European Journal of Internal Medicine 46 (2017) e9–e10

Contents lists available at ScienceDirect

European Journal of Internal Medicine

journal homepage: www.elsevier.com/locate/ejim

Letter to the Editor

Impact of drought on human health

Keywords:
Drought
Human health
Drought-related diseases
Sanitation
Water quality
Infectious diseases

Over the last few summers in Europe, increasingly hot and dry, we are experiencing a new great problem, the drought, associated with mugginess and insufficient winter and spring rainfall that do not allow the restoration of water reserves. Forecasts for the future are certainly not encouraging at the global level. It is in fact estimated that about half of the world population by 2025 will live in conditions of water scarcity, whose quality is definitely lowering in different parts of the world.

The greatest impact of drought is on farms and crops, with severe economic repercussions at this time of the year which, on the contrary, should boost the economy. The harmful effects of drought have been well defined and explored in the meteorological, hydrogeological, agricultural and economic context. Less studied is its impact on our health and perhaps we are not adequately prepared to deal with its short and long-term consequences, given the availability of water now taken for granted in Western and industrialized countries and considered a problem to "Third-World" levels.

Climate change that we are now facing, however, seriously undermine this certainty and also the medical community should be prepared to deal with drought-related effects in the daily professional practice, deepening the study of its effects on health and wellbeing. In this context the availability of quality, not contaminated and not stagnant drinking-water, is an essential prerequisite for the maintenance of adequate levels of sanitation and hygiene in the community and for the containment of transmission and spread of infectious diseases. The direct and indirect consequences of drought on human health obviously depend on both the duration and the severity of drought conditions as well as the economic and social fabric of the country and its availability of resources [1].

Drought-related diseases can be distinguished in: "transmitted by water" (contaminated water) diseases also known as waterborne diseases, which are transmitted through fecal-oral route, including different types of diarrhea and gastroenteritis caused by the bacterium *Escherichia coli* and other pathogens such as *Vibrio cholerae*, whose spread is increasing in various geographical areas; "water-based" diseases transmitted by pathogenic species that have life cycles linked to the water, as in the case of schistosomiasis and finally "water-related" diseases, in which not the parasite, but its vector has a cycle involving water. The best known example is malaria, caused by Anopheles mosquitoes whose life cycle occurs mostly in stagnant water. In addition to reducing the amount of available water, the drought worsens the water quality due to an increase of stagnant water where such pathogens can easily proliferate. Furthermore, there are also "water-washed" diseases, in which the water shortage affects even personal hygiene resulting in increased spread of microorganisms and hence increased possibility of contracting infectious diseases such as trachoma and parasites like scabies or lice [2]. These conditions are much stronger in such areas of the world such as Eastern Africa and South Asia where the inadequate sanitation and the reduction of safe water access are associated with the increased occurrence of diarrheal diseases especially in children. Particularly, it has been estimated that the risk of diarrheal diseases ranges from 3% to 11% for each increase in temperature of 1 °C thus demonstrating the critical implications of drought on human health [3]. Moreover, periods of drought are often opposed to heavy rainfall and flooding that in the majority of cases, mainly in the developing countries, correspond to contamination of treated water source [4].

In urban areas, the scarcity of rains, causes the exacerbation of acute and chronic respiratory tract disorders (asthma, allergies, bronchitis, pneumonia) mainly in the long term due to the accumulation of allergens, fine dusts and polluting agents typically washed away by rain [5]. Unsurprisingly in China, where the drought is becoming a serious emergency, respiratory diseases are spreading more easily [6]. These pathologies occur largely in the most vulnerable groups of population including children, the elderly and people with chronic or predisposing affections such as allergic persons, smokers and specialty types of risk workers. On the contrary, in the Mediterranean countries, warmer temperatures and drought have increased the recurrence of wildfire exposing population of large regions to toxic emissions including particulate matter (PM), ozone and other harmful compounds of fire smoke [3]. Growing evidence and epidemiological studies indicate that wildfire smoke exposure is responsible of respiratory morbidity and is associated with worsening of pulmonary and cardiovascular diseases [7].

