7 469.1	1 868.5	451.7	954.5	8 938.0	68 127.8	0.4	520.4	363.2	44 821.2
Total WSH-related	**38.2**	**332.7**	**2 135.1**	**1 612.7**	**56.1**	**na**	**873.5**	**6.4**	**na**	**76.9**	**2 022.5**	**12 377.5**	**0.0**	**1.9**	**na**	**6 437.5**
% of total DALYs	**6.6%**	**6.4%**	**17.2%**	**11.1%**	**6.4%**	**na**	**11.7%**	**0.3%**	**na**	**8.1%**	**22.6%**	**18.2%**	**3.8%**	**0.4%**	**na**	**14.4%**
Diarrhoeal diseases[a]	28.2	210.5	871.2	732.8	25.5	na	492.2	3.2	na	42.7	750.4	3 869.2	0.0	0.9	na	3 298.0
Intestinal nematode infections[b]	1.3	3.1	23.4	119.9	2.2	0.0	15.3	0.0	0.0	5.8	36.5	356.1	0.0	0.0	0.0	109.6
Malnutrition (only PEM)[a,c]	1.1	28.3	83.3	99.7	3.4	0.0	55.5	0.0	0.0	10.8	58.0	442.8	0.0	0.0	1.4	280.1
Consequences of malnutrition[a,c]	2.0	36.2	217.4	274.1	4.5	0.0	149.6	0.0	0.0	5.5	456.9	2 613.9	0.0	0.0	1.9	1 764.0
Trachoma[b]	0.0	16.6	39.7	10.2	0.0	0.0	2.9	0.0	0.0	0.0	25.7	232.9	0.0	0.0	5.8	15.7
Schistosomiasis[b]	0.0	5.5	66.7	0.0	4.0	0.0	0.8	0.0	0.0	0.0	43.9	334.2	0.0	0.0	1.0	0.0
Lymphatic filariasis[b]	0.0	0.0	24.7	15.2	0.0	0.0	24.1	0.0	0.0	0.0	15.9	170.4	0.0	0.0	0.0	0.1
Subtotal water supply, sanitation and hygiene	**32.6**	**300.2**	**1 326.4**	**1 251.9**	**39.6**	**0.0**	**740.4**	**3.2**	**0.0**	**64.7**	**1 387.2**	**8 019.4**	**0.0**	**0.9**	**10.2**	**5 467.4**
Malaria[c]	0.0	0.3	508.0	96.1	13.8	0.0	5.3	0.0	0.0	3.5	364.8	3 272.4	0.0	0.0	0.0	61.1
Dengue[c]	0.0	0.0	0.4	26.1	0.0	0.0	6.4	0.0	0.0	2.5	0.0	0.6	0.0	0.0	0.2	18.5
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.2	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.5	0.0	0.0	12.7	0.0	0.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.4
Subtotal water resource management	**0.5**	**0.3**	**508.4**	**134.9**	**13.8**	**0.0**	**16.8**	**0.0**	**0.0**	**6.0**	**364.8**	**3 307.2**	**0.0**	**0.0**	**0.2**	**157.1**
Drownings[c]	3.4	24.8	13.8	72.6	1.4	0.1	39.9	1.3	1.0	4.8	34.0	412.3	0.0	0.5	2.5	171.2
Subtotal safety of water environments	**3.4**	**24.8**	**13.8**	**72.6**	**1.4**	**0.1**	**39.9**	**1.3**	**1.0**	**4.8**	**34.0**	**412.3**	**0.0**	**0.5**	**2.5**	**171.2**
Other infectious diseases[c,d]	1.7	7.4	286.5	153.2	1.3	0.0	76.2	1.9	0.2	1.4	236.6	638.5	0.0	0.4	0.7	641.8

