



Editorial: Environment and Health

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Editorial on the Research Topic

Environment and Health

INTRODUCTION

Ten thousand years of protracted and increasing interaction between humans and their environment has influenced, beside the quality of ecosystems, also our quality of life, healthy life span, and health inequalities. In 2016 WHO reported that globally some 12.6 million deaths each year can be ascribed to unhealthy environments. Moreover, 24% of global deaths (and 28% of deaths among children under five) come from modifiable environmental factors (Prüss-Ustün et al., 2016). Human epidemiological studies and experiments in laboratory animals proved that exposure to some pollutants can increase susceptibility to diseases such as diabetes, heart disease, and reproductive cancers. Exposures to toxic agents can also cause immunosuppression, which increases vulnerability to infections, such as COVID-19 (Birnbaum and Heindel, 2020). Environmental factors which represent specific threats for humans and ecosystems are directly associated to exposure to hazardous substances in air, water, soils, and food. Marine sediments and seawater represent an additional major source of contaminants to the environment through multiple pathways. Risks and consequences are also amplified by climate changes and linear and non-linear combinations are reflected in multi-hazard effects. Consequences of living and working in a poor-quality environment could be further magnified in groups of people with poorer health and socio-economic status. In this view, the strategic framework of Agenda 2030 launched by UN refers to the Sustainable Development Goals as critical sectors where all Countries are urged to promote actions to protect the planet (https://www.who.int/topics/millennium_development_goals/en/). This comprehensive vision recognizes that building economic growth requires address a range of social needs including education, social protection and job opportunities, while tackling climate change and environmental defense. The highly integrated 17 Sustainable Development Goals represent a solid framework that ensuring healthy lives and promoting well-being at all ages is essential to sustainable development. Major progress was made in improving the health of millions of people and relevant efforts were also oriented in increasing life expectancy and reducing some of the common negative impacts. At the same time, worldwide consumption and production depend on the use of the natural environment and resources in a way that continues to have destructive impacts on the planet. Economic and social progress over the last century has been accompanied by environmental degradation that is endangering the ecological systems on which the human future depends. Thus, the development of multidisciplinary approaches for understanding mechanisms and dynamics of interference between environment and health is a crucial commitment. The holistic “One Health” approach (e.g., Gibbs and Paul, 2014; CE29.6.2017-COM, 2017 COM 339 Final, 2017) combining efforts of WHO, Food and Agriculture Organization, and World Organization for Animal Health,

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promotes multi-sectorial responses to food safety hazards, risks from zoonoses, and other public health threats. Thus, the human-animal-ecosystem-human interfaces represent primary fields of investigation for valuable improvements of the well-being of human population, ecosystem and environment.

This Research Topic comprises 14 studies including original research articles, method developments, reviews, and perspectives covering several aspects of the complex interaction between environment and health, with critical reviews on key environmental sectors as outdoor and indoor air quality, food, and marine environments. Also, specific proposals of modern approaches to monitor environment and health outcomes as well as restoration and recovery of polluted environments represent a crucial part of this topic. The collection contributes to create and implement effective conceptual links and “bridges” between distinct scientific communities, working in a multidisciplinary way. Most of the articles concern air and sea, as well as some insights dedicated to modern strategies to restore and recover polluted environment, also considering the impacts on human health and the economy.

AIR QUALITY

Poor air quality leads to premature death, cancer, and long-term damage to respiratory and cardiovascular systems. WHO estimates that environmental air pollution caused some 4.2 million deaths in 2016, while household air pollution from cooking with polluting fuels and technologies caused an estimated 3.8 million deaths in the same period (https://www.who.int/health-topics/air-pollution#tab=tab_1). Progress has been made to reduce unhealthy air emissions, an important step in creating a healthier environment. In particular, the Declaration of the Sixth Ministerial Conference on Environment and Health (held in Ostrava, Czech Republic, on June 15, 2017) includes a commitment to “prevent and eliminate adverse effects on the environment and health, costs and inequalities relating to waste management and contaminated sites, progressing toward the elimination of the disposal and trafficking of uncontrolled and illegal waste, and the proper management of waste and contaminated sites in the context of the transition toward a circular economy” (Sixth Ministerial Conference on Environment and Health. Available at: <http://www.euro.who.int/en/media-centre/events/events/2017/06/sixth-ministerial-conference-on-environment-and-health>). In this context, Manisalidis et al. (2020) documented, through a comprehensive knowledge-based analysis, modes and dynamics of air pollution and related impact on human health (at different systems level) and suggests specific science to policy actions as valuable trajectories to sustainable solutions. Perrino et al. (2020) measured continuous trace gases and aerosol (including NO_x, SO₂, O₃, NMHC) organic and inorganic pollutants on particulate matter (PM₁₀ and PM_{2.5}) over the period 2016–2018 from two highly polluted sites in southern Italy and offer original insights and understanding on the role of anthropogenic emissions and particularly on mechanisms of ozone formation, also considering the WHO limits. Kim et al. (2020) studied risk factors correlated to outdoor air pollutant exposure (PM₁₀, PM_{2.5}, and NO₂),

specifically in relation to cognitive impairment in elderly and gender-differentiated population of South Korea. The preliminary results suggest higher adverse effects of outdoor air pollution on cognitive function in women, indicating specific actions for prevention and intervention.

