Guest Editorial

Water Pollution and Human Health in South Asia: Exploring the Linkages

Saravanan V.S., Peter P. Mollinga and Shahbaz Khan[1]

Centre for Development Research (ZEF), Walter Flex Strasse. 3, D-53113 Bonn, Germany
[1]Section on Sustainable Water Resources Development and Management, UNESCO-IHP, Paris, France

Water is one of the most precious resources for day-to-day living. Its decreasing availability in terms of quality and quantity has been a major concern in both developed and developing worlds. Globally, the availability of water per person has declined markedly. The Millennium Ecosystem Assessment (Corvalan et al., 2005) reveals the amount of fresh water available per person declined from 16,800 m^3 to 6,800 m^3 in 2000, as a result of population growth. This fraction is expected to escalate further, with increasing use of fresh water for irrigated agriculture, livestock production, industry and the requirements of wealthier urban residents posing threat to about one third of the world's population now living in countries experiencing moderate to high water stress. Currently, over one billion people lack access to safe water supplies; and 2.6 billion people lack adequate sanitation. This has led to widespread microbial contamination of drinking water. Water-associated infectious diseases claim up to 3.2 million lives each year, approximately 6% of all deaths globally. The burden of disease from inadequate water, sanitation and hygiene totals 1.7 million deaths and the loss of more than 54 million healthy life years.

Every day each person needs 20-50 litres of water free from harmful chemical and microbial contaminants, for drinking, cooking and hygiene. Inadequate availability of safe drinking water and sanitation has given rise to various diseases, where water acts as a conduit or as a medium for the diseases. The global burden of disease reveals inadequate supply of water, sanitation and hygiene as one of the major risk factor for global ecological deaths (Ezzati et al., 2002, cited in Eyles & Consitt, 2004). The UNDP Human Development Report 2006 recognises water and sanitation as "the most powerful preventive medicines available to governments to reduce infectious disease. Investment in this area is to killer diseases like diarrhoea, what immunization is to measles – a life saver" (UNDP, 2006). This 'safe haven' approach has gained worldwide prominence. Many development agencies (national and international) have increased their investment on this powerful preventive medicine to combat water-related diseases to address the Millennium Development Goals (Goals 4, 6, and 7).

The collection of papers in this special issue unravels the linkages between water pollution and its implication on human health. Efforts were made to draw on diverse expertise from South Asia to comprehensively understand the root cause of the problem. Some of the papers were invited for a special session on 'Water Pollution and Human Health: Challenges ahead' at the 7th International Science Congress on the Human Dimensions of the Global Environmental Change or IHDP Open Meeting 2009 in April at the World Conference Centre in Bonn, Germany. While the papers from Rajib Dasgupta, Rahman et al., Atanu Sarkar and Papreen Nahar were invited by the editors for this Special Issue.

The paper by Jayati Chourey and Anjal Prakash reviews the water and health scenarios in South Asia. Their review reveals that unsafe and inadequate water is contributing significantly to the disease burden in South Asia. However, addressing these issues does not have simplistic linear solutions, but presents complexities and challenges for research and practice. While there may be evidence of inter-linkage between water supply and sanitation, the authors reveal lack of conceptualization and implementation of these inter-linkages at the policy and programme level.

Urbanisation is a growing concern in countries in Asia. India presents a daunting picture. Of the total population of 1.027 billion in India, about 742 million live in rural areas and 285 million in urban areas. "If urban India was considered a separate country, it would be the fourth largest in the world after China, India and the United States" claims Singh et al. (2004). As the cities grow, so do their slum population. The UN-Habitat reports (2006) 31 percent of the total urban population in the world and 41 percent in developing world live in slums. Slums are increasing at a rapid rate in South Asia. While more than 70 percent of the urban population in the world are officially provided access to sanitation, improper housing, inadequate drainage and sanitation coverage lead many slum dwellers to have no choice but to defecate in open. This causes contamination of water and land resources within cities and in its peripheral, leading to diffuse source of pollution. The paper by Rajib Dasgupta explores the problems of endemic cholera in the megacity of Delhi. The author reveals that endemic cholera is 'man-made': rapid increase in population (fuelled, in part, by large scale in-migration), managerial failures, illegal withdrawal of water, poor maintenance, potential contamination (from domestic and industrial sources) and the community's reliance on alternative sources much of which is contaminated groundwater act as critical issues making urban population in Delhi vulnerable to water-related diseases, than exclusive focus on technocratic piped water supply approach to address water-related diseases.

