

## Chapter 55

# Waterborne Diseases and Climate Change: Impact and Implications

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### ABSTRACT

*Waterborne diseases are caused by a multitude of pathogens and associated with a significant burden in both developed and developing countries. While the assessment of the adverse impacts of climate change on human health from infectious diseases has mainly focused on vector-borne diseases, waterborne diseases prevalence and transmission patterns are also likely to be impacted by environmental change. This chapter will outline relevant waterborne pathogens, summarise the impact of climate change on disease transmission and explore climate change adaptation options in order to reduce the increased burden of waterborne diseases.*

### INTRODUCTION

Waterborne diseases are caused by bacteria, viruses and parasites that contaminate water and are transmitted to humans through consumption or contact (Leclerc, Schwartzbrod, & Dei-Cas, 2002). These pathogens are usually excreted in the faeces of infected individuals and ensure transmission of the infection to new hosts via the faecal oral route (Leclerc et al., 2002). The link between water and disease was noticed earlier on and the first publication on PubMed linking ground water and disease dates back to 1890 (No authors listed, 1890). While some observations proved untrue (such as water transmission of smallpox), remarkably, several findings were correct and are currently backed by scientific findings, in particular the fact that droughts and heavy rain could be accompanied or followed by ill health and epidemic disease (No authors listed, 1890). The first mention of “waterborne disease” on PubMed dates back to 1895 and was associated with consumption of sewage contaminated shellfish that resulted in cholera and typhoid cases (No authors listed, 1895). The author’s recommendation was to urge the local authorities to take action in order to prevent sewage contamination. This good practice recommendation

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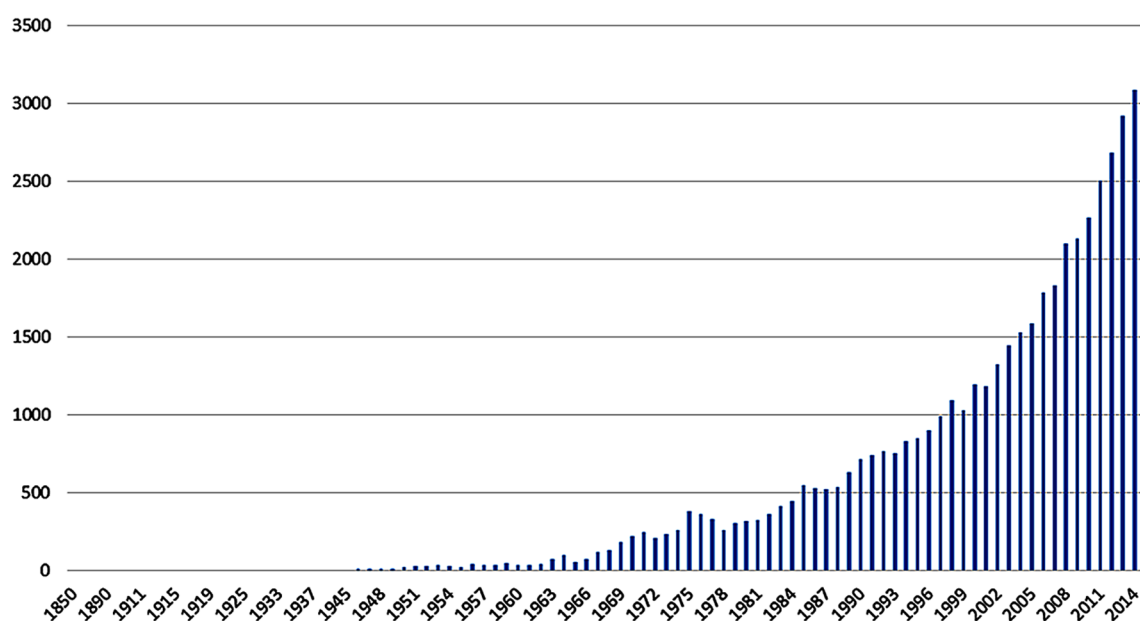
is still valid today. The number of publications about water and disease has steadily increased since as shown on Figure 1 reflecting the prevalence and relevance of waterborne diseases. Indeed, some authors consider that waterborne diseases are the single largest threat to global public health (Gray, 2014).

Waterborne diseases are not confined to developing countries with poor water quality and basic sanitation. Indeed, several sizeable outbreaks occurred in developing countries (Baldursson & Karanis, 2011; Beer et al., 2015; OECD/WHO, 2003; Smith et al., 2006) and are likely to continue to occur, highlighting that water supplies could be accidentally contaminated or have treatment failure. The issue in developing countries is mainly related to water availability and quality. From an international policy perspective, the need for a better understanding of the role of water in infectious diseases and improved management of water supplies were formally stated in 1996 at the Organisation for Economic Cooperation and Development workshop on “Biotechnology for Water Use and Conservation” in Cocoyoc, Mexico (P.R. Hunter, Waite, & Ronchi, 2003). In addition, improved water and sanitation was one of the Millennium Development Goals (UNICEF and World Health Organization, 2015) and is one of the post 2015 Sustainable Development Goals of the United Nations (<http://www.un.org/sustainabledevelopment/water-and-sanitation/>). These goals suggest that despite remarkable advances towards access to adequate water and sanitation, a large proportion of the world’s poorest are still suffering from water scarcity, poor drinking water quality and inadequate sanitation and the associated high risk of infectious diseases.

Climate change refers to “a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer” (IPCC, 2015). Climate change is attributed directly or indirectly to human activity (UNFCC, 1992). The adverse effect of climate change on human health is no longer a debatable issue (Kim, Kabir, & Ara Jahan, 2014; McMichael & Lindgren, 2011; McMichael, Woodruff, & Hales, 2006; Semenza & Menne, 2009; Wu, Lu, Zhou, Chen, & Xu, 2016). While, the effect of climate change on vector-borne

*Figure 1. Number of publications for “water and disease” per year (1850-2015)*

Source: <http://www.ncbi.nlm.nih.gov/pubmed>.



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