The Interplay of Climate Change and Air Pollution on Health

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Perspective

Air pollution has a significant impact on health, resulting in up to 7 million premature deaths each year, as well as an even higher number of hospitalizations and sick days. Climate change may modify the dispersion of primary pollutants, notably particulates, and increase the development of secondary pollutants such near-surface ozone. The goal of this review is to assess recent evidence on the effects of climate change on air pollution and health effects associated with air pollution, as well as to identify knowledge gaps for future research. Recent Discoveries Several studies calculated the health effects of future ozone and particulate matter concentrations under various climate scenarios. Most studies predict an increase in ozone and fine particle-related deaths as a result of climate change; however, results vary by geography, projected climate change scenario, and other factors such as population and background emissions [1].

The link between climate change, air pollution, and air pollution-related health effects is investigated in this review. The results are highly dependent on the climate change scenario used and projections of future air pollution emissions, both of which are subject to considerable uncertainty. Studies have mostly focused on mortality; estimates on morbidity are required.

The weather has a significant impact on air quality. Meteorological variables such as temperature, humidity, wind characteristics, and vertical mixing can influence pollutant emission, transport, dispersion, chemical change, and deposition. Climate change is projected to wreak havoc on air quality in a number of densely populated areas by altering atmospheric ventilation and dilution, precipitation and other removal mechanisms, and atmospheric chemistry. Reduced air quality will have a direct influence on human health, as well as ecosystems, which will have an impact on human health and climate in a feedback loop. Climate change has already impacted air quality, according to several research. For example, climatic change increased worldwide population weighted fine particle (PM 2.5) concentrations by 5% and near-surface ozone concentrations by 2% from pre-industrial (1860) to present (2000), according to study. According to the study, the shift from pre-industrial to post-industrial resulted in an additional 111,000 and 21,400 premature fine particle and ozone-related fatalities as a result of climate change, respectively [2]. Over the last two decades, every degree of warming (°F) in observed data has been linked to a 1.2 ppb increase in ozone concentrations. These effects are expected to persist in the future as the climate continues to change. The goals of this review are to characterise the connections between climate, air pollution, and health, to assess recent anticipated climate impacts on air pollution-related health effects, to address knowledge gaps and uncertainties, and to recommend research objectives for future research. We concentrate on the previous five years because older periods have been well-documented in other studies, such as We also concentrate on PM 2.5 and tropospheric ozone, which are the subjects of most investigations.

