References

1. *VISION 21: A shared vision for hygiene, sanitation and water supply and a framework for action. Proceedings of the Second World Water Forum, The Hague, 17–22 March 2000.* Geneva, Water Supply and Sanitation Collaborative Council, 2000.
2. Global burden of disease and injury. In: Murray C, Lopez A, eds. *Global health statistics.* Cambridge, MA, Harvard School of Public Health on behalf of the World Health Organization and the World Bank, 1996 (Series Vol. 2).
3. *The world health report: making a difference.* Geneva, World Health Organization, 2000.
4. Esrey SA et al. Effects of improved water supply and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis and trachoma. *Bulletin of the World Health Organization,* 1991, 69(5):609–621.
5. Chan M-S. The global burden of intestinal nematode infections – fifty years on. *Parasitology Today,* 1997, 13(11):438–443.
6. *Arsenic in drinking water.* Geneva, World Health Organization, 1999 (Fact Sheet No. 210).
7. *Health and environment in sustainable development: five years after the Earth summit.* Geneva, World Health Organization, 1997 (unpublished document WHO/EHG/97.8; available on request from Department of Protection of the Human Environment, World Health Organization, 1211 Geneva 27, Switzerland).
8. White GF, Bradley DJ, White AU. *Drawers of water: domestic water use in East Africa.* Chicago, University of Chicago Press, 1972.
9. Cairncross S. Health aspects of water and sanitation. In: Kerr C, ed. *Community health and sanitation.* London, Intermediate Technology Publications, 1990.
10. *World population prospects: 1998 revision.* New York, United Nations, Department of Economic and Social Affairs, Population Division, 1999.
11. *Proceedings of the advisory committee meeting of the Operation and Maintenance Working Group, Geneva, 26 February–1 March 1991.* Geneva, World Health Organization, 1991 (unpublished document; available on request from Department of Protection of the Human Environment, World Health Organization, 1211 Geneva 27, Switzerland).
12. Simpson-Hébert M, Sawyer R, Clarke L. *The PHAST initiative – Participatory Hygiene And Sanitation Transformation: a new approach to working with communities.* Geneva, World Health Organization, 1997 (unpublished document WHO/EOS/96.11; available on request from Department of Protection of the Human Environment, World Health Organization, 1211 Geneva 27, Switzerland).
13. *Statistics on official development assistance to the water sector.* Paris, Organisation for Economic Co-operation and Development, 1998 (Document prepared for the Water and Sustainable Development Conference, Paris, March 1998).
14. *Guidelines for drinking-water quality. Vol. 1.* Geneva, World Health Organization, 1993.
15. Simpson-Hébert M, Wood S, eds. *Sanitation promotion.* Geneva, World Health Organization, 1998 (unpublished document WHO/EOS/98.5; available on request from Department of Protection of the Human Environment, World Health Organization, 1211 Geneva 27, Switzerland).
16. Mara D, Cairncross, S. *Guidelines for the safe use of wastewater and excreta in agriculture and aquaculture.* Geneva, World Health Organization, 1989.
17. *Human development report 1998.* New York, Oxford University Press, 1998 (United Nations Development Programme).
18. Almedom A, Blumenthal U, Manderson, L. *Hygiene evaluation procedures: approaches and methods for assessing water- and sanitation-related hygiene practices.* Boston, MA, International Nutrition Foundation for Developing Countries, 1997.
19. *Household-centred environmental sanitation: report of the Hilterfingen workshop, March 1999, Geneva.* Geneva, Water Supply and Sanitation Collaborative Council, 1999.
20. Hardoy JE, Cairncross S, Satterthwaite D. *The poor die young: housing and health in the third world cities.* London, Earthscan, 1990.
21. *Our common future: report of the World Commission on Environment and Development.* Oxford, Oxford University Press, 1987.
22. *Consolidated report: operation and maintenance activities in Africa.* Geneva, World Health Organization, 2000 (unpublished document WHO/EOS/98.8; available on request from Department of Protection of the Human Environment, World Health Organization, 1211 Geneva 27, Switzerland).
23. *Proceedings of the meeting of the operation and maintenance working group, 19–22 June, 1990.* Geneva, Water Supply and Sanitation Collaborative Council, 1990 (unpublished document WHO/CWS/90.14; available on request from Department of Protection of the Human Environment, World Health Organization, 1211 Geneva 27, Switzerland).
24. *International conference on water and the environment: development issues for the 21st century, 26–31 January 1992, Dublin, Ireland.* Geneva, World Meteorological Organization, 1992.
25. Shordt K. *Trainer's manual: action monitoring for effectiveness.* Delft, Netherlands, IRC International Water and Sanitation Centre, 2000.
26. *Performance indicators of some African water supply and sanitation utilities.* Abidjan, Water Utility Partnership, 2000.
27. Edwards P. *Water supply and sanitation unit.* New York, United Nations Children's Fund, 2000.
28. *Programme Experiences Series: A synopsis of innovations and lessons learned in UNICEF cooperation.* New York, United Nations Children's Fund, 1999.
29. *Safe water and hygiene for children: UNICEF's integrated assistance in rural Tajikistan.* New York, United Nations Children's Fund, 1998.
30. Mishra NK. *Environmental sanitation project.* New Delhi, World Health Organization, 2000 (Report of the WHO Regional Office for South-East Asia).
31. *Evaluation of damage caused by hurricanes Georges and Mitch.* Washington, DC, Pan American Health Organization, 1998. (PAHO technical document of the Emergency Preparedness and Disaster Relief Coordination Programme, Economic Commission for Latin America and the Caribbean).
32. Basaran A. *Environmental sanitation project.* Manila, World Health Organization, 2000. (Report of the WHO Regional Office for the Western Pacific).