While there is growing concern for adequate provision of water supply and sanitation in many urban centres in developing countries, there is equal concern towards addressing wastewater generated by both industrial and domestic effluents affecting human health in urban regions. In many developing countries domestic wastewater remains untreated (UNDP, 2006). In China, sixteen cities that have more than half a million of population have no wastewater treatment facilities. Nationally, less than 20 percent of municipal waste receives any treatment, forcing households to boil their water before drinking. In Pakistan, water-borne diseases are common as more than 40 percent of water supplied is unfiltered and 60 percent of effluents remain untreated. In the first half of 2006, major outbreaks of water-borne diseases/epidemics have swept Faisalabad, Lahore, Karachi and Peshawar as a result of leakage of sewage and industrial waste into drinking water through damaged pipes. This led the government to finance more than 6000 water filtration plants. In India, with more than 50 percent of the urban population living in squatters, only about 35 percent of the wastewater from class I cities (having population more than 100,000) and Class II towns (having population between 50,000 and 100,000) is treated, posing potential hazard to human population (Bhardwaj, 2005).

The unprecedented urbanisation coupled with globalisation is exerting pressure on the quality of water resources placing human health at risk. Official estimates (PRC, 2004) of water quality across seven major rivers in China indicate about 60 percent of the water quality falling under grade IV, grade V and those inferior to these. This water quality is inadequate for human consumption (i.e., they can be mainly used for industrial and agricultural activities) and requires no direct contact with human beings. The most polluted rivers in China are Liaoche, Huaihe, Yellow Songhuajiang and Haihe with the presence of ammonia nitrogen, biological oxygen demand (BOD), permanganate index and petroleum compounds beyond the permissible limits. Lakes and reservoirs in China are much more polluted compared to rivers. Of the 27 lakes and reservoirs, more than 70 percent of these water storage structures were under grade IV and above, with nitrogen and phosphorous being the main polluters. Information on groundwater is unavailable for comparison. In India, out of 17 major rivers, 10 are considered to be grossly polluted on specific stretches with organic and bacterial pollution dominating in these stretches that makes them unfit for human consumption (Bhardwaj, 2005). Presence of major ions and other inorganics on surface water are generally of acceptable standards if not polluted wastewater discharges. The paper by Golam Rabbani, Mehrab Chowdhury and Naima A. Khan describes how economic liberalisation policy initiated by the Government of Bangladesh has provided impetus to trade and industrial sectors, subsequently affecting the water resources. Taking a case of industrial hot-spot in Bangladesh examines the health implications from rapid industrialisation. These papers call for effective wastewater regulation and disposal networks, in addition to simplistic technocratic pipe-line approach to water supply and sanitation.

Geogenic pollution is emerging as one of the major environmental health disaster in Asia. There are naturally occurring minerals in rocks, soil, water and in biota, which are essential, but are toxic when exceed a threshold level. There are about 20 or more common elements in nature that have been identified as potential hazards to human health. Of these, fluoride and arsenic are the two most common, and in recent years nitrate is emerging in many parts of South Asia. The weathering of these

elements from its natural environment is associated with the combination of natural and man-made factors, threatening human survival. Though precise data is lacking, estimates indicate about 200 million people are affected under the dreadful fate of fluorosis, and more than 100 million affected by arsenicosis. Excess fluoride, arsenic and nitrate in drinking water and water used for domestic purpose have caused serious public health problems worldwide. While contemporary attempts aim to technically source water through large projects or from rainfall, the papers in this collection argue that people are actively adapting to poor quality water. The paper by Habibur Rahman, A.Al-Muyeed and A. Ahmed argues that though there are different technologies to treat or provide alternative to arsenic polluted water there are several socio-cultural and institutional challenges in these technical interventions in Bangladesh. The paper by Atanu Sarkar assesses the social and health vulnerability of the affected population to cope with arsenic pollution at the household and community levels. From a randomly selected five villages in the Murshidabad district in India, the author finds that inadequate access to income, nutrition, health infrastructure and social safety nets with deprived population bear the multiple burdens of arsenicosis problems. Women are particularly vulnerable given inadequate choice to decide on education and health expenditure. The author establishes a complex inter-linkage of social, economic and cultural factors in influencing arsenicosis.

