4. Water supply and sanitation in large cities

This chapter provides information on various aspects of water supply and sanitation services in large cities, as reported in response to the questionnaire. It complements the findings of the previous chapter.

4.1 Urbanization

As noted in previous chapters, high rates of urban population growth will place particularly heavy demands on the capacity of the developing countries to extend, or even maintain, their service coverage. It is therefore useful to look more closely at water supply and sanitation in the largest cities in the world. The cities for which information was provided for this analysis (but not necessarily all the information requested) are listed in Table 4.1.

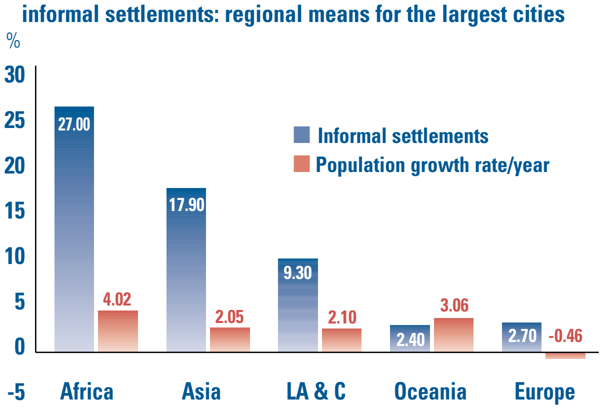
TABLE 4.1 CITIES PROVIDING INFORMATION FOR ANALYSIS OF WATER SUPPLY AND SANITATION

Africa	Asia	Europe	Latin America & Caribbean	Northern America	Oceania
Abidjan	Amman	Andorra-la-Vella	Asunción	Toronto	Apia
Accra	Bangkok	Budapest	Barquisimeto	New York	Funafuti
Addis Ababa	Colombo	Copenhagen	Basseterre		Honiara
Algiers	Dhaka	Ljubljana	Belize		Koror
Antananarivo	Jakarta	Monaco	Buenos Aires		Nuku'alofa
Asmara	Kathmandu	Oslo	(Metro region)		Port-Vila
Bamako	Malé	Stockholm	Cali		Rarotonga
Bangui	Mumbai	Tallinn	Camagüey		Saipan
Bissau	Nicosia	Vienna	Castries		South Tarawa
Blantyre	Seoul	Vilnius	Cayenne		
Brazzaville	Shanghai	Zagreb	El Progreso		
Bujumbura	Tbilisi	Zurich	Guatemala City		
Cairo	Teheran		Guayaquil		
Casablanca	Thimphu		Kingston		
Conakry	Ulaanbaatar		Kingstown		
Cotonou	Yangon		Lima		
Dakar			(Metro region)		
Dar Es Salaam			Managua		
Djibouti			Montevideo		
Douala			Panama		
Freetown			Paramaribo		
Gaborone			Plymouth		
Harare			Pointe-à-Pitre		
Kampala			Port-au-Prince		
Kigali			Port-of-Spain		
Kinshasa			Providenciales		
Libreville			Roseau		
Lomé			San José		
Luanda			(Metro region)		
Lusaka			San Juan		
Malabo			San Salvador		
Maputo			Santa Cruz de la		
Maseru			Sierra		
Monrovia			Santiago		
Moroni			(Metro region)		
Nairobi			Santo Domingo		
N'djamena			São Paulo		
Niamey			St. George's		
Nouakchott			St. John		
Ouagadougou					
Port Louis					
Sao Tome					
Windhoek					

The information from large cities has been provided by water supply and sanitation agencies, which normally generate substantive and reliable managerial information about their systems. Some of the findings in this chapter are presented as medians, rather than as means, given the huge population disparities between the large cities. For example, São Paulo, Brazil, has a population of 11 million people, whereas Roseau, Dominica, has a population of only 16 000 people. The information received from Europe, Northern America and Oceania is, in some cases, insufficient for a consistent analysis of some of the topics. Thus, these regions are not always represented in the graphs.