Acknowledgements

A large number of dedicated professionals in the water supply and sanitation sector have contributed greatly to the Global Assessment 2000. The staff of WHO and UNICEF country offices worked alongside national government officials to obtain the data which are presented and discussed in this report. Without their hard and valuable work, and support, the Global Assessment 2000 would not have been possible.

Special mention should be made of the staff of the WHO Regional Offices who coordinated the process of data collection in their respective regions and provided many useful inputs: Firdu Zawide, Emmiliene Anikpo and Honorat B. Hounkpatin from the WHO Regional Office for Africa; Luiz Carlos Rangel Soares, Sergio Caporali and Marta Bryce from the WHO Regional Office for the Americas; Kew Khosh-Chashm from the WHO Regional Office for the Eastern Mediterranean; Kathy Pond from the WHO Regional Office for Europe; John Pospisilik and Terrence Thompson from the WHO Regional Office for South-East Asia; and Ali Basaran and Paul Heinsbroek, from the WHO Regional Office for the Western Pacific. Particular thanks go to the WHO Regional Office for the Americas, including its Pan-American Centre for Sanitary Engineering and Environmental Sciences (CEPIS) and UNICEF Regional Office for South Asia for organizing regional and sub-regional workshops on indicators and data collection, and for promoting extensive reflection at the country level on the status of the water supply and sanitation sector, which has greatly contributed to the global assessment process.

The agencies that have produced survey data, such as Macro International, funded primarily by the U.S. Agency for International Development (Demographic and Health Surveys), and UNICEF (Multiple Indicator Cluster Surveys (MICS)) and their local counterparts, should be thanked for providing some of the basic information for this assessment.

Numerous specialists in the sector have given their time to comment on the methodology of the Global Assessment 2000 and on the various drafts of this report. They are: Brian Appleton, Communications Officer, Water Supply and Sanitation Collaborative Council (WSSCC), Geneva, Switzerland; Samuel Bickel, Regional Monitoring and Evaluation Officer, UNICEF, Bogota, Colombia; Eveline Bolt, Head, Research and Development, IRC International Water and Sanitation Centre, Delft, Netherlands; Margaret Catley-Carlson, Consultant, New York, USA; Piers Cross, Manager, Water and Sanitation Programme (WSP), World Bank, Washington, DC, USA; Ian Curtis, Department for International Development (DFID), London, England; Alejandro Deeb, WSP, World Bank, Washington, DC, USA; Gerardo Galvis, Director, Research and Development Institute (CINARA), Universidad del Valle, Cali, Colombia; Richard Jolly, Chairman, WSSCC, New York, USA; Jon W. Lane, Consultant, London, England; A. Milburn, Executive Director, International Water Association (IWA), London, England; Pierre Najlis, Consultant, New York, USA; Jef Paulussen, Water Supply Company, Flanders, Belgium; Mr Roger Pearson, Regional Monitoring and Evaluation Officer, UNICEF, Kathmandu, Nepal; Mayling Simpson-Hebert, Consultant, Steamboat Springs, USA; Odyer Sperandio, Consultant, Geneva, Switzerland; Paul Taylor, Consultant, Harare, Zimbabwe; Cheick Toure, Director, Regional Centre for Drinking Water and Sanitation (CREPA), Ouagadougou, Burkina Faso; Dennis Warner, Consultant, Felgeres, France; and Helmut Weidel, Director of Mountain Unlimited, Vienna, Austria. Their time and effort are greatly appreciated.