Climate change is emerging as a major player in Asian regions. These have resulted in increased droughts, and floods affecting human health. Papreen Nahar, Fariba Alamgir, Abbas Bhuiya and Andrew Collins examine the perception of the people on the relationship between natural disaster and health in Bangladesh. The authors use qualitative methods in three case study regions each representing three disasters – flood, drought and cyclone respectively. Iskandar Abdullayev examines the historical development process coupled with climate change affecting the Aral Sea basin in Central Asia.

Collectively the papers in this special issue highlight the complexity in understanding the linkage between water resource management and its implication on human health in South Asia. In addition, it cautions on the 'safe haven' approach adopted by national and international agencies in implementing 'water as infinite' approach. As highlighted by most of the papers (Golam et al., 2009; Papreen et al., 2009 and Abdullaev, 2009 in this issue), such an approach will soon be defeated by rapid urbanisation, intensification of agriculture, globalisation and climate change. These papers show people actually living and adapting themselves to poor quality water, with vulnerable groups (women, children and the poor) often falling prey to this poor quality of water. The link between water pollution and health is both a complex and contingent process. Increasing recognition of the need to understand complex systems in health sector have led to examine water pollution and health in a systemic perspective. Emerging from ecology (Holling, 2001) and resource management (Mitchell, 1997; Berkes et al., 1998) studies, the complex systems approach has gained prominence in health sector too (Label, 2003; McMicheal, 2001). Recognising water pollution and health as a complex system involves embracing the complex interplay of diverse factors, uncertainty associated with this interplay, conflicts negotiated across levels and change (Holling, 2001; Mitchell, 1997; McMichael, 2001). As McMichael et al. (2006) conclude, "little research has been done on the indirect pathways that link climate change to resultant social, economic and demographic disruptions and their knock-on health effects". Methodologically this requires diverse sets of methods and innovative analytical tools to understand and model complexity to highlight the differential role of diverse actors and contextual factors influencing human health.

References

Berkes, F. and C. Folke (Eds.) (1998). Linking social and ecological systems, management practices and social mechanisms for building resilience. Cambridge University Press, Cambridge.

Bhardwaj, R.M. (2005). Status of Wastewater generation and Treatment in India. IWG-Environment Joint Work Session on Water Statistics, Vienna, June 20-22.

Corvalan, C., Hales, S. and A. McMichael (2005). Ecosystems and human well-being – health synthesis. World Health Organization, Geneva.

Holling, C.S. (2001). Understanding the complexity of economic, ecological, and social systems. *Ecosystems*, **4(5):** 390-405.

Lebel, J. (2003). Health: An Ecosystem Approach. International Development Research Centre, Canada.

McMichael, J.A. (2001). Human frontiers, environments and disease: Past patterns, uncertain futures. Cambridge University Press, Cambridge.

McMichael, J.A., Woodruff, E.R. and S. Hales (2006). Climate change and human health: Present and future risks. *The Lancet*, **367:** 859-869.

Mitchell, B. (1997). Resource and Environmental Management. Longman Publication, London.

PRC (2004). State of the Environment in China. Peoples' Republic of China, http://www.sepa.gov.cn/english/SOE/soechina2004/water.htm (accessed 1 May 2007).

Singh, A.D., Taneja, S. and S. Agarwal (2004). Technical assistance to the government of India for urban health planning and national guidelines. Environment Health Project Activity Report 135. U.S. Agency for International Development, Washington, DC 20523.

UN-Habitat (2006). The State of the World's Cities Report 2006/2007. United Nations Human Settlements Programme (UN-HABITAT), Nairobi, Kenya.

UNDP (2006). Human Development Report 2006 - Beyond Scarcity: Power, Poverty and the Global Water Crisis. Palgrave Macmillan, New York.