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Situation analysis and epidemiology of infectious disease transmission: a South-East Asian regional perspective

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This paper analyses the situation in countries comprising the WHO South-East Asia Region with respect to water supply and sanitation services, hygiene and the epidemiology of related infectious diseases. Recently, published data from the WHO/UNICEF *Global Water Supply and Sanitation Assessment 2000 report* was reviewed to depict the situation with respect to consumers' access to improved water supply and sanitation services. It was shown that access to improved drinking water supplies is among the lowest in the world, and that sanitation coverage in this region is below all others. The paper also reviews selected surveys of hygiene behaviours in several countries of the region. Associations are suggested between access to services, hygienic practices and specific infectious diseases. The need is acknowledged to improve the evidence base on linkages between infectious diseases and water, sanitation and hygiene, and specific recommendations are made in this regard. There is a need now and for the foreseeable future to promote low-cost household-level interventions, including behaviour change strategies, that mitigate the health consequences of the current situation with respect to water supply, sanitation and hygiene. The role of health authorities in meeting this challenge, and as advocates for accelerating development of the water and sanitation sector, is highlighted.

Keywords: WHO South-East Asia Region; hygiene; epidemiology; water supply; sanitation; infectious disease.

Introduction

The World Health Organization (WHO) South-East Asia Region (SEAR) comprises 10 countries: Bangladesh, Bhutan, DPR Korea, India, Indonesia, the Maldives, Myanmar, Nepal, Sri Lanka and Thailand. The population of WHO's South-East Asia region is about 1.5 billion people, of which approximately 1 billion reside in India. Water supply and sanitation in this region is often unsafe and hygiene practices are often poor leading to a greatly increased potential for infection and disease transmission. There is an immediate need for low cost and low technology solutions to reduce risk factors and poor hygiene that leads to disease.

Drinking water coverage in the region

Coverage of drinking water in all 10 countries in the South-East Asia region has increased over the last decade (Table 1). In India, for example, water supply coverage has increased by more

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Table 1. Water supply and sanitation coverage by country in the South-East Asia Region (1990–2000)

Country	*Year*	*Total population (thousands)*	*Urban population (thousands)*	*Rural population (thousands)*	*Urban water supply coverage (%)*	*Rural water supply coverage (%)*	*Total water supply coverage (%)*	*Urban sanitation coverage (%)*	*Rural sanitation coverage (%)*	*Total sanitation coverage (%)*
Bangladesh	1990	109,466	21,090	88,376	98	89	91	78	27	37
	2000	129,155	31,665	97,490	99	97	97	82	44	53
Bhutan	1990	1,696	87	1,609	–	–	–	–	–	–
	2000	2,124	152	1,972	86	60	62	65	70	69
Korea (DPR)	1990	20,461	11,946	8,515	–	–	–	–	–	–
	2000	24,039	14,481	9,558	100	100	100	99	100	99
India	1990	850,785	217,254	633,531	92	73	78	58	8	21
	2000	1,013,662	288,283	725,379	92	86	88	73	14	31
Indonesia	1990	182,812	55,923	126,889	90	60	69	76	44	54
	2000	212,108	86,833	125,275	91	65	76	87	52	66
Maldives	1990	216	56	160	–	–	–	–	–	–
	2000	286	75	211	100	100	100	100	41	56
Myanmar	1990	40,520	9,984	30,536	88	56	64	65	38	45
	2000	45,611	12,628	32,983	89	66	72	84	57	65
Nepal	1990	18,772	1,680	17,092	96	63	66	68	16	21
	2000	23,931	2,844	21,087	85	80	81	75	20	27
Sri Lanka	1990	17,046	3,625	13,421	90	59	66	93	79	82
	2000	18,827	4,435	14,392	91	80	83	91	80	83
Thailand	1990	55,595	10,410	45,185	83	68	71	97	83	86
	2000	61,399	13,252	48,146	89	77	80	97	96	96

Source: WHO/UNICEF Global Water Supply and Sanitation Assessment 2000 Report.

than 220 million people. Despite these impressive gains across the region, 212 million people still lack access to improved water sources, and 881 million people lack access to sanitary means of excreta disposal (GWSSA 2000). Large disparities also exist between the urban and rural zones in most countries in this region and among geographical regions within each of the countries.

