



# WATER-ASSOCIATED DISEASES : A REVIEW

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## Abstract

Water, which is of critical signification for the life of the living, is the most likely resource found usually in the world. ‘Water-associated disease’ is groups of diseases related to water in different forms, the risks or agents that are the direct explanation of damage contain helminthes, viruses, protozoa, bacteria, chemicals and personal physical reasons. They are several groups of water-linked illnesses, according to the part water shows in the transmission method of illness : these contain: water-borne illnesses, water-washed diseases, water-based diseases, water related insect vector diseases and inhalation diseases. The large cause of these diseases are human or animal waste matter, industrial activity or be parts of normal or disturbed systems. Water-associated diseases have symptoms are divergent ranging of the acute (self-limiting diarrhea) to the chronic (cancers, blindness and life-long infections) and recurring (malaria). Epidemiological examination identifies various underlying associated factors like poverty, demography education, climate, housing and utilize of basic services. Water - borne and water-related illnesses are subtle to eco-friendly conditions, some or wholly that possible to be effected via climate change.

**Key words:** Water associated diseases, Epidemiology, inhalation disease.

## Introduction

Water is perhaps the most precious natural resource after air, water, which is of critical significance for the life of the living, is the most likely resource found usually in the world. The total water in the world consists of 98% which is accessible. in the oceans, sedimentary rocks and icebergs. Freshwater resources are even below 2% (Kocata, 1997; Ritabrata, 2019). The phrase water-linked illnesses are referred to infections that are mostly transmitted through contact by or consumption of infected water fig. 1. According to Bradley, they are 5 several groups of water-linked illnesses, dependent of part water shows in the illness transmission method : these contain: water-washed illnesses, water-borne illnesses, water-based illnesses, water related insect vector illnesses and inhalation illnesses.

Water - borne and water-linked illnesses are suitable to surrounding conditions, little or wholly that possible to be influenced via climate change. Of example, change climate is probable to reason variations in the prevalence of heavy rainfall events, storms and drought periods (IPCC, 2012), melting of ice polar and glaciers, warming and thermal expansion of the oceans happing sea level increase (Dangendorf *et al.*, 2002) and melting of

permafrost, that might contribute to further warming (Schoor *et al.*, 2015) fig. 2. Variations in interactions among the water cycle and the climate method will modify the risk of water - borne illnesses of the physical effects, as well as of the resulting risk of famine, shortages of water, reduced quality of water, rising habitat of mosquitoes, alterations to seasonality of illnesses and polluted recreational waters. Though, health effects of water -borne illness over the longer period might be secondary to another health affects linked by another water issues (*e.g.*, shortage, famine, flooding, the economy, sea level increase and war).

## Classification of water-linked illnesses

1. Water-borne illnesses: are illnesses make happen *via* the ingestion of path ogens in water. It is fundamentally concerned by water quality and security and attributed to water that have been polluted via animals, human or chemical wastes (White *et al.*, 1972; Bartram *et al.*, 2015) meanwhile the Protocol on Water and Health defines “water-related disease” to mean “any significant adverse effects on human health, such as death, disability, illness or disorders, caused directly or indirectly by the condition, or changes in the quantity or quality, of any waters”. These infections are spread *via* water -borne pathogens (*e.g.* *E. coli* O157:H7; *Vibrio cholera* O139).

Other pathogens have been recognized, counting several viruses, like rotavirus and norovirus (caliciviruses). Anther recognized factor contain the protozoans *Giardia* spp. and *Cryptosporidium* spp, together that has an ecologically resilient cyst of, the latter that less and has challenged less of the water handling procedures that are widespread in industrialized nations. Historically, cholera and typhoid are most important water-borne diseases are causing of mortality (Bartram *et al.*, 2015; Forstinus *et al.*, 2015).

Entry to safe water drinking, principal sanitation and best hygiene education might not only avoid diarrheal illnesses via approximately 90% (UN, 2010) then lead to improved health, poverty reduction and socioeconomic development (Fewtrell, 2005). Generally, waterborne illnesses are the second leading reason of death in children under the age of 5 years,

A recent assessment of the load of diarrheal illness of exposure to inadequate water drinking sanitation and hygiene in Low Medium income countries LMICs completed that 842 000 million diarrhoea deaths were produced via this group of increase agent. It is hard to detach the several components of faecal–oral illness diffusion, Particularly waterborne and water-washed illness (Prüss-Ustün *et al.*, 2014; Bartram *et al.*, 2015; Willison *et al.*, 2016).

