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Climate change and human health: Last call to arms for us

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Abstract

Climate change, now the foremost global health hazard, poses multifaceted challenges to human health. This editorial elucidates the extensive impact of climate change on health, emphasising the increasing burden of diseases and the exacerbation of health disparities. It highlights the critical role of the healthcare sector, particularly anaesthesia, in both contributing to and mitigating climate change. It is a call to action for the medical community to recognise and respond to the health challenges posed by climate change.

Key Words: Climate change; Carbon footprint; Sustainability; Greenhouse gases; Anaesthetic gases; Environmental impact; Disposable laryngoscope blades

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Core Tip: This editorial sharply focuses on the interplay between climate change and health, advocating for a proactive healthcare response, especially highlighting the environmental impact of anaesthesia and critical care medicine. This editorial is intended to be a call to action for the medical community to acknowledge and address the health challenges posed by climate change.

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INTRODUCTION

Climate change, which was once a looming threat, has rapidly transformed into the largest health danger humanity has ever faced. Recent data reveals that the last decade was the hottest on record, a stark indicator of the escalating climate crisis[1]. The evolving climate scenario is a mosaic of environmental catastrophes, each contributing to a complex array of health challenges. The World Health Organization predicted that between 2030 and 2050 climate change will directly or indirectly cause approximately 250000 more deaths *per* year. The direct damage costs to health are estimated to be between USD 2-4 billion/year by 2030[2]. Despite any denial or scepticism, this data confirms that climate change is an essential public health concern. Interestingly, the healthcare sector plays a dual role in this narrative—both as a victim and a contributor. Specifically, anaesthesia, a cornerstone in medical procedures, has an often-overlooked environmental impact. This editorial aims to galvanise collective action and foster a dialogue on sustainable solutions. We will explore the multifaceted impact of climate change on health, the urgency of immediate and coordinated action and the role and responsibilities of healthcare systems, with a special focus on anaesthesia.

THE IMPACT OF CLIMATE CHANGE ON HUMAN HEALTH

Climate change, in conjunction with various environmental stress factors, both natural and anthropogenic, significantly affects human health. Since 2016, The Lancet has annually published The Lancet Countdown on Health and Climate Change, a report based on international contributions that tracks the impact of climate change on health. This document is recognized as one of the most pivotal indicators of the health consequences of climate change and global warming[3]. Additionally, the Centers for Disease Control and Prevention highlights the health risks associated with an increasingly unstable climate[4]. Key threats identified in recent reports include the increasing frequency of heat waves and extreme weather events, such as heavy rainfall, floods, droughts, more intense storms like hurricanes, sea level rise and air pollution. These changes have the potential to have a negative impact on health[3,4]. The increased frequency and severity of heat waves correlate with increased morbidity and mortality, especially in vulnerable groups like the elderly and children. Heat-related illnesses, such as heat stroke, often have fatal outcomes and exacerbate chronic conditions, including respiratory, renal and cardiac diseases. They also indirectly impact health by limiting physical activity, which can lead to obesity[5,6]. The deterioration of air quality due to global warming and the increase of atmospheric particulate matter, have led to an increase in respiratory diseases, such as asthma and chronic obstructive pulmonary disease[5,7]. Climate change is facilitating the spread and geographical expansion of infectious diseases such as dengue, zika, chikungunya and malaria. Variations in temperature, rainfall and humidity aid the proliferation of disease vectors like *Aedes* and *Anopheles* mosquitoes, leading to increased disease incidence and their extension into previously unaffected areas, further accelerated by the global movement of people and goods[5,8]. Rising temperatures amplify the risk of waterborne bacterial diseases, notably cholera and gastroenteritis, due to the enhanced survival and proliferation of pathogens in warmer waters. This risk is exacerbated by frequent torrential rains and floods, which compromise potable water access and cause the destruction of sewerage infrastructure, elevating pathogen exposure[9]. Moreover, these infectious diseases, often lead to diarrhoea, and increase malnutrition by impairing nutrient absorption and utilisation. Climate variability adversely affects agricultural production, impacting food availability and quality, thus directly affecting human health[10]. Beyond physical health, climate change profoundly affects mental health. Extreme climate-related events, like floods and wildfires, are linked to increased mental health disorders, including anxiety, depression, and post-traumatic stress disorder[11,12]. It is critical to underline that the health impacts of climate change are neither uniform nor equitable. These effects disproportionately burden the most vulnerable and least resilient segments of the population, including low-income communities, minorities, people with pre-existing medical conditions and children[3, 13]. In particular, early childhood exposure to pollutants and climate changes can have long-lasting effects on physical and cognitive development[14,15].