Climate change can affect air quality, and air quality can influence climate change, all of which can have a direct or indirect impact on health. Degradation of removal processes (dispersion, precipitation) and increasing atmospheric chemistry are the two principal consequences of climate change on air quality. Primary (e.g., soot particles) and secondary (e.g., ozone and sulphate particles) pollutants will be affected. Changes in precursor emissions, meteorology, and the physical and chemical behaviour of particles in the atmosphere can all lead to higher PM 2.5 concentrations from anthropogenic sources. Aside from anthropogenic emissions, future climate will alter Biogenic Volatile Organic Compounds (BVOCs) emissions due to increased temperatures and altered plant metabolism, which will affect Secondary Organic Aerosols (SOAs) and secondary particle levels. By the end of the century, more and larger wildfires linked to climate change could have a severe impact on air quality. Dust storms and dust particle transport are two other natural causes; climate change may increase their frequency. For example, found that annual mean PM 2.5 concentrations in the United States and Europe will shift by 1 g/m3 as a result of climate change (mostly owing to weaker global circulation and a decrease in the frequency of mid-latitude cyclones) [3]. PM 2.5 has an impact on the climate as well. Because soot (black carbon) absorbs heat, it raises local temperatures. Other secondary particulates, like as sulphate particles, contribute to aerosol cloud interactions by cooling the environment. This includes the possibility of lowering soot levels and using tailored cooling particles to mitigate climate change. Another secondary pollutant generated by the interaction of precursor chemicals with sunlight, notably UV radiation, is near-surface ozone. Temperature affects the rate of creation. As a result, days with little or no cloud cover and higher temperatures are more favourable to increased ozone concentrations. Wind can reduce ozone generation by scattering precursor species and so controlling ozone levels. Ground-level ozone is also removed via dry deposition (to vegetation and surfaces). Chemical processes involving ozone precursor emissions from natural and manmade sources result in the creation of near-surface ozone. Several primary and secondary pollutants, including as VOCs, CH_4, and CO, react with hydroxyl radical (OH) to form ground-level ozone as the principal precursors. Increased natural VOC emissions, which alter ozone concentrations, are often associated with rising temperatures as a result of climate change. Furthermore, the generation of hydroxyl radicals is linked to the production of methane, another greenhouse gas. There are both direct and indirect links between air quality and health. First, particles, particularly those produced by combustion, have been shown to have an impact on cardiac mortality, hospitalisation, and respiratory disease (e.g., asthma, chronic bronchitis, and rhinitis [4]. Diabetes, rheumatic disorders, cognitive functioning, and neurodegenerative diseases have all been linked in recent studies. Furthermore, chemicals like the secondary pollutant ozone have been linked to all cause, cardiovascular, and respiratory deaths, as well as chronic respiratory disorders like asthma. Preterm delivery, reproductive health, and cognitive deterioration have all been linked to increasing ozone levels in studies. Second, primary and secondary pollutants can contribute to climate change, which can have an impact on public health by causing more severe temperatures, for example. Secondary pollutants like ozone can have an impact on crop yields, which, when combined with climate change, can have an impact on food security and public health. Climate change, according to one study, could cut world crop production by more than 10% by 2050. As a result, climate change may have a large indirect impact on public health, particularly in poorer countries [5].

Climate Change's Proposed Impacts on Air Pollution-Related Health Effects Climate change's influence on air pollution-related health effects have been quantified. Use projected air pollution concentrations, current and/or future population and mortality statistics, and previous epidemiological studies' concentration–response functions between air pollution exposure and mortality/morbidity. Future air pollution models used data from downscaled global climate models to generate a regional numerical model with a better spatial resolution to simulate local conditions in more detail. Different greenhouse gas emission scenarios are used in global climate models to adjust the magnitude and pattern of climate change (e.g., global temperature increase) in different forecasts. Data on meteorology, dispersion, chemistry, and deposition, as well as climate projections and primary pollutant emissions, are used in air pollution models. The potential impacts of climate change on air pollution-related health effects can be assessed based on anticipated air pollutant exposures and mortality/morbidity rates. We focused our assessment on research that projected the impact of climate change on air quality and measured the shift in health impacts [6].

In the last 5 to 6 years, 17 studies have been uncovered that project the health hazards of climate change on air pollution health consequences. Additional studies on the health consequences of expected future ozone and PM 2.5 concentrations have been published since previous assessments, with a proportionally bigger increase in publications on PM 2.5. Although all studies predicted that climate change would increase air pollution-related health consequences, the estimated health effects of air pollution owing to climate change alone were minimal in comparison to the health effects associated with direct emissions of those chemicals in several research. The fact that all of the results are anticipated under unknown future situations is one of the most significant issues in this research. As a result, there are inherent uncertainties about future emissions and the resulting climate change, which will have an impact on the expected health effects of air pollution. Furthermore, there is typically minimal uniformity in the assumptions made among investigations. Almost all of the studies examined, for example, use various climate change scenarios, air pollution emissions, time periods of investigation, and baseline data (either static or dynamic). As a result, it's evident that comparing the studies is nearly impossible. While it is critical to consider sensitivity (emissions, population change, etc.), predictions of the air pollution-related health hazards associated with climate change alone would be critical, with subsequent assessments providing more information on the primary sensitivities and uncertainties. Current uncertainties in climate change estimates, air pollution emissions, climate change and air pollution models, and health effect assessment data are discussed in the sections below [7].