Overall, water supply coverage in the South-East Asia region is estimated to be at 86%, approximately equal to the water supply coverage in Latin-America and the Caribbean. Worldwide, only Africa has lower water supply coverage. Sanitation coverage, though, in the 10 SEAR countries is estimated at only 42% – the lowest in the world in terms of sanitation coverage (Nath 2000).

Unfortunately, with respect to the safety of drinking water, drinking water quality, surveillance and control is generally inadequate in most of the urban systems of this region. Frequently, residual disinfectant is lacking in water distribution systems and a lack of continuous positive water pressure leads to groundwater infiltration, making the urban system prone to microbiological contamination. With few exceptions, adequate drinking water quality surveillance and control is non-existent in rural water supply systems. With the low levels of water supply service in many communities and the unreliability of water supply systems even in urban settings, storage and handling of water at the household level is inevitable, and can lead to contamination or re-contamination of drinking water in the home.

Sanitation coverage

A recent study of environmental sanitation found that 61% of the rural population in India washed their hands with water and ash or mud, 24% with water only, and only 14% with water and soap (Nath 2000). The percentage for handwashing in SEAR as a whole may be similar given that India comprises two thirds of the region's total population. Low sanitation coverage also leads to problems such as widespread open defecation, and its inherent health risks.

In another more recent study conducted in an urban slum in India, it was found that only 25% of the respondents understood the concept of faecal–oral transmission of disease. Most respondents did not believe children's faeces to be unhygienic, and the use of detergents and disinfectants was almost non-existent. This is a matter of concern, particularly in the light of WHO data from 1999, which showed that globally 19% of all infectious diseases were related to water and sanitation hygiene risk factors (Fig. 1) (www.worldwaterday.org. 2001).

Mortality due to poor sanitation

Unfortunately, poor sanitation contributes to mortality. About 3.4 million people, most of whom are children, die each year from water-related diseases, including about 1 million from malaria. Diarrhoeal diseases, including cholera, cause 2.2 million deaths per year worldwide, mostly children from developing countries. The South-East-Asia region as defined, accounts for an estimated 950,000 or 43% of these diarrhoeal deaths (World Health Report 2001). Among SEAR countries, there appears to be an inverse relationship between childhood mortality and sanitation coverage (Fig. 2). Associations such as this should provoke more research into the links between water, sanitation and hygiene risk factors for infectious diseases.

According to data published by Murray and Lopez in 1996, globally 5.3% of all deaths and 6.8% of all disability adjusted life years (DALY) are lost because of poor water supply, sanitation and personal and domestic hygiene (Murray and Lopez 1996).

