

Climate Change and Environmental Pollution Induced Risks on Children's Health: Are Pediatricians Prepared to Meet the Challenge?

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Increasing research and scientific evidence have highlighted strong links between climate change, environmental pollution, and adverse health effects in humans. In 2009, the report by *The Lancet* and University College London Institute for Global Health Commission emphasized climate change as the biggest threat to the survival of humanity and warned that its effects on health will affect most populations during the following decades, putting the lives and wellbeing of billions at increased risk.¹ More recently, a policy statement by the American Academy of Pediatrics (AAP) and the AAP technical report on global climate change and children's health stressed that children, particularly those belonging to lower socioeconomic status, are at higher risk of developing diseases for which climate change may be directly or indirectly responsible.^{2,3} The potential health effects of climate change and their related negative events, which plagued the world's population during recent years, have been extensively studied.⁴ These include disasters because of extreme weather events⁵ and heat waves,⁶ the increase in zoonosis,⁷ respiratory diseases due to air pollutants and aeroallergens,^{8,9} water scarcity, and low nutritional quality of food.^{10,11} Moreover, a recent review suggested that a link between climate change and mental health conditions cannot be ignored, as mental disorders represent one of the major common noncommunicable diseases.^{12,13}

The European societies of pediatrics are highly concerned about the influence of climate change and environmental pollution on child health.^{14,15} This commentary, authored by the working group on social pediatrics of the European Paediatric Association/Union of National European Paediatric Societies and Associations (EPA/UNEPSA), briefly discusses the important health impacts of climate change and its relevance to children. Our aim is to further raise the awareness of pediatricians and public health authorities on this key issue for the future of children's health and propose key areas for action.

Effects of Climate Change and Environmental Pollution on Child Health and Well-Being

The profound demographic, socioeconomic, and industrial changes that characterize the current era of globalization have directly and indirectly progressively influenced the environment.^{15,16} For thousands of years the Earth's climate has remained rather stable, being characterized by a consistent temperate central tendency and stable atmospheric levels of carbon dioxide.^{17,18} However, since the beginning of the

last century gas levels, including carbon dioxide, methane, and other greenhouse gases have increased in association with changes in climate and other earth systems. If global emission of different types of gas will progress with the same intensity shown during the past decades, models predict that in the turn of a century the climate will experience significant changes, including a profound weather variability, rise of world's mean temperature to 4.0°C, and a sea elevation of 0.58 ± 0.2 cm.¹⁸ The impact of climate change on infectious diseases is well known, particularly for those that are spread by insect vectors and by contaminated water. In parallel, the intense industrialization of the past decades has brought negative effects, such as worsening air pollution, that remain uncontrolled¹⁹ despite the efforts of several countries.²⁰ Environmental pollution events have been increasingly related to health conditions, including allergic diseases related to increased allergen production, infectious diseases, diabetes, respiratory, and cardiovascular diseases.^{21,22} Research on climate change and health concentrated on studying how chemical substances can interfere with children's health.²³ A particular interest has focused on endocrine disruptors,^{24,25} as experimental evidence of their possible damage on various endocrine and nonendocrine systems has accumulated over the years.²⁵ Several studies have reported innovative methodological approaches to better define the specific risk level, with the aim to clarify the different interpretations provided by toxicologists and endocrinologists.²⁶ Of particular concern are the reports that most of the chemicals studied are able to cross the placenta²⁷ and reach the fetus, causing possible damage to many organs and systems, including the central nervous system, and epigenetic alterations that can favor various pathologies later in life and in offspring.^{28,29}

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The increasing evidence of the effects of climate change and air pollution on children's health has prompted several scientific societies in Europe and the US to adopt precautionary principles in the presence of raising threats of harm to human health or the environment, even if cause and effect relationships are not fully established scientifically.^{30,31} Reports show that up to 90% of the consequences of climate change on health take place during the period between birth and adolescence.^{32,33} For instance, 50% excess mortality among infants in the perinatal period was documented during extremely hot periods in Spain,³⁴ and moderate and severe stunting are projected in children age <5 years at the national level in 2030 in 44 countries under low and high climate change.³⁵ Therefore, scientific societies have drawn attention to the importance of establishing effective precautionary measures to safeguard health throughout the developmental, and in particular in the perinatal and postnatal periods.³⁶

The Importance of Promoting Continuous Environmental Education in Pediatrics

As emphasized by the former president of the International Pediatric Association, pediatricians play an important role in protecting children from the risks of global adverse events.^{37,38} They must become engaged in strategies that address climate change, environmental sustainability of health systems, and the promotion of resilience, which help children and their families to face health adversities because of environmental instability.^{37,38} Promoting continuous environmental education dedicated to professional figures including pediatricians, healthcare professionals and schoolteachers is central to these strategies. Efforts should be made to develop basic training and continuing educational activities on environmental health, not only by educational institutions, but also by public or private organizations, including professional bodies and pediatric associations. For instance, climate change-related information and learning materials must be part of global child health teaching modules and open-access courses as well as residency training programs.³⁸ An example is provided by the Pediatric Environmental Health Specialty Units supported by the AAP, which provides pediatric and environmental health education to health care providers and health profession students.³⁹

Despite the importance of climate change and environmental pollution for children and adolescent's health, there is currently no effectively coordinated preventive strategy at a global level.^{15,40} A serious obstacle in raising awareness about these topics is the uncontrolled information often disseminated by social networks, which make it difficult to

distinguish between true and false data. In Europe the profound diversity among the public health services of its 50 countries have also hampered the development of effective common policies and reduced the operational ability of private institutions devoted to environmental health.^{15,41} A French survey, based on a questionnaires offered to midwives, gynecologists-obstetricians, general practitioners, and residents in gynecology-obstetrics and general medicine showed that the majority of health professionals did not provide information on endocrine disruptors to pregnant women.^{42,43} This is similar to previous studies showing that, with the exception of tobacco smoke, there was little attention in common clinical practice to environmental health by various health professionals including nurses and pediatricians.⁴⁴ A review on the impact of climate change on health reports that only two previous studies have focused on how to change behaviors and habits of patients toward climate change.^{44,45}

Conclusions

Management of the health effects of climate change and environmental pollution will require a collective coordinated effort involving stakeholders at all levels, including sectors of government and civil society and a close collaboration between many academic disciplines.^{45,46} Approximately two-thirds of all preventable ill health due to the environment occurs in children, as they are an especially vulnerable subpopulation due to their developing physiology and anticipated long-term exposure.⁴⁷ Therefore, pediatricians well trained in environmental health⁴⁸ should have a central role in the collective effort of tackling one of the biggest global health threats of the 21st century, taking preventive action in the face of uncertainty, exploring a wide range of alternatives to possibly harmful actions and increasing public participation in decision-making. Finally, pediatricians must take an active role in recognizing illnesses associated with climate change, and develop early warning systems and improve prevention and mitigation strategies. Particularly in the case of diseases occurring in the immediate term such as diarrhea, asthma, heat stroke, sunburn, allergies, and communicable diseases such as malaria, dengue, encephalitis, Lyme disease, and other emergent infectious diseases.^{47,49} ■

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