Figure 4.1 shows, for each region, the mean population growth rate of the cities for which data were received, as well as the proportion of the population living in informal settlements. The population growth rate for Africa (4.02% per year) is about twice that for Asia (2.05%) and Latin America and the Caribbean (2.10%), indicating that the urbanization process in the latter two regions is relatively more stabilized. Oceania has an intermediate growth rate. The populations of the European cities show slight declines, but in Europe as elsewhere the mean value conceals a wide variation between cities. For example, while the population of Vilnius (Latvia) is increasing at 6.9% per annum, that of Tallinn (Estonia) is falling at 4.4%. Northern America is not indicated in the graph as only one city reported (Toronto, Canada).

Figure 4.1 Population growth rates and proportions living in informal settlements: regional means for the largest cities



4.2 Informal settlements

The high growth rate of Africa's urban population is reflected in the relatively large proportion living in informal settlements, or shanty towns (Figure 4.1). Many millions of people also live in informal settlements in Asia and Latin America and the Caribbean. The proportion for Oceania seems small in view of the urban growth rate, but many countries did not respond to the question about informal settlements. This may be because the settlements were not large enough to constitute a problem in the towns of the small islands of the region. It is also possible that informal settlements were difficult to define, involving terms such as a lack of physical planning, the type of house construction, or the lack of formal land tenure.

4.3 Types of water supply service

Figure 4.2 shows the mean percentage of the population served by various types of water supply in the large cities of each region. The figures for household connections and yard taps were based on suppliers' statistics, unlike most of the coverage data in this report which were mainly drawn from consumer surveys. Overall, an average of less than 5% of the people in every region had yard taps, and frequently it was reported that no one had yard taps. The number of yard taps reported may have been confounded with information regarding the domestic plumbing arrangements of consumer households, so the two categories (house connections and yard taps) are combined in Figure 4.2. As the pie charts show, with the exception of Africa, the majority of the population has house connections or yard taps.

Some returns treated people with access to public taps or handpumps as being "unserved," while others did not. Wherever possible, people with access to public taps or handpumps were treated as "served" to ensure uniformity in the analysis.

It is no coincidence that the regions with the most rapid growth in the largest cities also have the highest proportion of the population without access to services in those cities. Africa, with the highest growth rate, has been more successful than other regions in making good the shortfall, using public taps. Local sources, particularly boreholes or tubewells fitted with handpumps, have also been used to good effect, particularly in Asia. There is room for other regions of the world, particularly Oceania, to make more use of intermediate levels of service such as these, as well as yard taps.

BOX 4.1 WATER CONTAMINATION AND LOSS IN PIPED WATER SUPPLY

Essential action to ensure that a piped water supply remains safe and sustainable include:

- Preventing contamination.
- Minimizing water loss.

Contamination of distribution pipelines may arise from:

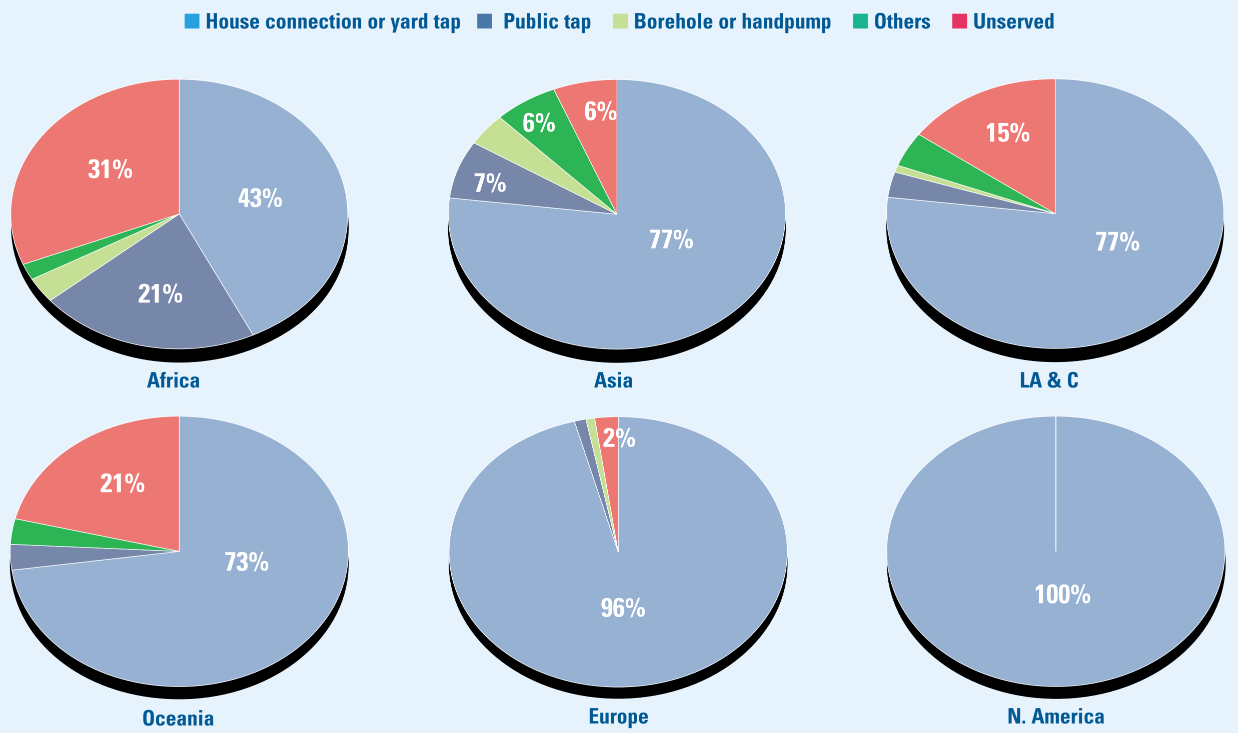
- Intermittent supply.
- Low water pressure in the distribution network.
- Leaking pipes.
- Inadequate wastewater collection systems.

