Effects of the COVID-19 pandemic on carbon dioxide emissions and the ozone layer

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Amidst the growing public health response to the COVID-19 pandemic, widespread lockdowns and travel restriction measures have drastically reduced levels of greenhouse gases including carbon dioxide in the atmosphere – many of which have an ozone depleting effect with evidence of holes in the ozone layer closing. By consequence, the findings and data recorded throughout the course of the pandemic has numerous implications for human health, the environment, and strategies moving forward. In this commentary, we review the impact of COVID-19 across a number of regions across the world and what lessons we can anticipate integrating in the context of policy and public health interventions.

Introduction

Amidst prevalent disease and mortality burdens of the COVID-19 pandemic, many promising outcomes have been observed regards to carbon dioxide (CO_2) emissions.[1-2] The ozone layer functions to trap the heat generated by the sun's natural radiation, similar to several greenhouse gases (GHGs) including CO_2, methane, nitrous oxide and other industrial gases.[3] GHGs are problematic as they trap heat within the Earth's atmosphere which has kept the climate habitable for humans and millions of other species. Ongoing human activities such as mass pollution (mainly industrial) are facilitating an increase in such gases, as a result, contributing towards harsh environment issues (e.g. global warming).[4] In response to the increase of pollution and resulting ozone damage, environmentalists have long voiced concerns over the excessive amounts of atmospheric GHGs and its contribution toward increasing global temperatures and ozone damage.[5] Continual ozone layer depletion increases levels of UV radiation contributing to adverse effects on planetary and human health.[4] Rationalizing a thorough list of UV radiation-linked impacts is difficult considering the many direct and indirect mechanisms involved. Excessive amounts of UV radiation have been directly associated with solar erythema (sunburns), non-melanoma/melanoma skin cancers, and a number of vision-related illnesses (i.e., cataracts).[6] Excessive UV radiation have also been observed to have harmful results in aquatic environments – impairments in growth, photosynthesis, nitrogen incorporation and enzymatic activity of marine phytoplankton, the bases of virtually all aquatic food chains are disrupted.[7] Aquatic food chain disruption would indirectly humans and other organisms higher in the food chain potentially leading to scarcity or disruption of resources needed for survival.[7] Thus, investigations varying levels of GHGs, particularly in reference to the COVID-19 pandemic would enable scientific study into potential benefits of reducing GHGs drastically in a short-term basis as well as offer strategies to further solidify the argument against GHGs promoting activities.

Decreased CO_2 Emissions

Shortly after the widespread COVID-19 lockdowns and curfews were imposed among most metropolitan cities, a large reduction in smog was reported across many cities worldwide. The reduction in smog was visibly observable, a prime example being the enhanced visibility of the Himalaya's observed in North Indian states.[8] Smog, which is a visible form of air pollution is based on the presence heightened CO_2 emissions. Thus, a reduction in smog was considered an encouraging finding given the continual rise of global CO_2 emissions. Le Quéré and colleagues showed rising CO_2 emissions at rate of 1% per year over the previous decade.[2] Increases in CO_2 are detrimental due to their contributions towards increases in temperatures. The resulting warming has and continues to impact agricultural conditions worldwide. The buildup of CO_2 emissions and resulting global warming also has secondary effects on soil

moisture level, which causes ecological and agricultural implications,[9] establishing the need to prevent such occurrence.

A study published in the Journal Nature Climate Change showed a drastic global reduction in daily emissions (17% or 17 million tonnes of CO_2) during the peak of confinement and quarantine measures in April 2020.[10] These numbers were compared to the mean daily levels that were taken in 2019 dropping to levels that were observed during 2006. The emissions from day-to-day surface transport such as cars, railways and other forms of transportation accounted for almost half of the decrease in global emissions during peak confinement.[2] Emissions from industrial plants and from generators powering a multitude of cities account for further 43% decrease in daily global emissions. Other pollutant industries such as aviation were shut down during lockdown but only accounted for 3% of global emissions, therefore had a 10% decrease in emission during the pandemic.[2] In this study they looked at individual countries and saw that on average 26% of the emissions decreased at the peak of their confinement.[2] There is clear indication that society's response to the global pandemic has created a substantial reduction on CO_2 emission levels. Despite the observations, they overall lack of structural or institutional policy to reduce emissions and return to pre-pandemic-like conditions make these changes short lived.[2]

Ozone Layer Effects & COVID-19 Pandemic

The ozone layer is a thin layer in the Earth's stratosphere with the primary role of blocking solar radiation of certain wavelengths from reaching Earth's surface.[11] This includes ultraviolet radiations and other forms of radiation that are often pathological to living being.[11] During the 1980s, ozone depletion at forefront of scientific discussion. Ozone depletion during this period was causing the Southern air currents to be driven further south, subsequently causing major climatic changes all across the globe but primarily in a few concentrated areas.[12] These changes included differing rainfall patterns and ocean currents which had lasting impacts on ocean salinity within South American, East African, and Australian regions.[13] More recently, ozone depletion has taken even greater precedent in debate and discussion due to the potential economic and sustainability challenges associated with CO_2 emissions. Despite the massive reductions in emissions, it remains unclear that improved conditions of GHGs and emissions during the most confined period of lockdowns will have lasting ecological benefits. However, the COVID-19 pandemic does provide a rationale for coordinated action towards mitigating climate related challenges.[2] An increase in the frequency of largescale, coordinated action against prevalent CO_2 emission producing activities. An increased frequency of these coordinated efforts may aid in management of pollutive activities until long-term, more feasible.[2]

Conclusion

A drastic reduction of CO_2 emissions were observed among globally during the most aggressive periods of lockdowns during the COVID-19 pandemic. Although these changes manifested in smog reduction, a key indicator of lower CO_2 emissions, it remains unknown if the temporary reductions of these emissions contributed to observable differences in hindering the process of climate change. Currently, a large sum of research is under extensive review based on the large amounts of data collected during the pandemic. Researchers should focus on the relationship between the short decrease in emissions and potentially long-term benefits on climate change. Positive relationships between these can be vital in supporting policy recommendations against high emission/pollutants producing activities.

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