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BOOK REVIEWS

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Water is central to the very existence and survival of all forms of life on the Earth. Humans have a special relationship with water as all of their activities throughout their history have depended directly or indirectly upon water. Early nomadic people may have had limited contact with and use of water but with the beginning of settlements around water bodies not only the human dependence on water increased, primarily for food production, but also their influence on the water quality through disposal of wastes. As the Vedic scriptures and early works of Greek philosophers like Hippocrates show, several thousands of years ago humans were aware of the differences in water quality and its effects on their well-being.

However, the link between water and human health was demonstrated only in the latter half of the nineteenth century. At least since 1817, starting from India, pandemic cholera outbreaks had occurred over the next few decades in Asia, Africa, Europe and America. While extensive investigations in London, by Dr John Snow after the 1854 outbreak, confirmed contaminated water as the source and the oral route of infection, microscopic examinations by Robert Koch, first in Egypt following the 1883 outbreak, and later in early 1884 in Calcutta established firmly the bacteria, later named *Vibrio cholerae,* to be the causative agent and fecal contamination of drinking water responsible for the deadly disease. Fascinating details of such interesting history and the persons responsible for major discoveries are only one aspect of the multifaceted relationships between water and health discussed is this voluminous work of nearly 100 editors and authors.

As pointed out by the editors in the Introduction, the volume places health at the centre and explores its linkages with many facets of water involving direct and indirect, and beneficial and detrimental relationships. The volume comprises of 70 articles organised into eight themes each of which is provided with an introduction. Each article begins with a few 'learning objectives' and lists at the end several additional readings before the cited references.

The theme 'water related hazards' discusses in detail the disease transmission routes, along with Bradley's system of classification, followed by accounts of water-borne and water-washed diseases, and those involving water-based insect vectors. Recognising that water is carried by women in many countries over long distances, its impacts on musculoskeletal disorders as well as other psychological, social, gender, age and other issues are discussed in one article. Further contributions cover the health problems caused by Legionella, cyanobacteria, chemicals (arsenic, fluoride, nitrate, lead, selenium, organic compounds including pesticides) and radionuclides.

This is followed by a group of articles describing the pathways of exposure to chemicals and pathogens (bacteria, viruses, protozoa, helmonths and fungi) as agents of disease, factors affecting the survival and movement of agents and their transmission from source to humans. The pathways include drinking water, water based recreation, food and water-borne zoonoses. The interventions required to prevent or reduce human exposure to chemicals and pathogens described in the next part include safe water supply, drinking water treatment, treatment within the households, wastewater treatment, system maintenance and management of chemical hazards. Seven articles in another section deal with the implementation of various interventions at different levels from household to rural and urban communities.

The next very important section recognises that the exposure to disease causing agents as well as the scope, scale, impact and sustainability of interventions are modified by a number of remote (distal) factors such as water scarcity, climate change, poverty, emergency and disaster, demographics, water reuse, and war and other conflicts. These factor need due consideration in developing policies, water quality regulations (e.g., for drinking water, outdoor recreation, swimming pools, wastewater treatment and reuse), water charges and subsidies etc. which are discussed in the next part.. This section also includes a brief account the concept and principles of integrated water resources management (IWRM) and its relevance to public health. Further contributions describe the water demand management; use, collection and dissemination of information on water, sanitation and hygiene; and health impact assessment

Yet another section includes ten articles devoted to the description of analytical tools for understanding water-health interactions and managing water and health. They include short accounts of epidemiology, assessment of microbial populations and burden of health risks, water quality monitoring, microbial indicators (including coliforms, coliphages, bacteroides, Clostridium, non-human viruses and H2S producing bacteria). Issues related to water and health management take us to the application of Geographic Information System (GIS) and the interface with economics in the discussion of valuation of benefits from WASH, cost-benefit analysis and cost-effectiveness analysis of WASH interventions. The final section peeps into the history of water related health problems from the antiquity and cholera epidemics of the 19th century to the problem of arsenic in Bangladesh (1990s), *Cryptosporidium* outbreak (1993) in USA and the bacterial contamination of groundwater from a farm in Walkerton (Canada). It closes with a look at the Public Health Act of 1848 in UK that marked the beginning of sanitary reforms around the world.

This Handbook will greatly benefit all those involved in water management, public health, WASH sector and those working towards achieving the Sustainable Development Goals (SDG6).

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