Several research has also associated drought with many other harmful effects on human health including hyponutrition, various mental illnesses and the aggravation of pre-existing chronic pathological conditions that may persist even after the end of the emergency. Studies conducted in California, a region at a high risk of drought, suggested the existence of a strong correlation between periods of drought and perception of the physical and mental health among inhabitants [8].

Appropriate measures need to be taken. What we can do? The greatest difficulty in predicting the impact of drought depends on the fact that it can take many months before the water reserves are consumed, but the same time or even more may be needed to restore them. The keyword that shares drought with medicine is therefore "prevention". Preventing drought through opportune environmental and social interventions aimed at more prudent management of a valuable and irreplaceable resource represented by water, means to prevent substantial health risks.

Funding

This study was supported by Associazione Italiana per la Ricerca sul Cancro (AIRC; IG N° 13312 to M. Bifulco).

http://dx.doi.org/10.1016/j.ejim.2017.08.009

Disclosure of potential conflicts of interest

The authors report no conflict of interest.

References

[1] Stanke C, Kerac M, Prudhomme C, Medlock J, Murray V. Health effects of drought: a systematic review of the evidence. PLoS Curr 2013;5.
[2] Sterk A, Schijven J, de Nijs T, de Roda Husman AM. Direct and indirect effects of climate change on the risk of infection by water-transmitted pathogens. Environ Sci Technol 2013;47(22):12648–60.
[3] Franchini M, Mannucci PM. Impact on human health of climate changes. Eur J Intern Med 2015;26(1):1–5.
[4] Levy K, Woster AP, Goldstein RS, Carlton EJ. Untangling the Impacts of Climate Change on Waterborne Diseases: a systematic review of relationships between diarrheal diseases and temperature, rainfall, flooding, and drought. Environ Sci Technol 2016; 50(10):4905–22.
[5] D'Amato G, Holgate ST, Pawankar R, Ledford DK, Cecchi L, Al-Ahmad M, Al-EneziF Al-Muhsen S, Ansotegui I, Baena-Cagnani CE, Baker DJ, Bayram H, Bergmann KC, Boulet LP, Buters JT, Garrasi D, Gómez M, Haahtela T, Halwani R, Hassani Y, Mahboub B, Marks G, Michelozzi P, MontagniM Nunes C, Oh JJ, Popov TA, Portnoy J, Ridolo E, Rosário N, Rottem M, Sánchez-Borges M, Sibanda E, Sienra-MongeJJ Vitale C, Annesi-Maesano I. Meteorological conditions, climate change, new emerging factors, and asthma and related allergic disorders. A statement of the World Allergy Organization. World Allergy Organ J 2015;8(1):25.
[6] Wang L, Liao Y, Yang L, Li H, Ye B, Wang W. Emergency response to and preparedness for extreme weather events and environmental changes in China. Asia Pac J Public Health 2016;28(2 Suppl):59S–66S.
[7] Reid CE, Brauer M, Johnston FH, Jerrett M, Balmes JR, Elliott CT. Critical review of health impacts of wildfire smoke exposure. Environ Health Perspect 2016;124(9): 1334–43.
[8] Barreau T, Conway D, Haught K, Jackson R, Kreutzer R, Lockman A, Minnick S, Roisman R, Rozell D, Smorodinsky S, Tafoya D, Wilken JA. Physical, mental, and financial impacts from drought in two California Counties, 2015. Am J Public Health 2017; 107(5):783–90.

Maurizio Bifulco
Department of Molecular Medicine and Medical Biotechnology, University of Naples Federico II, Naples, Italy
Department of Medicine, Surgery and Dentistry 'Scuola Medica Salernitana', University of Salerno, Salerno, Italy
Corresponding author at: Department of Molecular Medicine and Medical Biotechnology, University of Naples Federico II, Naples, Italy.
E-mail address: mbifulco@unisa.it.

Roberta Ranieri
Department of Medicine, Surgery and Dentistry 'Scuola Medica Salernitana', University of Salerno, Salerno, Italy

5 August 2017