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DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Palau	Panama	Papua New Guinea	Paraguay	Peru	Philippines	Poland	Portugal	Qatar	Republic of Korea	Republic of Moldova	Romania	Russian Federation	Rwanda	Saint Kitts and Nevis	Saint Lucia
Population ('000)	20	3 064	5 586	5 740	26 767	78 580	38 622	10 049	601	47 430	4 270	22 387	144 082	8 272	42	148
Total deaths	0.1	13.9	46.7	26.9	170.1	448.5	351.9	94.3	1.5	275.0	48.2	258.7	2 405.7	131.5	0.4	0.9
Total WSH-related	**0.0**	**0.4**	**4.9**	**1.0**	**6.6**	**23.3**	**1.0**	**0.2**	**0.0**	**na**	**0.4**	**1.1**	**14.4**	**21.2**	**0.0**	**0.0**
% of total deaths	**3.2%**	**3.0%**	**10.4%**	**3.6%**	**3.9%**	**5.2%**	**0.3%**	**0.2%**	**0.9%**	**na**	**0.8%**	**0.4%**	**0.6%**	**16.1%**	**2.6%**	**1.9%**
Diarrhoeal diseases[a]	0.0	0.2	2.1	0.7	3.9	10.6	0.0	0.0	0.0	na	0.1	0.0	0.7	11.7	0.0	0.0
Intestinal nematode infections[b]	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Malnutrition (only PEM)[a,c]	0.0	0.0	0.4	0.1	0.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Consequences of malnutrition[a,c]	0.0	0.0	0.8	0.0	0.3	4.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	2.9	0.0	0.0
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**0.0**	**0.2**	**3.4**	**0.8**	**4.7**	**16.5**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	**0.7**	**15.3**	**0.0**	**0.0**
Malaria[c]	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
Dengue[c]	0.0	0.0	0.0	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.0**	**0.4**	**0.0**	**0.0**	**3.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.2**	**0.0**	**0.0**
Drownings[c]	0.0	0.1	0.3	0.1	1.0	2.7	0.8	0.0	0.0	1.1	0.3	0.9	13.1	0.8	0.0	0.0
Subtotal safety of water environments	**0.0**	**0.1**	**0.3**	**0.1**	**1.0**	**2.7**	**0.8**	**0.0**	**0.0**	**1.1**	**0.3**	**0.9**	**13.1**	**0.8**	**0.0**	**0.0**
Other infectious diseases[c,d]	0.0	0.1	0.7	0.1	0.8	1.0	0.2	0.2	0.0	0.5	0.0	0.1	0.5	3.8	0.0	0.0