Water loss (physical loss) often amounting to more than 50% of supplies, mainly arises from:

- Leaking pipes, joints and valves.
- Overflowing service reservoirs.
- Waste of water through illegal connections and non-metered house connections.

Source: *(7)*

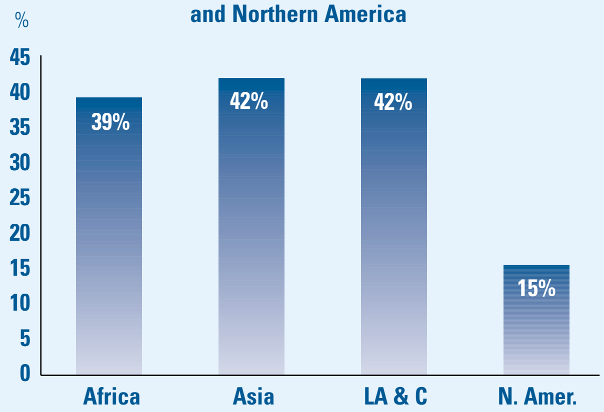
Figure 4.2 Water supply in the largest cities: mean percentage of the population with each type of service, by region



4.4 Accounting for water loss

The mean rates of unaccounted-for water are shown in Figure 4.3, by region. The figures for Northern America are low, but they are based on data from only two cities. From the responses to the questionnaire, it can be concluded that the majority of unaccounted-for water is represented by physical losses from the distribution system.

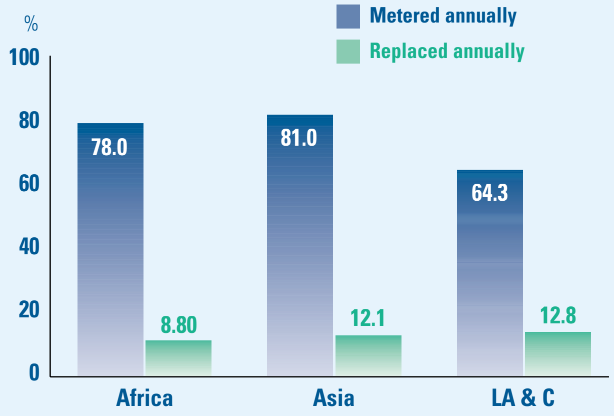
Figure 4.3 Mean unaccounted-for water in large cities in Africa, Asia, Latin America and the Caribbean, and Northern America



In many cases, the unaccounted-for water indicator reflects the efficiency of the management of a water utility. The reduction of unaccounted-for water requires coherent action to address not only technical and operational aspects, but also institutional, planning, financial and administrative issues (see Box 4.1).

