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Environment and Health: Old and New Challenges for European Countries

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Technological progress and the worldwide spread of the industrialisation process, the exponential growth of the global population – which has almost tripled since the 1950s[1] – and the climate changes caused by emissions of anthropogenic greenhouse gases into the atmosphere are only some of the global megatrends that the world has had to face in recent decades, and which have led to the emergence of large-scale challenges in terms of environment and human health. Europe has suffered significantly because of these changes, not only as a consequence of its historical social, economic and political links with the industrialised nations and recently expanding economies, for example for energy supply, but above all because of the interconnection of natural systems. In a world with permeable boundaries, at least in terms of intangible risk factors such as atmospheric pollutants, it is therefore a priority to face up to these global challenges not only from a reactive perspective but above all by means of proactive interventions, through prevention and health promotion. The ecological and socio-sanitary resilience of a continent such as Europe will be significantly affected over the coming decades by the environmental issues emerging around the world.

The 2015 SOER Report, the document released by the European Environmental Agency (EEA) every five years describing the state of health and the prospects for the environment in Europe,[2] has stated the need to define a vision in terms of environment and health common to all EU countries, and has identified 11 megatrends that will constitute the target of many global challenges, but also of undoubted opportunities, to which Europe will need to find a response. Climate change, increasing pollution, acceleration of technological progress, economic growth, pressure on ecosystems and changes in disease burden are just some of the priority issues on the European agenda. On the other hand, political planning and strategic decision-making cannot be confined to the short term of the legislatures, but must, rather, embrace a long-term, broad-based, integrated and global perspective. The efforts made by the European Union to reduce greenhouse gas emissions, in accordance with the Kyoto Protocol, and to increase resource efficiency and create a low-carbon society, are just one admirable example of forward-looking policies in this sense.

Environment and human health are now considered an inseparable binomial. The former, as a series of physical, chemical and biological factors external to an individual, and all of the behaviours impacting these factors, excluding those that cannot reasonably be modified,[3] is one of the main determinants of the health status of a population.

According to the report "Disease through Healthy Environments: A Global Assessment of the Burden of Disease from Environmental Risks", published in 2016 by the WHO,[3] about 24% of all worldwide deaths, as well as 22% of disability-adjusted life years (DALYs), appear to be attributable to exposure to environmental factors.

Preventing the impact that environmental factors – which are modifiable by definition – have on human health would prevent up to 12.6 million deaths globally. It is important to understand, however, that "environment" does not include merely the classical chemical, physical and biological factors, such as indoor and outdoor pollution, noise, electromagnetic fields, vibrations, light pollution, ultraviolet (UV) radiation and pathogens.

Environment is a complex matter, identifiable as a multiform conceptual framework, which also includes general socioeconomic and cultural conditions, as well as nutrition, work, housing and social welfare. Therefore, it is necessary to rethink European and global environmental challenges from a new perspective, taking into account all of the exogenous and endogenous *milieu* of interconnections.

Climate Change as a Key Driver of Migration and Food Insecurity

The increase in the worldwide population recorded over the past five decades, with the consequent growth of urbanisation, and the simultaneous process of industrialisation of agriculture, has rapidly increased global pressure on habitats and landscapes.

Meat-based diets have impacted the most on natural resources: they use five times as much land as their plant-based equivalent and have a water footprint about 20 times larger.

Population growth, demand for food and climate change are expected to create significant threats to freshwater availability. This implies a threat to both human water security and to the functioning of ecosystems, which are increasingly losing their biodiversity.

Climate change is real: the increase in anthropic activities, in particular greenhouse gas emissions, agriculture and deforestation, has impacted air pollution and the atmospheric concentration of particulates, carbon dioxide, methane and ozone, to cite only some of the most relevant pollutants. The increase of greenhouse gas emissions is probably the biggest factor responsible for the observed rise in global surface temperatures since the mid-20th century.

Higher and higher carbon emissions and global warming have certainly caused climate change, but they have also led to

changes in crop yields, infectious disease burden and distribution, violent conflicts and population displacement.

The recent Lancet Countdown document on health and climate change, released in 2018, states that climate change migrants will increase from 25 million to 1 billion people by 2050.[4]

According to another report,[5] published in Science in 2017, the number of asylum applications can be used as index of climate change and weather-related conflicts. Indeed, as the authors state, when temperatures have deviated from the moderate optimum (~20°C), which is considered the best for agriculture, asylum applications have increased in high-income countries.

The Role of Technical Innovation

The surge in technical innovation, in particular in healthcare, embraces a large number of fields: from drug therapies to surgical procedures, devices and tests.

Innovation is universally identified as a positive issue for human evolution and wellbeing, but a critical reappraisal of its role in healthcare improvement should be undertaken.[6]

To clarify this point, we need only look at one of the paradigms of scientific progress, such as the introduction of antibiotics. Due to the frequent incorrect use of these drugs and spillage of pharmaceutical waste and hospital litter with high concentrations of antibiotics and other compounds with antimicrobial activity, such as disinfectants and heavy metals,[7] resistant bacterial strains have developed in Europe and all over the world. This issue is all the more critical, as it is not accompanied by the market introduction of a sufficient variety of new antibiotics.