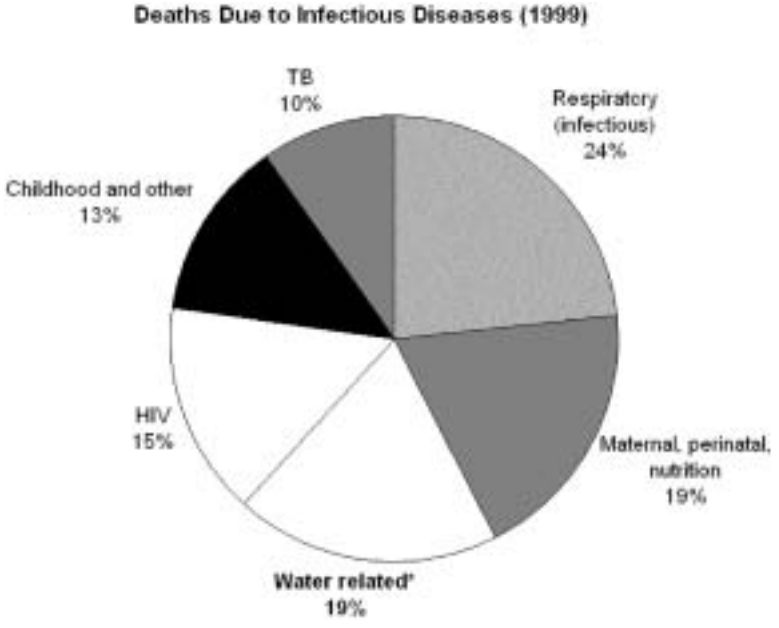
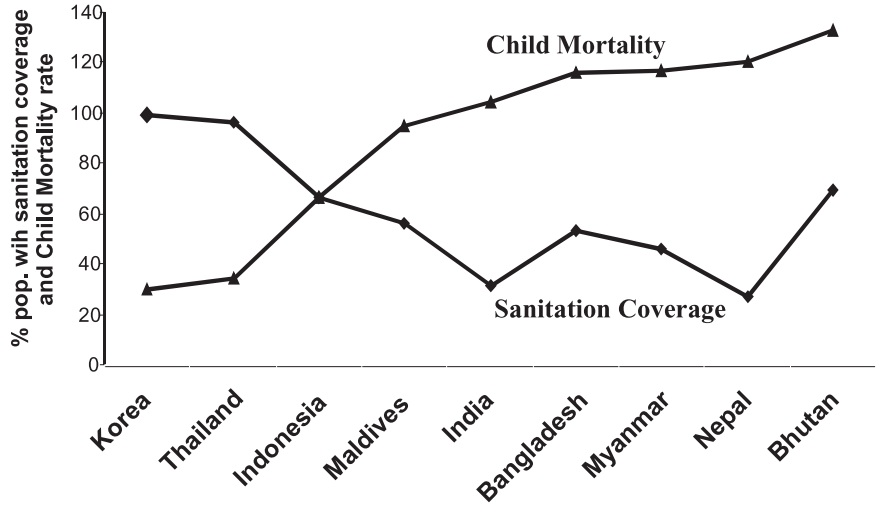


Fig. 1. Deaths due to infectious disease worldwide as estimated by the WHO (1999).



Source: UNICEF End Decade Databases and Global Water Supply and Sanitation Assessment

Fig. 2. Child mortality association with sanitation coverage.

In the South-East Asia region the percentages of deaths are higher. It is estimated that 6.6% of all deaths and 7.2% of all DALYs are lost due to diarrhoeal diseases (Water Quality Guidelines 2001). The countries in this region seem to suffer a disproportionately high burden of diarrhoeal diseases.

Assessing links between sanitation, hygiene and disease

There is a great need to improve the evidence base on the links between infectious diseases and water, sanitation and hygiene risk factors. Past studies have been limited by insufficient sample size and failure to control for confounding variables related to community, household, maternal and childhood factors and for water supply. More longitudinal studies are required, as opposed to cross-sectional studies, which allow for the measurement of incidence, duration and severity of diseases. Although it is unlikely that several variables will be measured in any single study, relying on diarrhoea data alone could underestimate benefits gained from improvements in water supply and sanitation.

There are inherent difficulties in assessing water-related disease burden. One is that exposure often occurs at the household or small community level, and is therefore difficult to measure. Diseases transmitted by water, such as diarrhoeal diseases, are mostly non-specific, therefore creating difficulty in attributing a disease to a specific exposure. Competing pathways of disease exposure exist. For example, in drinking water, contaminated food, person-to-person contact and lack of hygiene, exposure–risk relationships have not been clearly established. Given the status of the global burden of disease from water supply, sanitation and hygiene risk factors, there is a great need to improve the knowledge of and the relative importance of pathways of transmission.

Interventions to improve hygiene and sanitation

In a review published in 1991 of 144 separate studies from more than 20 countries, the effect of different interventions on the reduction of diarrhoeal diseases was estimated (Esrey 1991). According to this review, improvements in water quality and quantity were seen as being responsible for 15 and 20% reductions in diarrhoeal disease, respectively, while improvements in hygiene and in sanitation were responsible for 33 and 36% reductions, respectively. However, a new report released by WHO indicated that the conclusion regarding the effectiveness of water quality in reducing diarrhoeal disease was underestimated (Sobsey 2002).

The review from 1991 outlined projects that improved the water quality in pipe distribution systems. However, water quality improvements in pipe distribution systems do not necessarily result in an improvement at the point of use. In rural and peri-urban zones of many SEAR countries, water is frequently contaminated at the household level.