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DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Palau	Panama	Papua New Guinea	Paraguay	Peru	Philippines	Poland	Portugal	Qatar	Republic of Korea	Republic of Moldova	Romania	Russian Federation	Rwanda	Saint Kitts and Nevis	Saint Lucia
Total DALYs	3.6	451.8	1 608.4	1 020.6	5 153.3	14 991.2	5 832.4	1 415.5	70.6	6 370.2	883.0	4 106.1	39 410.0	4 527.6	8.1	24.4
Total WSH-related	**0.1**	**17.2**	**183.0**	**41.3**	**267.2**	**1 031.6**	**na**	**na**	**2.6**	**na**	**9.7**	**na**	**381.9**	**770.2**	**0.2**	**0.6**
% of total DALYs	**3.7%**	**3.8%**	**11.4%**	**4.0%**	**5.2%**	**6.9%**	**na**	**na**	**3.6%**	**na**	**1.1%**	**na**	**1.0%**	**17.0%**	**2.5%**	**2.6%**
Diarrhoeal diseases[a]	0.0	9.2	72.6	28.7	160.6	392.9	na	na	0.4	na	1.7	na	43.2	388.8	0.1	0.3
Intestinal nematode infections[b]	0.0	0.7	8.1	1.2	24.2	76.7	0.0	0.0	0.0	19.5	0.0	0.0	0.0	10.2	0.0	0.1
Malnutrition (only PEM)[a,c]	0.0	1.6	21.9	4.1	25.4	105.0	0.6	0.0	0.1	8.9	0.3	1.4	13.8	35.4	0.0	0.0
Consequences of malnutrition[a,c]	0.0	0.3	28.7	0.0	10.8	171.9	0.0	0.0	0.0	0.0	0.2	1.7	0.0	98.3	0.0	0.0
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	14.2	0.0	0.0
Schistosomiasis[b]	0.0	0.0	0.3	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.9	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	3.6	0.0	0.0	50.4	0.0	0.0	0.0	198.6	0.0	0.0	0.0	10.9	0.0	0.0
Subtotal water supply, sanitation and hygiene	**0.1**	**11.7**	**135.2**	**33.9**	**221.0**	**800.4**	**0.6**	**0.0**	**2.2**	**227.1**	**2.3**	**3.2**	**57.0**	**575.7**	**0.1**	**0.4**
Malaria[c]	0.0	0.1	13.7	1.5	5.2	14.3	0.0	0.1	0.0	0.2	0.0	0.0	0.8	50.2	0.0	0.0
Dengue[c]	0.0	0.0	0.0	0.0	0.1	104.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	2.2	0.0	0.0	7.2	0.0	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.1**	**15.9**	**1.5**	**5.3**	**125.6**	**0.0**	**0.1**	**0.0**	**6.3**	**0.0**	**0.0**	**0.8**	**50.2**	**0.0**	**0.0**
Drownings[c]	0.0	3.3	9.5	3.2	27.2	83.8	18.5	0.4	0.3	26.3	6.8	20.3	305.3	23.4	0.1	0.2
Subtotal safety of water environments	**0.0**	**3.3**	**9.5**	**3.2**	**27.2**	**83.8**	**18.5**	**0.4**	**0.3**	**26.3**	**6.8**	**20.3**	**305.3**	**23.4**	**0.1**	**0.2**
Other infectious diseases[c,d]	0.0	2.0	23.0	2.8	13.7	22.5	4.7	2.0	0.1	6.2	0.5	3.4	18.8	121.0	0.0	0.0

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DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Saint Vincent and the Grenadines	Samoa	San Marino	Sao Tome and Principe	Saudi Arabia	Senegal	Serbia and Montenegro	Seychelles	Sierra Leone	Singapore	Slovakia	Slovenia	Solomon Islands	Somalia	South Africa	Spain
Population ('000)	119	176	27	157	23 520	9 855	10 535	80	4 764	4 183	5 398	1 986	463	9 480	44 759	40 977
Total deaths	0.8	1.1	0.3	1.4	97.3	102.8	120.9	0.5	131.7	18.1	49.9	18.2	3.0	175.3	679.8	355.7
Total WSH-related	**0.0**	**0.0**	**0.0**	**0.1**	**na**	**17.0**	**0.2**	**0.0**	**25.7**	**0.0**	**0.1**	**0.0**	**0.3**	**26.5**	**17.9**	**0.8**
% of total deaths	**1.4%**	**4.2%**	**0.1%**	**9.0%**	**na**	**16.5%**	**0.1%**	**2.6%**	**19.5%**	**0.2%**	**0.3%**	**0.2%**	**11.4%**	**15.1%**	**2.6%**	**0.2%**
Diarrhoeal diseases[a]	0.0	0.0	0.0	0.1	na	6.5	0.0	0.0	11.5	0.0	0.0	0.0	0.2	14.0	11.9	0.0
Intestinal nematode infections[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Malnutrition (only PEM)[a,c]	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.2	1.4	0.0
Consequences of malnutrition[a,c]	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.0	4.5	0.0	0.0	0.0	0.0	7.6	1.0	0.0
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.3	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**10.1**	**0.0**	**0.0**	**17.4**	**0.0**	**0.0**	**0.0**	**0.3**	**22.1**	**14.4**	**0.0**
Malaria[c]	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0.0	3.9	0.0	0.0	0.0	0.0	1.7	0.0	0.0
Dengue[c]	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**5.5**	**0.0**	**0.0**	**3.9**	**0.0**	**0.0**	**0.0**	**0.0**	**1.7**	**0.0**	**0.0**
Drownings[c]	0.0	0.0	0.0	0.0	1.2	0.5	0.1	0.0	0.5	0.0	0.1	0.0	0.0	0.6	1.0	0.3
Subtotal safety of water environments	**0.0**	**0.0**	**0.0**	**0.0**	**1.2**	**0.5**	**0.1**	**0.0**	**0.5**	**0.0**	**0.1**	**0.0**	**0.0**	**0.6**	**1.0**	**0.3**
Other infectious diseases[c,d]	0.0	0.0	0.0	0.0	0.4	0.8	0.1	0.0	3.8	0.0	0.0	0.0	0.1	2.1	2.4	0.5