Antimicrobial resistance is a widespread phenomenon in Europe, with considerable variations depending on the bacterial species and subgroups, as well as on the geographical region. As reported by ECDC in 2016,[8] antimicrobial resistance shows a visible north-to-south and west-to-east gradient in Europe. In general, lower resistance prevalence is reported by northern countries, whereas in the south and east of Europe, a higher percentage has been detected. These differences are most likely related to local variations in antimicrobial use, infection prevention and control practices, and dissimilarities in diagnostic and healthcare utilisation patterns among the countries concerned.[8]

Excluding the field of antimicrobial drugs, there can be no question that the pace of technological change, especially in the nano and biotechnology sectors, is unprecedented. Innovations in this field could reduce the impact of human beings on the consumption of environmental resources, which are becoming more limited and will run out, but at the same time they represent a potential threat for human health, although there are currently no specific risks linked to prolonged exposure to nanomaterials (ENM), as shown by studies carried out on populations of workers exposed to ENM. However, there is a consensus that material characteristics, such as the dimensions and the effects of chemicals, influence ENM effects. Available data suggest, for example, that multiple-wall carbon nanotubes (MWCNTs) impact on the immune system and cause lung inflammation or signs of asthma, whereas carbon nanofibers (CNFs) may induce interstitial fibrosis. Furthermore, metal and metal oxide nanoparticles, along with MWCNT, generate genotoxicity and mutagenic effects. Currently, the lack of understanding of the mechanisms for the real effects of ENMs on human health makes an ENM-related risk assessment necessary.[9]

In the last few years, the hypothesis that nanomaterials may behave as endocrine disruptors (EDCs) has been made.[10] Indeed, these materials appear to be capable of altering the functions of the endocrine system, consequently causing adverse health effects in an intact organism, in its progeny or in subpopulations.[11]

There are many chemicals identified as endocrine disruptors. Polycyclic aromatic hydrocarbons (PAHs), pesticides, dioxins, persistent organic pollutants (POP), bisphenol A (BPA), phthalates and heavy metals are just a few examples.[10]

EDCs are ubiquitous and exposure to these substances can occur through different pathways: contaminated water, indoor and outdoor air, food and soil.

Agriculture and industrial activities, with their large-scale use of pesticides and plastic materials, are responsible, for example, for aquatic environmental pollution[12] and, consequently, for the contamination of the food chain.

Every year, Europe produces around 25.8 million tonnes of plastic waste, with less than 30% of that amount destined for recycling. According to the European Commission report from 2018,[13] 150,000 to 500,000 tonnes of plastic litter pollutes European seas every year, becoming a real threat both for ecosystems and human health, particularly if there is contamination of the food chain. Furthermore, plastics contain many additives, such as bisphenol A and phthalates, and metal contaminants (e.g. cadmium, lead, selenium and chromium), that behave as endocrine disruptors.[14]

We should point out that EDCs have effects not only on the reproductive and endocrine systems, potentially causing cancer, infertility, obesity and diabetes, but they are also able to increase the risk of cardiovascular diseases and to induce nervous system damage, with short- and long-terms effects ranging from dizziness to permanent brain damage, especially in children living in areas with high concentrations of plastic waste and pesticides in water and food.[15]

Pesticides (organochlorides, organophosphates, carbamates), chemicals designed to kill rodents, fungi and insects affecting intensive farming, originally represented a benefit for human health. However, their widespread and improper extensive use in agriculture (worldwide consumption of pesticides has grown from 0.49 kg/ha in 1961 to 2 kg/ha in 2004)[16] has turned them into a hazard for the environment and for human health, inducing both short- and long-term effects, because of their ability to persist for long periods in soils and water, and also in the tissues of invertebrates and vertebrates.

Besides playing the role of endocrine disruptors, it is well established that many of these agents also have a mutagenic and carcinogenic action. Indeed, there is evidence of occupational risk of various forms of cancer due to professional exposure to pesticides.

Work as Environment-Related Risk

Technical advantages, which enable machines to perform human tasks, and significant changes in jobs characteristics – ranging from recognition of new workplace health hazards to transformation of work itself – have had a deep impact on human health, being responsible for a rise in occupational disease and a volume of 2.3 million potentially work-related deaths worldwide each year,[17] along with an increase in the unemployment rate. Alongside workplace-related risks for safety and health, its opposite, job loss, should also be considered as a potential risk for psychophysical wellbeing.

According to 2018 Eurostat statistics, around 8.1% of euro-area inhabitants are unemployed.[18]

This does not mean merely wealth-related problems. Indeed, people who lose their jobs are at a higher risk for suicide, mental disorders and cardiovascular disease,[19] as well as for increased all-cause mortality. This is particularly true for men, whereas effects on women were more limited and not statistically significant, according to a recent cohort study.[20]

Job loss radically changes people's life perspectives, generating stress, anxiety, depression and consequent serious forms of somatisation. Furthermore, income reductions cause significant lifestyle changes, in terms of nutrition and alcohol and drug intake. It has further consequences on social relationships, self-esteem, learning opportunities, and exposure to situations and environments that are more unfavourable to health.

We should note that, thanks to European policy, environment quality – in the broad sense – has considerably improved in the EU over the last decade, but there are still old and new challenges to be addressed if we wish to significantly reduce that burden of 24% of deaths and 22% of DALYs[3] that is in part attributable to the interconnection between environment and human health.

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