Feature Article

Climate Pulmonology: When Pulmonologists Can Mitigate Climate Change and Air Pollution

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ABSTRACT
The healthcare sector is mobilized into the frontline to address climate-related disasters and diseases but at the same time produces a lot of greenhouse gases. Climate pulmonology seeks to equip pulmonologists with the basic science of climate change and air pollution, and their impact on people and planetary health. A solid background on this issue will empower lung specialists to narrate the climate story to stakeholders and move towards a sustainable future.

Keywords: climate pulmonology; climate change; air pollution; mitigation; sustainability

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Industrialization sparked the "Great Acceleration" in the 1950s but also caused significant environmental degradation and health issues.[1] Ever since coal was discovered to fuel anthropogenic activities coupled with rapid urbanization that depleted the Earth's green spaces, unprecedented global warming has intensified heat waves and degraded air quality. Direct greenhouse gas emissions and climate change effects (e.g., increased ground-level ozone) exacerbate air pollution that kills 7 million lives prematurely every year.[2] The Intergovernmental Panel on Climate Change (IPCC) warns that a global temperature increase of 1.5 degrees Celsius will lead to loss of biodiversity and will impact human health. If no actions are taken to restore Mother Earth, the globe will scale 2.6 to 4.8 degrees Celsius warmer by the end of the century,[3] making sustainability the most critical agenda in the Anthropocene.

The ozone layer around Earth acts as a natural shield and maintains the core temperature of Mother Earth. It absorbs energy from the sun to heat the stratosphere, and absorbs infrared radiation emitted by the earth's surface. Anthropogenic activities, however, depleted the ozone layer (through chlorofluorocarbons) and produced a layer of greenhouse gases like carbon dioxide, methane, and nitrous oxides in the troposphere. Heat that is supposed to be radiated back into space is trapped within this layer creating the 'greenhouse effect' of climate change. This dense layer also contains gases like ozone, nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulate matters ($PM_{2.5}$ and PM_{10}) that pollute the air. Once inhaled, these gases evoke an inflammatory response in the bronchial airways. The finer particulate matters penetrate the alveolocapillary membrane and invade the systemic circulation to cause oxidative stress and endothelial dysfunction. These manifest in strokes, heart diseases, exacerbation of respiratory illnesses like chronic obstructive pulmonary disease (COPD) and bronchial asthma. $PM_{2.5}$ also causes metabolic effects, disrupts reproductive health, brings abnormal neurological development in children, and causes cancer[4,5] – the "climate penalty" as construed by the World Meteorological Organization Air Quality and Climate Bulletin.[6]

Climate change and air pollution inevitably increase health risks and demands for healthcare. The health organization, however, moves "bidirectional" as described by Professor Jeffrey Braithwaite.[7] In its mission to be vanguards of peoples' health, the healthcare organization also produces greenhouse gases. There are three scopes of the healthcare carbon footprint based on the Greenhouse Gas Protocol: The first scope covers direct emissions (10-20%) from operating service facilities controlled or owned by the organization like vehicles, and gas anesthetic leaks in operating rooms. The second scope of the healthcare carbon footprint is indirect emissions (0.3%) from purchased electricity. The third and largest scope is indirect but optional (50-75%) that includes greenhouse gas (GHG) emissions from the procurement of disposables and consumables (pharmaceuticals, medical products and devices, dietary food), business travel, and healthcare waste.[8] Green procurement will consequently reduce the healthcare carbon footprint. Overall, the healthcare sector's carbon footprint is 4-5% of GHG emissions worldwide, spewing 2 gigatons of carbon dioxide into the environment. This is equivalent to the annual GHG emissions from 514 coal-fired power plants.[9]

How can we, as physicians, be true to our mission in both words and in actions? How do we heal and harm no one especially Mother Earth?

Physicians pledged to uphold reverence for "life from the beginning." They are trusted, credible sources of information and are able to convey complex health issues and make it more relevant to diverse patients and communities.[10] If each physician could convey the message that climate change and air pollution threaten the survival of people and Mother Earth, increasing public awareness could leverage health data toward a climate action. Healthcare professionals clearly have three buckets to fill – climate mitigation, adaptation, and resilience. Mitigation seeks to reduce GHG emissions and limit global warming. Adaptation aims to reach out and help people adjust to the current and future effects of climate change. Climate resilience is a political process that increases the ability to recover from, or to mitigate vulnerability to, climate-related events such as typhoons and floods.[11]

The way forward to restore peoples' health is to restore Earth first. The healthcare sector's carbon footprint may be lowered by addressing the three scopes of GHG emissions. Alternative sources of energy and even walking, biking, and the use of mass transit systems have always been floated but, in the Philippine context, remains an empty comment that shifts the blame and responsibility of climate change down to the common Filipino. While a cultural shift definitely needs to occur, stronger and more involved call towards good policy and good execution has to be in place. The long-debunked notion of "adding more lanes" needs to be supplanted with better bus and rail transit systems. Highway megacities that add more lanes encourage people to live further away (no one wants to live next to the noisiest streets) and drive longer distances. Bicycle lanes-turned-"free" parking spaces with car engines idling discourage initiatives to walk and bike more.

