

Preface

A few years ago I was invited to an international scientific meeting on water and health organized in a developing country with huge problem of water availability and quality: all sessions were opened by an authority. In my session, he complained about the state of the water in his country and felt sad that we ourselves are polluters of the same water we use for drinking, fishing, bathing, irrigating the fields. He was addressing the scientific community to ask the reasons for this paradox and possible solutions. His expression was dismayed, the testimony of a discomfort. What power of purifying polluted water can we have? How did this happen? What mistakes were made? How to fix and find the balance with the environment that surrounds us?

Undoubtedly the development of societies has not been often accompanied by the necessary capacity to protect the environment, therefore, even the water. The cause of this imbalance was due mainly to the lack of knowledge about the strict relationships between environment and health.

Currently, thanks to the numerous studies available, many of these relationships are known. Scientific knowledge has provided the basis on which many developed countries have built a modern normative, aimed at protecting the quality of the environment, including water, thus preventing people from hazardous exposures, in a context of sustainable development. The technological progress of water disinfection prior to distribution for drinking and the possibility of controlling the microbiological quality relatively easily, using bacterial indicators, have represented milestones in the history of the protection of human health.

In developed countries, epidemics of cholera, typhoid fever belong to a distant past. However, even these countries are not exempt by problems, sometimes serious. We have discovered that bacterial indicators are not adequate to predict parasites and viruses which can be more resistant to disinfection; furthermore, results of the analysis to detect their presence are not immediate. Several outbreaks caused by emerging pathogens have been reported from national surveillance systems of developed countries (e.g., Legionella, Cryptosporidium, enterohaemorrhagic E. coli, norovirus, rotavirus, hepatitis A virus). The lesson learned from these outbreaks has guided towards new preventive approaches, such as the Water Safety Plans proposed by the WHO, where monitoring activities are only a stretch of the system necessary to ensure safe access to water.

We also know that predicting a risk provides the possibility of preventing from dangerous exposures. A practical application of this principle is represented by the new European directive on bathing waters, where rainfalls, that can worsen the microbiological quality of these waters, are used directly as predictors of potential short-term events of contamination.

Yet, monitoring still remains an irreplaceable activity in providing information on water quality. But these activities should be tailored on the basis of the faced situation. Besides bacterial indicators specific pathogens may be added. Monitoring activities can be also enriched with innovative tools, like genotyping and biomolecular methods, particularly useful during incident and outbreak investigations in attributing sources and establishing correct interventions.

In spite of the available evidence, most of the developed countries have not set up a surveillance system on water related diseases, probably reflecting the belief that these diseases belong to the past. On the contrary, surveillance offers a systematic approach to data collection, and is crucial in helping countries to monitor and evaluate emerging patterns and trends of disease. Developed countries should strengthen national disease surveillance systems in critical areas, especially for pathologies that are currently recognized to be under-reported. Data from these surveillance systems should be used to upgrade water quality management and reduce vaccine-preventable diseases, as those caused by rotavirus.

A quite recent reason of public concern is due to the awareness of the possible simultaneous occurrence in water of a wide variety of substances, as pharmaceuticals, pesticides in non agricultural areas, chemicals that interact with the endocrine system, personal care products, surfactants, nanomaterials, etc. These substances are not currently included in routine monitoring programs, hence the database on their environmental concentrations is poor. The potential adverse effects of the additivity and/or interactions among these substances is difficult to assess and this area represents a new scientific challenge, since the current chemicals legislation is based predominantly on assessments carried out on individual substances.

New challenges are also posed from the expansion of potentially harmful microalgae and cyanobacteria in "new" ecosystems as a consequence of intensification of intercontinental traffic, ballast waters, climate

change. This is a severe challenge from a scientific and regulatory point of view.

Recreation has a substantial role in the life of ever increasing number of citizens in the world. Man-made water recreational environments offer health promotion and social benefits accompanied with increasing comfort and sophisticated services but that can also present risky exposures to physical, microbiological, or chemical agents. In the period from 1999 to 2008 the US CDC reported 292 outbreaks attributed to "treated recreational venues", i.e. pool, spa and similar facilities. Pathogenic protozoon with high resistance to chlorine, especially *Cryptosporidium* spp., were the most important etiological agents responsible for these outbreaks.

Worldwide survey results show a wide variability in the absolute concentrations of natural radionuclides in waters. The highest dose fraction is often attributable to radium isotopes, that have been found only in few cases in drinking water. Yet, in some areas, radium iso-

topes occur at relatively high levels and specific treatments are necessary to prevent from dangerous exposures through drinking water.

Water and health is a complex issue. The risk factors that can occur in water are numerous and it is often necessary to address and possibly anticipate new ones to avoid having to recognize them in the midst of new environmental emergencies. This monographic issue is an attempt to cover some of the most relevant ones for the time being. I also hope that at least partially it contains answers to the questions raised by the religious authority in the above mentioned scientific event.

I am particularly grateful to the authors who accepted my invitation to contribute to this monographic number.

Enzo Funari

Dipartimento di Ambiente e Connessa Prevenzione
Primaria, Istituto Superiore di Sanità, Rome, Italy