2. Water-washed disease: The water-washed illness group is essentially concerned by approach to and utilized of water personal, domestic hygiene and food. In opposition to waterborne illness, the part of water is in

avoidance of illness diffusion rather than as a vehicle of transport of pathogens. Water-washed illnesses might be simply divided in to 2 kinds. The primary having faecal–oral illnesses, that might too be water and food-borne, because water play together as a vehicle of their transport and is vital for sufficient personal and food hygiene whereby both adequate water and safe water are fundamental of affective avoidance. The second contains illnesses similar skin sepsis (diverse bacterial causes),trachoma (*Chlamydia trachomatis*) and yaws (*Treponema pertenuae*) where transportation is person to person and hygiene too shows a part in avoidance (Bartram *et al.*, 2015).

The water-washed illness lesson is fundamentally concerned by water access, that controlled at a household level *via* W.H.O and U.N.I.C.E.F, indicating that 56 percent of the global populace live in households by water ‘on plot’ (commonly a piped supply) and a further 33 percent utilize an ‘developed source’ like a protected communal source. These 2 groups of access serve as indicators of comparative household water utilize (Evans *et al.*, 2013; Freeman *et al.*, 2014).

3. Water-based disease: The water-based illness group is related to those pathogens of illness that pass an obligatory section of their life cycle in water. Infection might be by ingestion – as is the case by dracunculiasis. Thus overlaps by the water-borne class; or could be across the intact or damaged (wounded, abraded) skin (percutaneous) – as is the happen by schistosomiasis and leptospirosis (Bartram *et al.*, 2015; WHO, 2016), fig. 3.

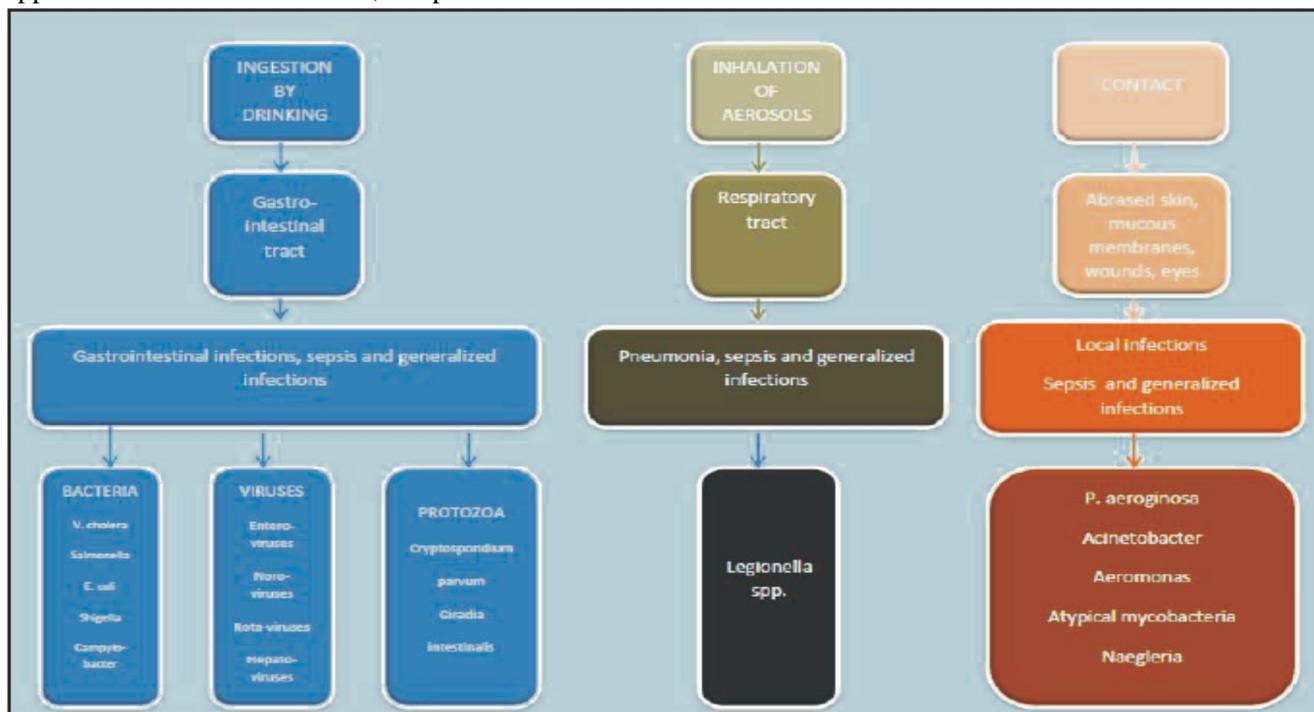
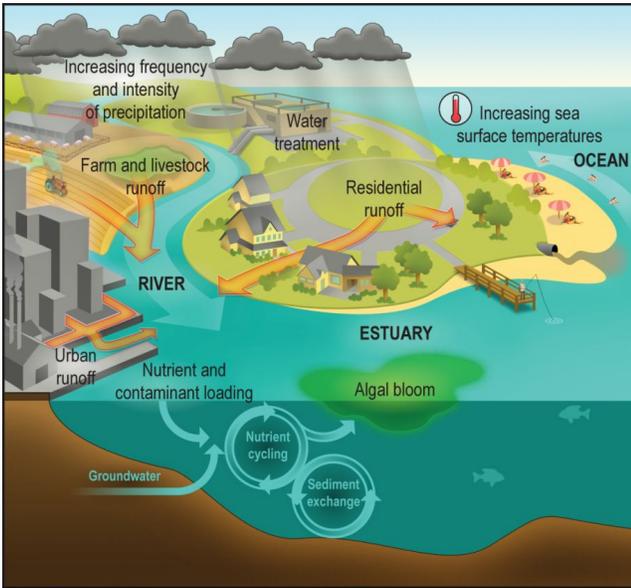