Climate change is likely to raise air pollution levels in the future, while lowering pollutant emissions would mitigate the negative effects of climate change, resulting in an improvement in forecast air quality. Several studies predicted that PM 2.5 levels will rise faster than ozone-related health impacts. PM 2.5 is the principal pollutant that contributes to air pollution's health burden. However, there was some evidence that climate change could enhance air quality in some areas (for example, northern Europe and Poland), owing to changes in long-range atmospheric air pollutant transportation. More regional analyses are needed, especially in low- and middle-income nations where air pollution levels are currently greater, because climate change consequences on air quality differ widely. Comparing these regional ratings would be easier if all research used the same approach. The assessment uncovered a number of significant research gaps. The research that was examined concentrated on the direct impact of air pollution on health, particularly premature death. However, the implications of exposure to higher amounts go far beyond premature death. Only five research looked at morbidity, which means that additional health impacts, such as those in children, are mostly ignored. A better knowledge of the indirect consequences of air pollution on human health, such as crop loss and subsequent malnutrition, is also required. These kinds of consequences have yet to be considered [8]. Future studies should evaluate the health consequences of future air quality under a changing climate with changes in other risk variables as a result of climate change. Only one study, for example, compared the impacts of air pollution and temperature together. Even if the health effects of air pollution are reduced as a result of emission reductions, ambient temperatures and heat waves are projected to rise. More research is needed because higher temperatures and higher concentrations of air pollution may have synergistic effects, especially on cardio-vascular illness, resulting in even greater health burdens than either alone. Understanding where this could happen will assist to inform emission laws, which would help to decrease future health risks [9]. Similarly, when climate change increases the likelihood of storms and flooding that can harm people's health, indoor air quality will likely be harmed by processes like mould growth. Because future air pollution health impacts, notably PM 2.5 and ozone will be determined by efforts taken to reduce responsible emissions, a better knowledge of air pollution emissions under various development paths is required. As a result, increased investment in understanding the spectrum of potential future health concerns associated with changes in air pollution under a variety of future climates and emissions is vital to informing policies. Because present emissions have exceeded expected trends, lowering emissions will necessitate even more stringent regulatory controls than are now contemplated. Recent studies confirm that climate change will likely raise near-surface ozone and particulate matter concentrations, with negative health impacts and considerable uncertainty. Because the choices for lowering human vulnerability to air pollutants are limited, safeguarding population health in future warmer climates would include regulatory actions such as carbon reduction. To inform these tougher restrictions, further research is needed to evaluate the size and pattern of future risks, taking into account the complete range of morbidity and death.

References

1. Fiore, A.M., et al. "Air quality and climate connections." *J Air Waste Manage Asso* 65.6 (2015): 645-685.
2. Haase, D., et al. "A quantitative review of urban ecosystem service assessments: concepts, models, and implementation." *Ambio* 43.4 (2014): 413-433.
3. Fang, Y., et al. "Air pollution and associated human mortality: the role of air pollutant emissions, climate change and methane concentration increases from the preindustrial period to present." *Atmos Chem Phy* 13.3 (2013): 1377-1394.
4. Silva, R.A., et al. "Global premature mortality due to anthropogenic outdoor air pollution and the contribution of past climate change." *Environ Res Lett* 8.3 (2013): 034005.
5. Bloomer, B.J., et al. "Observed relationships of ozone air pollution with temperature and emissions." *Geophy Res Lett* 36.9 (2009).
6. Ebi, K.L., & Glenn M. "Climate change, tropospheric ozone and particulate matter, and health impacts." *Environ Health Persp* 116.11 (2008): 1449-1455.
7. Madaniyazi, L, et al. "Projecting future air pollution-related mortality under a changing climate: progress, uncertainties and research needs." *Environ Intern* 75 (2015): 21-32.
8. Sujaritpong, S., et al. "Quantifying the health impacts of air pollution under a changing climate-a review of approaches and methodology." *Intern J biometeorol* 58.2 (2014): 149-160.
9. Carslaw, K.S., et al. "A review of natural aerosol interactions and feedbacks within the Earth system." *Atmos Chem Phy* 10.4 (2010): 1701-1737.

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