As can be seen from Figure 4.4, the use of water meters is remarkably prevalent. The cities of Africa and Asia appear to use meters for roughly 80% of domestic consumers. The use of meters is slightly less prevalent in Latin America and the Caribbean. There is little difference in the frequency with which the meters are replaced in Africa, Asia , and Latin American and the Caribbean (Figure 4.4). The mean percentages replaced each year implies that each meter is replaced after eight years of service or more. Considering that the meters typically under-read as they age, it is likely that a considerable proportion of unaccounted-for water is explained by metering errors. The cost of meter replacement represents a substantial expenditure for a water supply agency; and in many countries it may comprise a high proportion of the foreign exchange expenditure in the water supply sector. It is not surprising, therefore, that meter replacement is kept to a minimum in the large cities of the developing world, even though this may have unfortunate consequences in terms of broken meters, poor customer relations and unaccounted-for water. The data received from Europe, Oceania and Northern America were not sufficient to permit a representative analysis of conditions in the regions. For this reason, those regions are not shown in Figure 4.4.

Figure 4.4 Percentage of household connections metered, and percentage of meters replaced annually: regional means for the largest cities

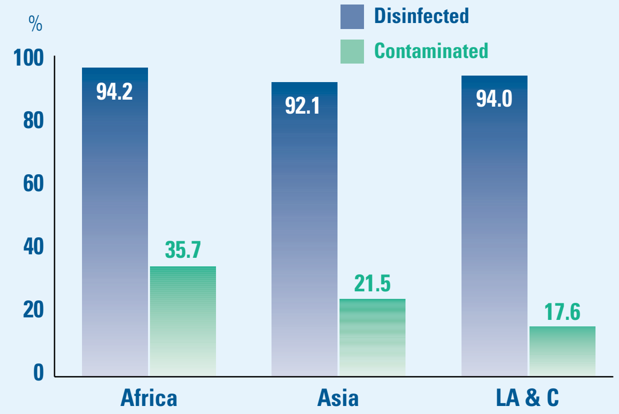


4.5 Water quality

Figure 4.5 shows two indicators of the quality of water supplied. One is the proportion of disinfected water supplied in the largest cities with a free residual chlorine greater than 0.1 mg/l. In most of the returns received the proportion was at or close to 100% The variation between regions is largely a consequence of a small number of countries, typically one or two per region, for which only a minority of the water supplies is disinfected, usually because the local authority considers it unnecessary to disinfect good quality ground water. For example, less than a quarter of the water supplied in Copenhagen (Denmark) and Ljubljana (Slovenia) is disinfected.

Figure 4.5 also shows the proportion of drinking-water samples that violated national standards with regard to microbiological, chemical, physical or aesthetic characteristics. A minority of cities reported that most samples violated a standard, but many cities stated this happened reasonably often. That so many cities were willing to admit that this occurs inspires confidence in these and other data, though the particular standards violated were not reported and may be of limited health significance.

Figure 4.5 Percentage of water supply which is effectively disinfected (free residual chlorine over 0.1 mg/l), and percentage of drinking-water quality test results that violate national standards (microbiological, chemical, physical, aesthetic)



4.6 Types of sanitation facility

The types of sanitation systems available, and the proportion of the population using each, are shown in Figure 4.6.

As in the case of house connections for water supply (Chapter 2), regions where the populations of large cities are growing fastest are also those with the lowest coverage with conventional sewers. Africa and Oceania have the lowest coverage, while Latin America and the Caribbean and Asia lie between them and the industrialized regions of Europe and Northern America. Asia has done better than the other regions of the developing world in extending use of septic tanks and pour-flush systems. Septic tanks are also widely used in Oceania, where on average they serve nearly half the population of the largest cities, and in Latin America and the Caribbean, where they serve one-quarter. In the large cities of Africa, septic tanks are not as common, but a larger proportion of the population uses pit latrines, or ventilated improved pit latrines, than in other regions.

As seen in Figure 4.6, some regions rely more heavily than others on a given sanitation technology. There are certainly cities in Asia and Oceania that could make greater use of dry pit latrines, particularly in settlements where the water supply is limited, expensive or unreliable. On the other hand, in parts of Africa and in Latin America and the Caribbean there is an unexploited potential for the use of pour-flush toilets, which can give a service that is aesthetically little different from a flush toilet, at a more modest cost.

Figure 4.6 Sanitation in the largest cities: mean percentage with each type of facility, by region