HEALTHCARE SYSTEMS AND CLIMATE CHANGE: A TWO-FACED JANUS

Carbon footprint is a key metric that, more effectively than any other variable, enables us to assess the environmental consequences of human activities on climate change and, consequently, on global warming[16]. It quantifies the total greenhouse gas (GHG) emissions, mainly carbon dioxide, resulting from individual, organisational or product-specific activities. This measure is central to understanding and mitigating the impact of human actions on the environment[17]. The healthcare sector, often perceived as a beacon of healing and care, ironically contributes significantly to environmental degradation primarily due to energy-intensive operations, waste production, and resource utilisation[18,19]. It has been estimated that if the healthcare industry were a country, it would be the fifth-largest GHG emitter on the planet[8]. Globally, the healthcare sector is accountable for a substantial share of GHG emissions, ranging from 4.4% to 4.6% of total emissions, primarily due to energy-intensive operations, waste production and resource utilisation[20]. Notably, emissions vary based on the nature of the institution, with a significant gap between public and private healthcare facilities. The public healthcare sector, often expansive and government-managed, has a substantial carbon footprint due to its extensive operations. However, it also has the capacity for impactful change through policy and regulation[17,21]. The United Kingdom of National Health Service, for instance, has set ambitious targets to become carbon neutral by 2040, demonstrating the potential of public healthcare systems to lead in environmental sustainability[22]. The geographical dimension adds another layer of complexity. Developed countries like the United States and Europe contribute dispro-

portionately to health emissions compared to regions like Africa and Latin America[3]. This highlights a crucial aspect of global environmental and health equity. Healthcare institutions in developed nations, with their financial and technological resources, can generate higher GHG but also invest in mitigation strategies. This contrasts with their counterparts in developing countries, which often lack the means to reduce their emissions. The harsh consequence is that low-income countries, which contribute much less to the problem, often bear more of the negative impact of climate change on health [3,23].

In this context, the role of anaesthesia is particularly noteworthy. Nearly half of GHG healthcare emissions are attributed to hospitals[24]. About one-third of hospital waste is generated by operating rooms, with a daily rate of 13.6 kg *per patient* and a total carbon intensity of 160 kg CO₂ *per operation*[25,26]. A similar rate applies to intensive care units [27].