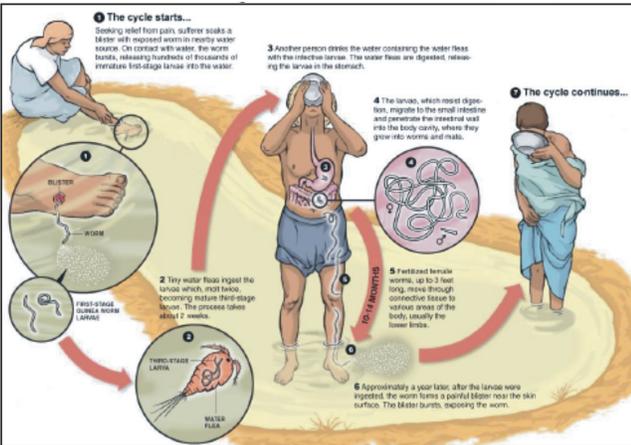
Fig. 1: Transmission pathways, Source: WHO, 2004.



**Fig. 2:** Links among Climate Alteration, Water Amount and Quality and Human Exposure to Water-Related Disease. (source : Trtani *et al.*, 2016) : Water-Related Disease -Climate and Health.

White *et al.*, (1972) divide the water-based category in to 2: the primary contain of the helminths (*Schistosoma*), that think through ‘water breeding’ because of reproduction in the middle snail host; and the second contain of guinea worm (*Dracunculus medinensis*), whose larvae infect aquatic crustaceans but don’t proliferate in them. Like someone excreting *Schistosoma* who pollutes their own water basis might (if there are appropriate snail hosts present) be further infected by water contact and *via* that raise their own workload. This is essential because the harshness of illness is linked to the potency of infection.