Several studies have demonstrated that point-of-use disinfection and safe storage of drinking water can reduce diarrhoeal diseases by between 6 and 90% (Sobsey 2002). Water quality improvements may be on a par with, or even superior, to sanitation and hygiene in terms of their effectiveness in reducing diarrhoeal disease (Table 2).

The WHO Commission on Macroeconomics and Health has stated that handwashing education and soap availability results in global reductions of 30–48% in disease prevalence, and that morbidity reductions of between 27 and 89% can result from handwashing alone (Vaz and Jha). Handwashing studies from four SEAR countries (Bangladesh, India,

Table 2. Efficacy of safe storage or chlorination of household water: disease reduction

	Disease reduction (%)
Bangladesh	20.8
India	17.0
Bolivia	44
Saudi Arabia	48
Zambia	48
Uzbekistan	85

Sobsey MD. Managing Water in the Home: Accelerated Health Gains from Improved Water Supply, Water, Sanitation and Health Department of Protection of the Human Environment. World Health Organization 2002.

Indonesia and Myanmar) and the United States found a median reduction of 35% for diarrhoea morbidity.

Vision 21: future goals

In order to improve hygiene and ultimately to reduce the amount of diarrhoeal diseases, Vision 21, developed recently by the Water Supply and Sanitation Collaborative Council and other collaborators, was set up through an extensive consultation process at the global and regional level. Its aim is to achieve by the year 2025 a world in which each person has knowledge of the importance of hygiene and enjoys safe and adequate water and sanitation (Vision 21. 2000). An interim target for 2015 has been set to reduce by one half the proportion of people not currently served with safe water and adequate sanitation. The authors estimate that the costs to meet the year 2015 target in the ten SEAR countries lie between $US 1.6 billion and $US 9.6 billion per year (GWSSA 2000; www.esa.un.org). The range of potential cost is large because it is dependent on the type of technology used. At the low end of the estimate the target would be met by simple technologies, such as bore holes and rainwater catchment, while at the high end of the estimate more complex technologies could be employed, including conventional water treatment and distribution systems and sewerage.

If this target is met in the region by the year 2015, the authors estimate that the savings to the health sector could range from $US 2.25 billion to $US 6.3 billion per year (GWSSA 2000; www.esa.un.org; Brandon and Hommann 1995). Interestingly, the benefits of this investment would accrue to the health sector but the costs would not. Investment costs in water supply and sanitation are normally borne by urban and rural development authorities, municipal and other local authorities. Thus, it would be only logical that health ministries should be advocates for increased investment and increased efficiency in the water supply and sanitation sector.

One study by Varley *et al*. (1998) estimated the cost of interventions as being comparable with that for oral rehydration therapy to control diarrhoea among children less than 5 years of age. This does not imply that hygiene education should replace oral rehydration therapy but instead that the two strategies could be run simultaneously to complement each other. It could only be beneficial for health authorities to carry out hygiene education interventions in parallel to pursuing oral rehydration therapy.

The role of health authorities in water supply, sanitation and hygiene

Health authorities have a role in reviewing, approving and modifying designs for water supply and sanitation projects in such a way as to maximise the health impact achieved from them. They can regulate the delivery of water and sanitation services, and conduct surveillance on the quality of services. Health authorities also have a responsibility, through education and social marketing, of promoting low cost interventions that would mitigate inadequacies that exist in water supply and sanitation infrastructure and in poor hygienic practices. Appropriate local cost interventions, may include handwashing, point-of-use disinfection and safe storage of drinking water, as well as safe disposal of excreta. However, health authorities also have a longer term role as advocates for increased investment and increased efficiency in the water supply and sanitation sector.

Conclusion

In conclusion, water supply and sanitation coverage is low in the 10 countries of the South-East Asia region, water quality is frequently unsafe and poor hygienic practices are very common. There exists a need to improve and increase research on disease burden due to water, sanitation and hygiene risk factors. However, the available evidence is already substantial to compel action. Health authorities also need to advocate increased investment and increased efficiency in the water supply and sanitation sector while simultaneously promoting interim low cost interventions.

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