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DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Saint Vincent and the Grenadines	Samoa	San Marino	Sao Tome and Principe	Saudi Arabia	Senegal	Serbia and Montenegro	Seychelles	Sierra Leone	Singapore	Slovakia	Slovenia	Solomon Islands	Somalia	South Africa	Spain
Total DALYs	22.7	29.0	3.0	42.4	3 724.1	3 808.9	1 823.4	16.1	4 517.0	441.7	834.3	282.4	109.1	6 363.9	20 560.5	4 951.6
Total WSH-related	**na**	**1.6**	**na**	**5.6**	**na**	**662.1**	**10.7**	**na**	**895.6**	**8.0**	**4.5**	**na**	**12.2**	**974.4**	**821.4**	**18.4**
% of total DALYs	**na**	**5.6%**	**na**	**13.3%**	**na**	**17.4%**	**0.6%**	**na**	**19.8%**	**1.8%**	**0.5%**	**na**	**11.2%**	**15.3%**	**4.0%**	**0.4%**
Diarrhoeal diseases[a]	na	0.6	na	1.7	na	216.8	6.3	na	371.6	1.7	1.1	na	6.5	455.0	402.8	8.2
Intestinal nematode infections[b]	0.0	0.2	0.0	0.4	0.3	28.7	0.0	0.2	15.3	3.3	0.0	0.0	0.8	28.4	43.6	0.0
Malnutrition (only PEM)[a,c]	0.0	0.1	0.0	0.3	21.7	17.3	0.7	0.0	35.2	2.0	0.1	0.0	0.9	50.9	76.8	0.0
Consequences of malnutrition[a,c]	0.0	0.0	0.0	0.6	0.0	108.8	0.0	0.0	158.1	0.0	0.0	0.0	1.1	259.7	35.7	0.0
Trachoma[b]	0.0	0.0	0.0	0.3	25.5	15.3	0.0	0.5	12.5	0.0	0.0	0.0	0.0	0.0	97.9	0.0
Schistosomiasis[b]	0.0	0.0	0.0	0.3	4.8	23.3	0.0	0.0	18.0	0.0	0.0	0.0	0.0	23.2	91.0	0.0
Lymphatic filariasis[b]	0.0	0.1	0.0	0.2	0.0	14.0	0.0	0.1	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**0.1**	**1.0**	**0.0**	**3.9**	**52.3**	**424.3**	**7.0**	**0.8**	**617.3**	**7.0**	**1.2**	**0.0**	**9.2**	**817.3**	**747.9**	**8.2**
Malaria[c]	0.0	0.0	0.0	1.3	3.1	200.7	0.0	0.0	141.6	0.0	0.0	0.0	0.3	63.5	1.4	0.1
Dengue[c]	0.0	0.0	0.0	0.0	8.8	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.1**	**0.0**	**1.3**	**11.9**	**200.8**	**0.0**	**0.0**	**142.2**	**0.3**	**0.0**	**0.0**	**0.4**	**63.5**	**1.4**	**0.1**
Drownings[c]	0.2	0.2	0.0	0.1	35.6	17.8	2.4	0.2	15.6	0.2	2.8	0.3	0.8	21.0	32.3	5.8
Subtotal safety of water environments	**0.2**	**0.2**	**0.0**	**0.1**	**35.6**	**17.8**	**2.4**	**0.2**	**15.6**	**0.2**	**2.8**	**0.3**	**0.8**	**21.0**	**32.3**	**5.8**
Other infectious diseases[c,d]	0.0	0.3	0.0	0.3	8.5	19.3	1.3	0.0	120.6	0.5	0.5	0.1	1.7	72.7	39.7	4.3