4. Water-related insect vector: Diseases by a water-related insect vector White *et al.*, (1972) found this group as ‘those infections distribution via insects that propagate in water or bite near it’ much tropical contagion by insect



**Fig. 3:** Life cycle of guinea worm disease Source : health department center- New Delhi municipal council, 2017.

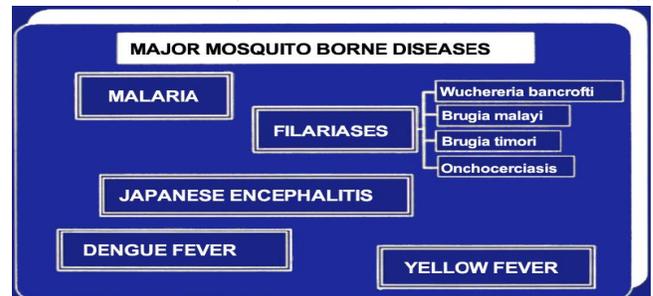
vectors and the larvae of many aquatic insects. The name of that group is especially self-explanatory. The pathogen it self may not have relationship link by water; an rather its insect vector every breeds in or bites near water bodies. The relationship to water is estimation *via* the insect vector, by little favoring appear touching contaminated waters and anthers clean favoring, fast touching waters. Generally malaria is the utmost significant of this group, that too includes onchocerciasis, Bancroft Ian filareiasis, dengue onchocerciasis,, yellow fever and other arboreal infections wholly that transferred via insects by aquatic larvae. Tsetse flies, that transfer Gambian sleeping sickness, are find near rivers but don’t breed in water (Bartram *et al.*, 2015), fig. 4.

5. Inhalation disease (new proposed group): also called engineered water system associated group. It has been formerly proposed (Bradley, 2009) that an added group to contain aerosol-transferred illness should be needed. The principal hazard of concern is bacteria *Legionella*, the causal pathogens of legionellosis, that proliferate in biofilms, particularly in engineered water methods, (plumbing, evaporative cooling) where temperature and nutrient conditions support their growth. They survive and proliferate within a number of free-living protozoa in a system similar to the ‘complex life cycles’ of several water-based illnesses.

*Legionellae* can be ingested via trophozoites of certain amoebae similar *Acanthamoeba*, *Hartmannella* and *Naegleria*, that might show a part in their persistence in water environments (WHO, 2017).

*Legionella* are not revealed via HPC systems and *E. coli* (or, alternatively, thermos tolerant coliforms) is not a suitable index for the presence/absence of this organism (WHO, 2017).

*Legionnaires’* illness found its name from the media reference given to a mysterious pneumonia-like illness that distressed several visitors of an American Legion convention at the Bellevue-Stratford Hotel in Philadelphia during July, 1976. An onset of illnesses occurred, presenting Pennsylvania Department of Public Health officials with a reported 221 cases of a usual respiratory illness contracted by convention (hotel) visitors and by



**Fig. 4:** Major water-related insect vector Source: WHO, 1988.

some pedestrians passing by the hotel. (AWT, 2019).

There are several factors influence Legionella amplification involved surviving of Legionella at water with temperatures to 50 (warm), the PH of bulk water is in the range of 5.0 to 8.5, the presence of microbiota, like bacteria and algae in biofilm that provide important nutrients for Legionella, the presence of corrosion, decrease of water flow cause loss of chemical that result of aging of water” within the water system, the presences of sediment, scale which provide formation of biofilm at surfaces and the presence of amoebae or other protozoan that assist surviving of Legionella in harsh environmental conditions, such as chemicals and disinfectants (AWT 2019).

There are many types of water system serve as source of Legionella multiplication and distributor include systems of potable/domestic hot water by tap faucets, showerheads and aerators, cooling towers and evaporative condensers, decorative water and water fountains, misters and Humidifiers, equipment of Respiratory therapy/CPAP, dental hygiene equipment and machines of Ice (Bradley, 2009).

## Conclusion

Water-associated illnesses have symptoms are divergent ranging of the acute (self-limiting diarrhea) to the chronic (cancers, blindness and life-long infections) and recurring (malaria). Epidemiological examination identifies various underlying associated factors like poverty, demography education, climate, housing and utilize of basic services. Water - borne and water-related illnesses are subtle to eco-friendly conditions, some or wholly that possible to be effected via climate change.