So how can anaesthetists concretely contribute to reducing the environmental impact of operating rooms and Intensive Care Unit? First, the ongoing mantra must be 'Reduce, Reuse, Recycle'. To minimise healthcare's carbon footprint, specifically in pre-operative evaluations, anaesthesiologists can limit redundant or unnecessary tests and examinations, often performed for defensive medicine. By implementing initiatives like 'Choosing Wisely', which target the reduction of healthcare waste and unnecessary procedures, they can decrease both patient risks and costs[28]. The same principles apply to avoiding ineffective critical care admissions. It is about balancing environmental considerations with clinical accuracy. Anaesthesiologists are at a crossroads of patient care and environmental responsibility. According to a survey conducted in Australia and New Zealand, only 10% of anaesthesiologists consider environmental impact when choosing anaesthetics[29]. This is a critical area for improvement, especially considering the environmental toll of inhalation anaesthetics. For instance, in a seven-hour surgical session utilizing inhalational anaesthetics at a fresh gas flow rate (FGF) of 0.5 L/min, the CO₂ equivalent emissions from 2% sevoflurane, 1.2% isoflurane, and 6% desflurane are analogous to a car traveling 783 km, 667 km and 3924 km, respectively[30]. When it is clinically safe, anaesthesiologists should prefer intravenous, regional or neuraxial anaesthesia. If inhalation anaesthetics are necessary, sevoflurane or isoflurane are preferable over desflurane, which requires higher gas concentrations for general anaesthesia. Additionally, minimizing FGF, even during induction, is a vital strategy[31]. Medication waste is an inevitable aspect of anaesthesia care. In daily practice, propofol is the most wasted drug by volume[31], whereas emergency medications (*e.g.* atropine, epinephrine) see a high percentage of waste after being opened but not used[32]. To mitigate environmental impact, several strategies can be implemented. These include employing pre-filled syringes for emergency drugs and requesting pharmacy services to divide vials in sterile conditions to minimise waste, particularly beneficial during drug shortages. Additionally, keeping medications accessible yet unopened when feasible, utilising paediatric-specific vial sizes and ensuring the proper disposal of controlled substances is crucial. This is particularly important to prevent illegal sewer disposal, in compliance with legal regulations[31]. In recent years, there has been a significant rise in the use of disposable devices within healthcare, particularly in anaesthesia. Examples include disposable laryngoscope blades and single-use fibre-optic endoscopes. This trend has significant environmental repercussions[33]. To mitigate these impacts, the adoption of reusable devices, which can be cleaned and sterilised after each use should be promoted. Additionally, an emerging practice in many hospitals is the reprocessing of single-use devices, encompassing both anaesthesia and surgical equipment, *via* third-party vendors. This involves a comprehensive process of sterilisation, tracking and repackaging[31, 32].

CONCLUSION

The interconnection between climate change, carbon footprint and healthcare, particularly anaesthesia, is an area that demands immediate attention and action. While healthcare is a vital sector for human well-being, its role in contributing to climate change cannot be overlooked. The poor or insufficient information on this topic, the trivialisation of the problem and the low perception of genuine risks, could lead to postponement of the adoption of measures, which are individually and collectively necessary to effectively combat the climate crisis. Unfortunately, we are in a code red and there is no more time to waste. In this era marked by a pervasive crisis of trust in institutions and the scientific community, physicians uniquely maintain high levels of trust among the majority of the population, being perceived as the most reliable professionals. However, it is crucial to acknowledge that this trust is not unconditional and can be influenced by demographic, socioeconomic and geographical factors[34]. Studies show that patients of colour[35], Hispanic patients[35], women[34] and those from lower socioeconomic backgrounds[36] are more likely to report lower trust in physicians compared to the general population. This can stem from multiple factors, such as previous negative experiences, language, cultural barriers and imbalanced power dynamics, where the physician's perceived authority might impede trust and open communication. These insights underscore the importance of recognising the complex dynamics of trust within global healthcare systems, which could critically influence the response to public health challenges posed by climate change. Through the construction and strengthening of trust in the doctor-patient relationship, all of us doctors are called upon to provide clear answers to our patients about the incurred risks due to climate change. It is our responsibility to deliver information about how to change habits, for example, our eating habits, to combat this emergency. It is also our fundamental role to identify those subjects who are susceptible to diseases related to pollution and at risk for the contribution of medical-environmental-social factors. In addition, all health professionals must lead the way in adopting sustainable practices; considering this point of view, anaesthesiologists can do a great deal to reduce the carbon footprint related to their daily practice. Health professionals should also stimulate institutions to implement primary prevention policies that counteract environmental risk factors. Finally, another important action is to train future medical classes on climate change as well as its effects on human health. Some public health schools at universities, such as Yale, Harvard and Washington, have already integrated curricula dedicated to this topic into their

teaching offerings^[37]. To paraphrase the words of Bruce Chatwins, to wound the earth is to wound yourself, and if others wound the earth, they wound you. This is our last call to arms! It is time to act, not only for us, but for the smiles of our children on this planet, which they will inherit.

FOOTNOTES

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