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DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Sri Lanka	Sudan	Suriname	Swaziland	Sweden	Switzerland	Syrian Arab Republic	Tajikistan	Thailand	The former Yugoslav Republic of Macedonia	Timor-Leste	Togo	Tonga	Trinidad and Tobago	Tunisia	Turkey
Population ('000)	18 910	32 878	432	1 069	8 867	7 171	17 381	6 195	62 193	2 046	739	4 801	103	1 298	9 728	70 318
Total deaths	145.5	346.2	3.3	26.0	91.1	60.9	70.9	54.3	419.1	19.0	6.8	62.5	0.6	11.8	55.8	436.9
Total WSH-related	**2.7**	**39.0**	**0.1**	**1.1**	**0.2**	**0.1**	**2.4**	**2.2**	**13.5**	**na**	**0.6**	**8.5**	**0.0**	**0.1**	**1.0**	**8.6**
% of total deaths	**1.9%**	**11.3%**	**3.1%**	**4.2%**	**0.2%**	**0.2%**	**3.4%**	**4.0%**	**3.2%**	**na**	**9.0%**	**13.5%**	**3.9%**	**0.7%**	**1.7%**	**2.0%**
Diarrhoeal diseases[a]	0.6	17.2	0.0	0.5	0.0	0.0	1.8	1.8	2.8	na	0.1	2.6	0.0	0.0	0.6	6.0
Intestinal nematode infections[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Malnutrition (only PEM)[a,c]	0.0	0.9	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Consequences of malnutrition[a,c]	0.1	8.4	0.0	0.1	0.0	0.0	0.1	0.0	0.4	0.0	0.2	2.4	0.0	0.0	0.1	1.6
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**0.8**	**28.2**	**0.0**	**0.7**	**0.0**	**0.0**	**1.9**	**1.8**	**3.9**	**0.0**	**0.3**	**5.1**	**0.0**	**0.0**	**0.7**	**7.8**
Malaria[c]	0.4	8.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	2.7	0.0	0.0	0.0	0.0
Dengue[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water resource management	**0.5**	**8.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**4.0**	**0.0**	**0.0**	**2.7**	**0.0**	**0.0**	**0.0**	**0.0**
Drownings[c]	0.7	1.5	0.0	0.1	0.1	0.0	0.2	0.2	2.3	0.0	0.0	0.3	0.0	0.0	0.2	0.5
Subtotal safety of water environments	**0.7**	**1.5**	**0.0**	**0.1**	**0.1**	**0.0**	**0.2**	**0.2**	**2.3**	**0.0**	**0.0**	**0.3**	**0.0**	**0.0**	**0.2**	**0.5**
Other infectious diseases[c,d]	0.9	1.4	0.0	0.3	0.1	0.1	0.3	0.1	3.2	0.0	0.2	0.4	0.0	0.0	0.1	0.3