## References

- Association of Water Technologies (AWT) (2019). Legionella: A Position Statement and Guidance Document.
- Bartram, J., R. Baum, P.A. Coclanis, D.M. Gute, D. Kay, S. McFadyen, K. Pond, W. Robertson and M.J. Rouse (2015). Routledge. Handbook of Water and Health. 1<sup>st</sup> edition Howick Place, London UK, Routledge (2015), chapter 3, Bartram, J., Hunter, P., Bradley classification of disease transmission Routes for water related hazards : 20-37
- Bradley, D. (2009). The Spectrum of Water-Related Disease Transmission Processes. *Global Issues in Water, Sanitation and Health*, pp.60-73. The National Academies Press, Washington DC, USA.
- Dangendorf, F., S. Herbst, R. Reintjes and T. Kistemann (2002). Spatial patterns of diarrhoeal illnesses with regard to water supply structures—a GIS analysis. *International journal of hygiene and environmental health.*, **205(3)**: 183-191.
- Evans, B., J. Bartram, P. Hunter, A. Rhoderick Williams, J. Geere, B. Majuru, L. Bates, M. Fisher, A. Overbo and W. Schmidt (2013). Public health and social benefits of at-house water supplies. *University of Leeds: Leeds, UK*, 1-61.
- Fewtrell, L., R.B. Kaufmann, D. Kay, W. Enanoria, L. Haller and J.M. Colford Jr (2005). Water, sanitation and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *The Lancet infectious diseases.*, **5(1)**: 42-52.
- Forstinus, N., N. Ikechukwu, M. Emenike and A. Christiana (2015). “Water and Waterborne Diseases: A Review”, *Intern. J. of TROPICAL DISEASE and Health.*, **12(4)**: 1-14.
- Freeman, M.C., M.E. Stocks, O. Cumming, A. Jeandron, J.P. Higgins, J. Wolf, A. Prüss Ustün, S. Bonjour, P.R. Hunter, L. Fewtrell and V. Curtis (2014). Systematic review: hygiene and health: systematic review of hand washing practices worldwide and update of health effects. *Tropical Medicine and International Health.*, **19(8)**: 906-916.
- IPCC (2012). Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. In A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change; Field, C.B.B.V., Stocker, T.F., Qin, D., Dokken, D.J., Ebi, K.L., Mastrandrea, M.D., Mach, K.J., Plattner, G.K., Allen, S.K., Tignor, M., Midgley, P.M., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 1-582.
- Kocata, A. (1997). Ecology and Environmental Biology, Ege University Printing House, Bornova-zmir, 564.
- Prüss-Ustün, A., J. Bartram, T. Clasen, J. Colford , J.M., O. Cumming, V. Curtis, S. Bonjour, A.D. Dangour, J. De France, L. Fewtrell, M.C. Freeman, B. Gordon, P.R. Hunter, R.B. Johnston, C. Mathers, D. Mäusezahl, K. Medlicott, M. Neira, M. Stocks, J. Wolf and S. Cairncross (2014). Burden of diarrhoeal disease from inadequate water, sanitation and hygiene in low- and middle-income settings: a retrospective analysis of data from 145 countries. *Trop Med. Internat. Hyg.*, **19(8)**: 894-905.
- Ritabrata, R.(2019). An Introduction to water quality analysis. *Int. J. Env. Rehab. Conserv.*, **IX(1)**: 94-100.
- Schuur, E.A., A.D. McGuire, C. Schädel, G. Grosse, J.W. Harden, D.J. Hayes, G. Hugelius, C.D. Koven, P. Kuhry, D.M. Lawrence and S.M. Natali (2015). Climate change and the permafrost carbon feedback. *Nature.*, **520(7546)**: 71-179.
- Trtani, J.M., L. Jantarasami + 9 author and J. Thurston (2016). Water-Related Illness Climate and Health chapter 6.
- White, G., D. Bradley and A. White (1972). Drawers of Water. University of Chicago Press, Chicago, IL, USA.
- Willison, H.J., B.C. Jacobs and P.A. Van Doorn (2016). Guillain-barre syndrome. *The Lancet.*, **388(10045)**: 717-727.
- World Health Organization WHO (1988). Source Environmental Management for Vector Control : Training and informational materials.
- World Health Organization WHO (2004). Guidelines for drinking-water quality. Third edition. Volume 1 Recommendations. Geneva, World Health Organization.
- World Health Organization WHO (2016). The situation of water-related infectious diseases in The pan-european region.
- World Health Organization WHO (2017). Guidelines for Drinking-Water Quality: Fourth Edition Incorporating the First Addendum 11 Microbial fact sheets. 221-295.