The United Kingdom Department for International Development is to be greatly thanked for providing substantial funding for technical assistance through its resource centre WELL (Water and Environmental Health at London and Loughborough).

The World Health Organization and the United Nation Children's Fund would like to acknowledge the important contribution of WELL to the overall process, particularly in having undertaken the majority of data compilation and analysis for the assessment, and the drafting of the text of this publication. Particular thanks go to Caroline Hunt who provided technical management, with quality assurance and guidance from Sandy Cairncross and Pete Kolsky, and overall support from the WELL team in conducting the above tasks. UNICEF initiated the development of the statistical methodology, provided most of the summary sheets on household surveys, and compiled the data and analysed the coverage trends for the 16 most populous developing countries of the world. WHO coordinated the overall assessment process and lead the revision of earlier drafts to produce the final version of this document.

Finally, mention is made of Jose Hueb, Jamie Bartram and Richard Helmer from WHO, and Michel Saint-Lot, Gourisankar Ghosh, Gareth Jones and Roeland Monasch from UNICEF, who were responsible for the Global Assessment 2000 within the framework of the WHO and UNICEF Joint Monitoring Programme.

Annex A Methodology for the Global Water Supply and Sanitation Assessment 2000

Monitoring the population with access to improved drinking-water supply and facilities for improved sanitation has posed major problems. A review of water and sanitation coverage data from the 1980s and the first part of the 1990s showed that the definition of safe, or improved, water supply and sanitation facilities sometimes differed not only from one country to another, but also for a given country over time. Indeed, some of the data from individual countries often showed rapid and implausible changes in level of coverage from one assessment to the next. This indicated that some of the data were also unreliable, irrespective of the definition used. Furthermore, coverage data were based on estimates by service *providers*, rather than on the responses of *consumers* to household surveys, and these estimates can differ substantially. For example, public water utilities are unlikely to consider private household wells, and little may be known officially of householders' own sanitation facilities.

The Assessment 2000 marks a shift from gathering provider-based information only to include also consumer-based information. The use of consumer-based information was discussed in the previous Joint Monitoring Programme report.[1] The current approach aims to take a more accurate account of the actual use of facilities, and of initiatives to improve facilities taken by individuals and communities, which in some cases might not be included in official national water supply and sanitation statistics. By using household surveys, this approach also provides more information on breakdowns and service deficiencies, which might render the facilities unusable after they had been installed, and on service technologies. A drawback of this approach is that household surveys are not conducted recurrently in many countries. Another problem is the lack of standard indicators and methodologies, which makes it difficult to compare information obtained from different surveys.

Data collection

Data were collected from two main sources: assessment questionnaires and household surveys. Assessment questionnaires were sent to all WHO country representatives, to be completed in liaison with local UNICEF staff and relevant national agencies involved in the sector. Initially, assessment questionnaires were distributed with detailed instructions on the process by which it was to be completed. WHO staff (or, where appropriate, consultants or government officers) were requested to liaise with the local UNICEF country office and with the various national agencies involved in providing water supply and sanitation services.

Those completing the questionnaire were first asked to compile an inventory of existing population-based data on access to water supply and sanitation, particularly national census reports, Demographic Health Surveys (DHS) conducted by Macro International and funded by the United States Agency for International Development, and UNICEF's Multiple Indicator Cluster Surveys (MICS). The coverage figures returned by each country with the endorsement of government officials were to be based, as far as judged appropriate, on the estimates from such surveys and recent censuses.

[1] *Water supply and sanitation sector monitoring report - sector status as of 31 December 1994.* Geneva, World Health Organization, 1996 (WHO/UNICEF joint report).

Household survey results were collected and reviewed, including the DHS and MICS results. The DHS and MICS are national cluster sample surveys, covering several thousand households in each country. The samples are stratified to ensure that they are representative of urban and rural areas of each country. They collect information, at household level, on the main source of drinking-water used, as well as the sanitation facility. In most cases, each household is asked to identify the type of water source or sanitation facility they use from a list of technologies, such as piped in-house water supply, private well, borehole or protected spring. These surveys have therefore collected data from consumers on the faculties which they actually use, including those which they have installed themselves, such as private wells or pit latrines. Estimates by services providers often neglect to check that their facilities are functioning, let alone used; moreover, service providers are usually unaware of self-built facilities, or even systems installed by small local communities. Household surveys therefore provide an important step forward in obtaining more accurate coverage information for the sector.