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DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Sri Lanka	Sudan	Suriname	Swaziland	Sweden	Switzerland	Syrian Arab Republic	Tajikistan	Thailand	The former Yugoslav Republic of Macedonia	Timor-Leste	Togo	Tonga	Trinidad and Tobago	Tunisia	Turkey
Total DALYs	3 499.8	11 748.8	89.2	805.7	977.4	798.6	2 663.7	1 374.3	12 754.8	326.0	152.9	2 103.4	15.8	267.4	1 543.7	11 449.8
Total WSH-related	**111.7**	**1 668.7**	**4.7**	**43.3**	**2.7**	**2.1**	**103.4**	**84.0**	**532.0**	**na**	**21.8**	**329.4**	**0.8**	**3.1**	**35.0**	**371.5**
% of total DALYs	**3.2%**	**14.2%**	**5.3%**	**5.4%**	**0.3%**	**0.3%**	**3.9%**	**6.1%**	**4.2%**	**na**	**14.3%**	**15.7%**	**5.2%**	**1.2%**	**2.3%**	**3.2%**
Diarrhoeal diseases[a]	28.4	591.8	1.7	18.2	0.9	0.7	69.5	62.0	124.4	na	4.4	86.4	0.3	1.3	19.5	211.0
Intestinal nematode infections[b]	15.8	88.1	0.1	1.3	0.0	0.0	0.1	0.0	59.7	0.0	0.6	13.9	0.1	0.2	0.0	0.3
Malnutrition (only PEM)[a,c]	7.8	89.9	0.2	5.8	0.0	0.0	7.8	5.7	27.5	0.2	1.0	7.5	0.0	0.1	1.3	18.0
Consequences of malnutrition[a,c]	4.3	286.7	0.2	3.7	0.0	0.0	4.3	0.0	14.2	0.0	7.0	82.4	0.0	0.0	1.9	55.4
Trachoma[b]	0.0	97.0	0.0	1.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	7.4	0.1	0.0	0.0	0.0
Schistosomiasis[b]	0.1	86.2	0.2	2.1	0.0	0.0	6.3	0.0	0.5	0.0	0.0	10.2	0.0	0.0	3.6	0.4
Lymphatic filariasis[b]	12.5	47.0	0.0	0.0	0.0	0.0	0.0	0.0	40.8	0.0	0.0	6.7	0.1	0.0	0.0	0.9
Subtotal water supply, sanitation and hygiene	**68.7**	**1 286.6**	**2.3**	**32.7**	**0.9**	**0.7**	**88.0**	**67.7**	**267.2**	**0.2**	**13.0**	**214.5**	**0.5**	**1.6**	**26.3**	**286.0**
Malaria[c]	17.1	286.5	0.3	0.4	0.0	0.0	0.0	6.5	67.6	0.0	0.3	99.3	0.0	0.0	0.0	57.4
Dengue[c]	1.0	0.2	0.9	0.0	0.0	0.0	0.0	0.0	66.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Subtotal water resource management	**18.1**	**287.8**	**1.1**	**0.4**	**0.0**	**0.0**	**0.0**	**6.5**	**133.6**	**0.0**	**0.7**	**99.6**	**0.0**	**0.0**	**0.0**	**57.4**
Drownings[c]	15.6	49.3	1.0	2.0	1.0	0.7	7.2	6.2	64.9	0.4	1.4	8.2	0.1	1.2	6.7	17.1
Subtotal safety of water environments	**15.6**	**49.3**	**1.0**	**2.0**	**1.0**	**0.7**	**7.2**	**6.2**	**64.9**	**0.4**	**1.4**	**8.2**	**0.1**	**1.2**	**6.7**	**17.1**
Other infectious diseases[c,d]	9.3	45.0	0.2	8.3	0.8	0.6	8.1	3.7	66.3	0.3	6.7	7.2	0.1	0.4	2.0	11.0

Figures have been computed by WHO to ensure comparability; thus they are not necessarily the official statistics of Member States, which may use alternative rigorous methods.