Stapleton et al. (2020) reported on a pilot study in 21 homes selected from the NIH funded cohort residing in Iowa of current and former smokers, with and without a history of respiratory exacerbations. The aim of the research was at assessing whether indoor air particulate collected from their homes would affect *in vitro* bacterial growth, biofilm formation, and primary human airway surface liquid antimicrobial activity, identifying mechanisms in the development of respiratory tract infections, including bacterial growth, biofilm formation, and innate immunity. Herting et al. (2020) assessed a systematic review on the available literature on the evidence from Magnetic Resonance Imaging studies on how early-life exposure responds to outdoor air pollution on neuro-development. Correlations between pollutants and physiological brain features suggested that outdoor air pollution may significantly affect structure and function of brain. Further air pollution-neuroimaging studies are urgently needed in a developmental neuroscience perspective. Viegas et al. (2020) presented a comprehensive study on the effects of mineral sulfurous thermal waters on lung epithelial-immune crosstalk through the action of its main component, H₂S as valuable inhalational treatment of respiratory diseases.

Marine Environment and Human Health

The marine environment is essential for human health through the provision and quality of air, food and water and offering health-enhancing economic and recreational opportunities. However, human activities such as transport, industrial processes, agricultural and waste management exerts an increasing pressure on marine environment. Many knowledge gaps still significantly limit planning of policies orienteered to a sustainable use of marine resources and environmental and human health protection. The European Marine Board (2013) reported a global estimate of 250 million cases of gastroenteritis from bathing in contaminated water, and 50,000–100,000 annual deaths caused by infectious hepatitis. The global burden of human disease caused by sewage pollution of coastal waters has been estimated at four million casualties, annually. The knowledge about the behavior and ecotoxicity of pollutants (including those of emerging concern) in the marine environment is particularly relevant given the complex interactions among different matrices (sediments, seawater, atmosphere, and biota), and represents a field of cutting-edge multidisciplinary science. In this context, Ausili et al. (2020) presented a comprehensive view on the current status of monitoring and recovery actions of highly industrialized coastal-marine areas in Italy, and provide quantitative indicators to inform policies for restoring huge territory affected by pollution. D’Agostino et al. (2020) reported on the environmental status of contamination by persistent and emerging contaminants (polycyclic aromatic hydrocarbons, Pesticides, polybrominated diphenyl ethers, etc.) from a

highly contaminated site in southern Italy, and offer new approaches to estimate cancer and non-cancer human health risk due to dermal absorption from contaminated seawater and/or ingestion of contaminated fish. Mekni et al. (2020) examined a mixture of legacy (polybrominated diphenyl ethers) and emerging contaminants, such as halogenated (norbornenes (HNs)) and organophosphate (OPFRs) flame retardants, in sediments and samples of eel (*Anguilla anguilla*) from the Tunisian Bizerte Lagoon. Chemical behavior at the environmental interfaces has been explored and health risk associated to the consumption of eel has been estimated, offering original methodological approaches to evaluate impacts by new classes of pollutants in the marine environment. Simmons et al. (2020) reported on a bead-based salivary IgG antibody multiplex immunoassay to determine and quantify infections from environmental exposures to six waterborne pathogens. Results refer to a wide spectrum of 2,091 study participants at Boquerón Beach, Puerto Rico during the summer of 2009 and show how simultaneous infections could affect human health, in synergistic and/or antagonistic interactions. Combined to water quality studies, environmental microbial pathogenesis provides valuable risk assessment tools in estimating exposure potential and facilitating the development of disease surveillance and screening tools.

Strategies for Solutions

The scientific community is urged to provide valuable knowledge about the dynamics of pollutants in the environment but also to offer solutions at short to mid-term to improve environmental quality and ecosystem and human health. In this view, Drago et al. (2020) reported preliminary results from a new birth cohort in highly contaminated sites in southern Italy. The approach offered an unprecedented opportunity to monitor effects of integrated environmental effects on the health of mother-son

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couples in the short- to long-term period. Di Bella et al. (2020) presented original results about a suite of organic and inorganic contaminants detected in food (terrestrial and seafood) from highly contaminated sites in southern Italy offering original approaches to assessment of associated health risk for different age profiles. Moxley et al. (2020) presented detailed results on the biodegradation efficiency of halogenated compounds in contaminated soils using groups of meso- to thermophilic microorganisms under the extreme conditions of arid and semi-arid areas. Francocci et al. (2020) presented a comprehensive view and original applications of the circular bioeconomy applied to contaminated sites as valuable holistic solution for restoration/recovery of large polluted sites.

CONCLUSIONS

This Research Topic should inspire future science trajectories focused on multi- and interdisciplinary investigations to meet environment restoration and healthier societies. The complexity and significant heterogeneity of the contributions reinforce the urgency to broaden and integrate science approaches and visions on the relationship between environment and health. An issue of increasing priority and urgency.

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All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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