Definitions of access

The following technologies were included in the assessment as representing "improved" water supply and sanitation:

Water supply	**Sanitation**
Household connection	Connection to a public sewer
Public standpipe	Connection to septic system
Borehole	Pour-flush latrine
Protected dug well	Simple pit latrine
Protected spring	Ventilated improved pit latrine
Rainwater collection	

The following technologies were considered "not improved":

Water supply	**Sanitation**
Unprotected well	Service or bucket latrines (where excreta are manually removed)
Unprotected spring	Public latrines
Vendor-provided water	Latrines with an open pit
Bottled water[2]	
Tanker truck-provided water	

[2] *Considered as "not improved" because of concerns about the quantity of supplied water, not because of concerns over the water quality.*

The assessment questionnaire defined access to water supply and sanitation in terms of the types of technology and levels of service afforded. For water, this included house connections, public standpipes, boreholes with handpumps, protected dug wells, protected springs and rainwater collection; allowance was also made for other locally-defined technologies. "Reasonable access" was broadly defined as the availability of at least 20 litres per person per day from a source within one kilometre of

BOX A.1 BOTTLED AND VENDED WATERS

In developing the methodology of the Assessment 2000 there was considerable discussion regarding the acceptability of sources such as bottled water and vendor-provided supplies (including tanker-truck supplies). These categories were considered inadequate. In some circumstances vendor-provided supplies may provide adequate minimum volumes although evidence suggests that this is rarely the case. The volumes secured from vendor sources may be severely limited by cost and experience suggests that water quality is often poor. Bottled water alone does not provide adequate volumes of water for domestic use and water for other domestic purposes must be secured from other sources. There may be circumstances in which the combination of readily available (but non-potable) water for domestic use, plus high quality and affordable bottled water for drinking, may be adequate. This combination of circumstances was not considered common and its omission is estimated to have had a negligible impact on regional and global statistics. The table below indicates the extent to which bottled, vendor-provided and tanker-truck water contribute to supply worldwide. It should be recalled that a large proportion of bottled water will be consumed by individuals who have access to improved water in their households.

Country	Year	Source of water	Percentage of the urban population that consumes bottled or vended water	Percentage of the rural population that consumes bottled or vended water
Angola	1996	Tanker truck	25.2	0.8
Cambodia	1998	Vendor	16	3.5
Chad	1997	Vendor	31.5	0.5
Dominican Republic	1996	Bottled water	37	6.3
Ecuador	1990	Tanker truck	16	7
Eritrea	1995	Tanker truck	30.5	1.4
Guatemala	1999	Bottled water	25.5	7.1
Haiti	1994	Bottled water	26	0.3
Jordan	1997	Tanker truck	1	10.6
Libyan Arab Jamahiriya	1995	Tanker truck	6.8	13.9
Mauritania	1996	Vendor	53	0.9
Mongolia	1996	Vendor	16	1
Niger	1998	Vendor	26.4	1.9
Oman	1993	Bottled water	39.5	42
Syrian Arab Republic	1997	Tanker truck	4.1	11.3
Turkey	1998	Bottled water/demi john	14.9	1
Yemen	1997	Bottled water	14.6	0.1

Source: JMP Databook 2000 (in press)

the user's dwelling. Types of source that did not give reasonable and ready access to water for domestic hygiene purposes, such as tanker trucks and bottled water, were not included (Box A.1). Sanitation was defined to include connection to a sewer or septic tank system, pour-flush latrine, simple pit or ventilated improved pit latrine, again with allowance for acceptable local technologies. The excreta disposal system was considered adequate if it was private or shared (but not public) and if it hygienically separated human excreta from human contact.

Access to water and sanitation, as reported below, does not imply that the level of service or quality of water is "adequate" or "safe". The assessment questionnaire did not include any methodology for discounting coverage figures to allow for intermittence or poor quality of the water supplies. However, the instructions stated that piped systems should not be considered "functioning" unless they were operating at over 50% capacity on a daily basis; and that handpumps should not be considered "functioning" unless they were operating for at least 70% of the time with a lag between breakdown and repair not exceeding two weeks. These aspects were taken into consideration when estimating coverage for countries for which national surveys had not been conducted. However, they were not taken into consideration when estimating national coverage using survey data, on which the report is primarily based.