DEATHS ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Turkmenistan	Tuvalu	Uganda	Ukraine	United Arab Emirates	United Kingdom	United Republic of Tanzania	United States of America	Uruguay	Uzbekistan	Vanuatu	Venezuela (Bolivarian Republic of)	Viet Nam	Yemen	Zambia	Zimbabwe
Population ('000)	4 794	10	25 004	48 902	2 937	59 068	36 276	291 038	3 391	25 705	207	25 226	80 278	19 315	10 698	12 835
Total deaths	41.7	0.1	388.4	783.0	9.2	599.3	596.4	2 420.6	30.5	171.5	1.2	114.5	515.8	171.3	232.0	284.2
Total WSH-related	**1.7**	**0.0**	**61.6**	**3.9**	**0.2**	**0.6**	**78.0**	**8.7**	**0.2**	**2.2**	**0.1**	**2.3**	**20.8**	**27.5**	**30.5**	**11.6**
% of total deaths	**4.0%**	**5.6%**	**15.8%**	**0.5%**	**1.9%**	**0.1%**	**13.1%**	**0.4%**	**0.6%**	**1.3%**	**4.8%**	**2.0%**	**4.0%**	**16.0%**	**13.2%**	**4.1%**
Diarrhoeal diseases[a]	1.0	0.0	26.8	0.0	0.0	0.0	28.2	0.0	0.0	0.5	0.0	1.4	9.4	16.9	13.7	5.4
Intestinal nematode infections[b]	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Malnutrition (only PEM)[a,c]	0.0	0.0	1.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.2	0.0	0.8	0.5	1.4
Consequences of malnutrition[a,c]	0.4	0.0	11.3	0.0	0.0	0.0	10.4	0.0	0.0	0.7	0.0	0.1	2.3	6.8	4.7	0.9
Trachoma[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Schistosomiasis[b]	0.0	0.0	0.4	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.5	0.6
Lymphatic filariasis[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subtotal water supply, sanitation and hygiene	**1.4**	**0.0**	**39.7**	**0.0**	**0.0**	**0.0**	**43.7**	**0.0**	**0.0**	**1.2**	**0.0**	**1.7**	**11.8**	**24.6**	**19.5**	**8.3**
Malaria[c]	0.0	0.0	17.2	0.0	0.0	0.0	23.6	0.0	0.0	0.0	0.0	0.0	1.8	0.5	8.0	0.2
Dengue[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Subtotal water resource management	**0.0**	**0.0**	**17.2**	**0.0**	**0.0**	**0.0**	**23.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.1**	**0.5**	**8.0**	**0.2**
Drownings[c]	0.3	0.0	1.3	3.7	0.1	0.1	2.5	2.1	0.1	0.8	0.0	0.5	3.1	1.2	0.4	0.5
Subtotal safety of water environments	**0.3**	**0.0**	**1.3**	**3.7**	**0.1**	**0.1**	**2.5**	**2.1**	**0.1**	**0.8**	**0.0**	**0.5**	**3.1**	**1.2**	**0.4**	**0.5**
Other infectious diseases[c,d]	0.0	0.0	3.3	0.2	0.0	0.4	8.1	6.6	0.1	0.1	0.0	0.1	3.9	1.2	2.6	2.6

Figures have been computed by WHO to ensure comparability; thus they are not necessarily the official statistics of Member States, which may use alternative rigorous methods.

DALYS[e] ('000) ATTRIBUTABLE TO WATER, SANITATION AND HYGIENE, BY CAUSE AND WHO MEMBER STATE, 2002 (CONTINUED)