Urbanization "paved our paradise" and turned forested areas into communal living. Deforestation leads to the loss of the natural carbon sink. Trees remove carbon dioxide from the air and store carbon in them and release oxygen into the atmosphere. To augment the carbon sink, several training institutions of the Philippine College of Chest Physicians (PCCP) initiated tree-growing activities. And these are not merely pet projects, as studies by Professor Mylene Cayetano of the University of the Philippines Diliman Institute of Environmental Science and Meteorology suggest that heavily congested areas in the National Capital Region with small pockets of forests had better air quality – leading to better health outcomes.[12] This demonstrates that greener cities and sustainable urban planning are not merely for aesthetic flair, but a necessity for a sustainable tomorrow.

Healthcare waste management is one of the challenges in hospital operations as exemplified by the pile up of "infectious waste" during the Covid-19 pandemic. In an audit of healthcare waste during the pandemic in five key hospitals in the Philippines, approximately 50% of infectious waste were "non-essentials" from plastic eating utensils, wrappings, single-use plastics.[13] Segregated waste labelled "infectious" are not treated like general waste but are packed in yellow clinical waste bags, collected, stored, and transported via accredited vans of the Department of Environment and Natural Resources – Environmental Management Bureau to treatment facilities for final disposal. Each kilogram of waste from a Tacloban hospital that is transported to a treatment facility in Isabela, Leyte costs approximately Php 46 to Php 60. Thus, in municipalities of the Philippines where there are no treatment facilities, healthcare waste leaves a trail of greenhouse gases from the time waste is collected from the hospital to its movement to another region. Not only is the process hazardous, it is also very expensive. Waste incineration in treatment facilities releases Persistent Organic Pollutants (POPs) like nitrous oxide, dioxins, and furans into the environment, aggravating air pollution. Adverse health outcomes in communities near waste incinerators like reproductive dysfunction and cancers (non-Hodgkin lymphoma, bowel cancers, and soft tissue sarcoma) have been reported.[14] Sustainable waste treatment like autoclaving or recycling technologies must be reinforced. Another outcome of waste pollution is the catastrophic flooding in major cities of the National Capitol Region, not only from the massive rainfall from Typhoon Carina on July 24, 2024 and the southwest monsoon, but from sewers clogged with 1,513 tons of trash especially plastics.[15] Maintenance of sewage systems and a cultural drift from the "throw away living" and rampant littering, to discipline on proper segregation and waste disposal has to be inculcated. A collective action like bringing personal water flasks during conventions (and in our daily routine) not only reduces cost for hydration but obviates plastic pollution from refusing PET (polyethylene terephthalate) bottles and single-use plastics. A proper needle disposal system in the community and a drum to collect cooking or motor oils are simple measures to safer waste management. Clearly, a framework has to be in place. Solid waste can be limited by observing the 5 Rs of the environment – refuse, reduce, reuse, recycle, repurpose – complemented by the 5S (sort, set in order, shine, standardize, sustain) of good housekeeping not only in medical facilities but also in our homes.

Inhaler medications are central in the control of obstructive lung diseases. Earlier pressurized metered-dose inhalers contained chlorofluorocarbons but were phased out as they depleted the ozone layer. In its place, a new propellant, hydrofluorocarbon, was introduced though it is a potent greenhouse gas that contributes to global warming. Dry powder forms and soft mist inhalers are more environment-friendly options.[16] Since inhaler therapy is an important armamentarium in pulmonary care, clinical guidelines emphasizing the right indications, patient education to avoid triggers, monitoring of condition, and good compliance to inhaler medications are integral to control pulmonary diseases and reduce healthcare cost and unnecessary GHG emissions.

Physicians should reinforce proper nutrition. Consumption of more greens and seafood and less meat not only improves health but decreases carbon footprint.

Increasing temperature and carbon dioxide levels affect plant growth and are expected to alter the composition of respiratory allergens, molds, and other bioaerosols.[17] These aggravate allergic conditions and heighten exacerbations of COPD and asthma like in "thunderstorm asthma." Health professionals can protect vulnerable patients by teaching them to stay indoors during poor air quality days.

This year, heat and humidity too severe for human tolerance have been reported. Dangerous heat indices of 42 degrees Celsius and above can cause strokes, mental stress, dyspnea, heart attacks, and liver and kidney injury.[18] An advisory on the air quality index and heat index is mandatory to allow citizens to make appropriate decisions.

The PCCP tackled climate change and air pollution as a priority program. The society forged a coalition with the Philippine College of Physicians (PCP), Philippine Society of Allergy, Asthma and Immunology (PSAAI), Lung Center of the Philippines (LCP), and Health Care Without Harm Southeast Asia (HCWH-SEA) to form Health Alliance for Climate and Clean Air Philippines (HACCAP). HACCAP aims to transform researches into policies and narrate the climate and air pollution story to the masses. Another flagship program of the PCCP is the Lunghap campaign with a training module, "Blazing a Trail for Healthy Lungs and Clean Air" to educate PCCP

members on air pollution and climate change. This knowledge should resonate in daily practice to champion compleat patient care.

To recover from climate change, the Conference of the Parties United Nations (COP UN) Chief António Guterres emphasized, "The era of fossil fuels must end with justice and equity." Sustainability is not a step backward to undo the climate crisis, but needs to be innovative and enduring for generations to come. For the first time, Health Day was one of the highlights of COP28 in Dubai last December 2023 with a demand to elevate health in climate negotiations. While countries need to cooperate to make one global climate action, physicians have a contribution to make. Every patient encounter is an opportunity to tell the story that climate change and poor air quality contribute to their illnesses. This is when physicians are able to advocate for a sustainable future and close the gap of climate science to action. By winning one person at a time. For Mother Earth and her people.

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