In some regions, where higher levels of service were more prevalent, there was a tendency by national reporting authorities to set stricter requirements for access compared to other regions. These tendencies may be reflected in the data and should be taken into account when the national estimate is based exclusively on figures collected through the assessment questionnaire.

Definitions of urban and rural

The Assessment 2000 did not provide a standard definition of urban or rural areas. Instead, the questionnaire asked for the countries' own working definition of urban and rural. Similarly, when using household survey data, definitions predetermined by those responsible for the survey were accepted.

Data analysis

Electronic country files were prepared presenting all of the information collected from the global assessment questionnaire and existing survey data. The definitions of access to improved water supply and sanitation were consolidated across the two types of information source.

For each country, coverage estimates from surveys were plotted against the year in which the corresponding survey had been carried out. Four separate charts were used to show coverage by year in the period 1980–2000, one each for urban water, rural water, urban sanitation and rural sanitation. All other sources of data were also plotted in these charts for comparison and context, but were labelled differently. Some surveys were part of this latter category because the classification of sources or facilities was insufficient. Unfortunately, some surveys did not provide all of the information needed, not having been designed specifically to collect information about water and sanitation. For example, in many cases wells are reported without any indication of whether or how they are protected. The situation is often similar for springs.

For charts where coverage estimates from surveys were considered adequate, a line was drawn on each chart that, in the opinion of the review group, best fitted the survey estimates over the period 1990–2000. If the estimate from this best-fit line differed substantially from the 2000 estimate provided by the country, the country was asked to review its estimate in the context of the data displayed on the chart. The resulting discussions sometimes led to modification of the chart, sometimes to changes of the national estimate. Where no resolution could be obtained, the 2000 estimate derived from the survey data was used.

In a small number of charts there were insufficient survey data to derive a 1990 estimate. In these cases, an estimate for 2000 only was used. For countries where there were inadequate survey data, the national estimate for 2000 provided by the country was used.

Particular care was taken with the larger developing countries, as the conditions in those countries have a disproportionate effect on the global and regional averages. In particular, the 40 most populous developing countries – which account for some 90% of the population of the developing world – were the subject of special attention. These forty countries are:

Islamic State of Afghanistan
People's Democratic Republic of Algeria
Argentine Republic
People's Republic of Bangladesh
Federative Republic of Brazil
People's Republic of China
Republic of Colombia
Democratic People's Republic of Korea
Democratic Republic of the Congo
Arab Republic of Egypt
Federal Democratic Republic of Ethiopia
Republic of Ghana
Republic of India
Republic of Indonesia
Islamic Republic of Iran
Republic of Iraq
Republic of Kenya
Republic of Madagascar
Malaysia
United Mexican States
Kingdom of Morocco
Republic of Mozambique
Union of Myanmar
Kingdom of Nepal
Federal Republic of Nigeria
Islamic Republic of Pakistan
Republic of Peru
Republic of the Philippines
Republic of Korea
Kingdom of Saudi Arabia
Republic of South Africa
Democratic Socialist Republic of Sri Lanka
Republic of the Sudan
Kingdom of Thailand
Republic of Turkey
Republic of Uganda
United Republic of Tanzania
Bolivarian Republic of Venezuela
Socialist Republic of Viet Nam
Republic of Yemen

Methods for developing regional coverage figures

Estimates of percentage coverage for a region are based upon available data from the reporting countries in the region. When no data were available for countries in a region, estimates were extrapolated from countries in the region for which data were available. Such extrapolation, however, is used only to compute regional statistics: any country data reported in this assessment are based on reports for the country concerned.

In summary, while the type of water source and the type of excreta disposal facility can be associated with the quality of water and the adequacy of disposal, respectively, they cannot adequately measure population coverage of *safe* water or of *sanitary* excreta disposal. Hence, the coverage estimates presented in this report represent the population covered by *improved* water sources and *improved* sanitary facilities.

Photography:
Raymond Geary Assoc., cover illustration; UNICEF/Alsbirk, p. viii; UNICEF/Balaguer, p. 59;
UNICEF/Charton, pp. 46, 53; UNICEF/Lemoyne, pp. 25, 76; UNICEF/Murray-Lee, pp. 14, 21;
UNICEF/Noorani, p.6; UNICEF/Pirozzi, cover, p.61; UNICEF/Press, p. vi; World Bank/Kinley, pp.37, 40