Disease or injury	Turkmenistan	Tuvalu	Uganda	Ukraine	United Arab Emirates	United Kingdom	United Republic of Tanzania	United States of America	Uruguay	Uzbekistan	Vanuatu	Venezuela (Bolivarian Republic of)	Viet Nam	Yemen	Zambia	Zimbabwe
Total DALYs	1 070.0	2.8	13 359.3	11 340.8	413.2	7 555.0	20 235.0	41 520.9	558.1	4 300.4	38.0	4 110.0	13 359.7	6 940.3	7 501.5	8 589.0
Total WSH-related	**58.8**	**0.2**	**2 290.0**	**111.9**	**13.8**	**na**	**2 950.4**	**169.2**	**7.9**	**93.6**	**2.4**	**124.9**	**1 007.3**	**1 017.2**	**1 091.7**	**421.6**
% of total DALYs	**5.5%**	**6.6%**	**17.1%**	**1.0%**	**3.3%**	**na**	**14.6%**	**0.4%**	**1.4%**	**2.2%**	**6.3%**	**3.0%**	**7.5%**	**14.7%**	**14.6%**	**4.9%**
Diarrhoeal diseases[a]	33.6	0.1	875.1	14.7	1.8	na	943.2	58.2	3.4	25.7	1.0	75.7	321.1	560.1	449.3	179.7
Intestinal nematode infections[b]	0.0	0.0	32.0	0.0	0.0	0.0	44.1	0.1	0.5	0.1	0.2	5.9	190.9	2.6	14.1	14.7
Malnutrition (only PEM)[a,c]	2.7	0.0	86.3	4.6	0.1	0.0	174.7	0.0	0.7	12.8	0.1	14.5	112.5	88.4	37.3	57.9
Consequences of malnutrition[a,c]	12.3	0.0	391.0	0.8	0.0	0.0	352.3	0.0	0.2	23.3	0.0	1.9	78.9	235.0	162.1	29.8
Trachoma[b]	0.0	0.0	32.9	0.0	7.8	0.0	111.1	0.0	0.0	0.0	0.0	0.0	15.8	7.2	16.8	13.9
Schistosomiasis[b]	0.0	0.0	51.7	0.0	0.0	0.0	99.9	0.0	0.0	0.0	0.0	7.1	0.7	4.8	26.9	33.5
Lymphatic filariasis[b]	0.0	0.0	33.1	0.0	0.0	0.0	49.9	0.0	0.0	0.0	0.1	0.0	50.4	0.3	14.6	18.0
Subtotal water supply, sanitation and hygiene	**48.6**	**0.1**	**1 502.2**	**20.1**	**9.7**	**0.0**	**1 775.2**	**58.4**	**4.7**	**61.9**	**1.5**	**105.2**	**770.4**	**898.5**	**721.1**	**347.5**
Malaria[c]	0.1	0.0	636.4	0.0	0.0	0.1	858.3	0.0	0.0	0.1	0.1	2.8	69.9	36.0	289.5	12.2
Dengue[c]	0.0	0.0	0.4	0.0	0.1	0.0	0.4	0.0	0.0	0.0	0.0	0.5	5.0	0.0	0.0	0.0
Onchocerciasis[c]	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Japanese encephalitis[c]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6	0.0	0.0	0.0
Subtotal water resource management	**0.1**	**0.0**	**639.3**	**0.0**	**0.2**	**0.1**	**858.7**	**0.1**	**0.0**	**0.1**	**0.1**	**3.3**	**85.5**	**36.1**	**289.5**	**12.2**
Drownings[c]	8.2	0.0	42.2	85.1	3.0	3.1	73.8	55.4	2.3	25.3	0.3	14.4	87.2	40.4	11.5	16.5
Subtotal safety of water environments	**8.2**	**0.0**	**42.2**	**85.1**	**3.0**	**3.1**	**73.8**	**55.4**	**2.3**	**25.3**	**0.3**	**14.4**	**87.2**	**40.4**	**11.5**	**16.5**
Other infectious diseases[c,d]	1.9	0.0	106.3	6.7	0.9	5.1	242.6	55.4	0.8	6.3	0.5	2.0	67.5	42.2	69.6	45.4

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How much disease could be prevented through increased access to safe water and adequate sanitation, through improved water management and through better hygiene? What do we know about effective interventions, their costs and benefits in specific settings, or about financing policies and mechanisms? This report presents an overview of our current knowledge on the health impacts by country and by disease, of what has worked to reduce that burden, and of the financial requirements.

Almost one tenth of the global disease burden, mainly in the developing countries, could be prevented by water, sanitation and hygiene interventions. Moreover, effective and affordable interventions have been shown to further reduce this burden significantly. The economic return of investing in improved access to safe drinking-water is almost 10-fold. Investing in water management will have dual benefits for health and agriculture.

This overview provides arguments for fully integrating water, sanitation and hygiene in countries' disease reduction strategies - a prerequisite to achieving the Millennium Development Goals. It provides the basis for action by the health sector and those sectors managing critical water resources and services. Resulting benefits will include poverty alleviation, improved quality of life and reduction of costs to the health-care system.

978 92 4 159643 5
9 789241 596435

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