

Infectious disease, the climate, and the future

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Abstract:

Emergence and resurgence of infectious diseases are serious threats to population health. The ongoing COVID-19 pandemic has caused an enormous human toll and health crisis. Responses to the pandemic are significantly affecting the global economy. What is most concerning about COVID-19 is not the virus itself, but rather that it may compound with other and more serious crises. Climate change will likely affect human health, economy, and the society more than disease outbreaks. Governments at all levels, from local to international, can chart a greener, healthier, and equitable course for the future, investing in strategies and technologies that minimize and prevent risks, including those posed by climate change and the pandemic, promoting obligations to drastically reduce emissions, enhancing societal equality, improving community resilience, and achieving sustainable development goals.

Key Words: Climate change; COVID-19; Environmental Epidemiology; Health policy

Over the last few decades, the world has focused on addressing the growing burden of noncommunicable diseases (NCDs) for human health and well-being; NCDs cause the largest burden of disease.¹ However, emergence and resurgence of infectious diseases are also important threats to population health. For example, the world has been fighting epidemics of dengue, severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), Zika and Ebola virus. In December 2019, a new coronavirus disease emerged and rapidly becomes a pandemic. The ongoing coronavirus disease 2019 (COVID-19) pandemic has reminded us that we live in an increasingly interconnected, interdependent, and environmentally constrained world.² This pandemic will not only have impacts on population health and well-being but also on economics, international trade, politics, people's behavior, and social inequality. When this paper was written, there were more than 89 million confirmed COVID-19 cases, with over 1.9 million deaths globally, and many countries or regions have been locked down a second or third time to reduce virus spread.³ In addition to an enormous human toll and health crisis, the global economy is experiencing a serious setback. Even though uncertainty around the economic outlook remains high, the World Bank envisions a 5.2% contraction in global gross domestic product (GDP) in 2020—the deepest

global recession since World War II (Figure 1).⁴ The recession induced by the COVID-19 pandemic may be twice as bad as the 2008–2009 financial crisis.⁵ These warnings are, however, based on predictions with high levels of uncertainties. The outcome will depend on priorities given to improving the economy and social conditions for those in need.

Since 1870, the world economy experienced 14 global recessions in 1876, 1885, 1893, 1908, 1914, 1917–1921, 1930–1932, 1938, 1945–1946, 1975, 1982, 1991, 2009, and 2020. The COVID-19 recession is unique as it is the only episode, at least since 1870, to have been triggered solely by a pandemic and the actions taken to contain it.^{4,5} The pandemic is expected to push many countries into recession in 2020, with per capita income contracting in the largest fraction of countries globally since 1870.

What is most concerning about COVID-19 is not the virus as the pandemic will be controlled eventually, but rather that it may compound with other and more serious crises. The climate crisis is one of them as climate change is increasingly recognized as a global emergency and could become the largest threat the humanity faces in this century.⁶ The consequences of climate change have already been felt in many parts of the world. For example, heatwaves, which were the deadliest meteorological hazard in the 2015–2019 period, affected all continents and resulted in numerous new temperature records.⁷ It is beyond

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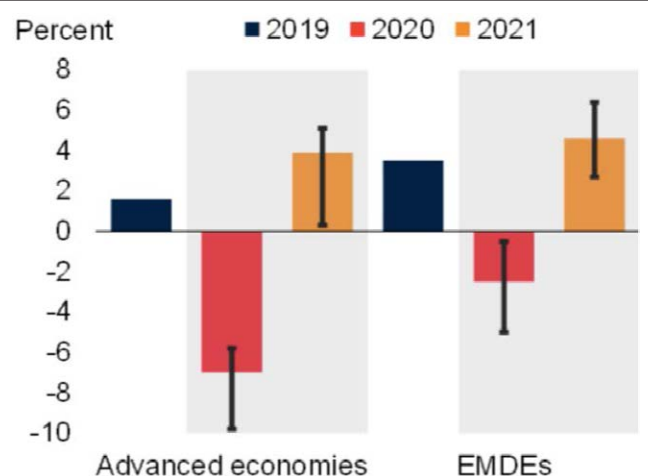


Figure 1. Growth in advanced economies and EMDEs (adapted from The World Bank⁴). EMDEs indicates emerging market and developing economies.

any reasonable doubt, climate change will affect human health, economy, and the society more in the coming decades.

There has been a temporary reduction in daily global CO₂ emissions during the COVID-19 lockdowns. Government policies during the COVID-19 pandemic have drastically altered patterns of energy demand around the world. Many international borders were closed and populations were confined to their homes, which reduced transport and changed consumption patterns. Daily global CO₂ emissions decreased by 17% by early April 2020 compared with the mean 2019 levels.⁸ The impact on 2020 annual emissions depends on the duration of the confinement, with a low estimate of -4% if prepandemic conditions return by mid-June, and a high estimate of -7% if some restrictions remain worldwide until the end of 2020. However, government actions and economic incentives postcrisis will likely influence global CO₂ emissions path for decades.

While many countries are battling the rapid emergence or the second/third wave of the COVID-19 pandemic, concerns are growing about the potential impact of economic recovery plans post COVID-19 that may be similar to the 2008–2009 financial crisis, leading to a sharp rise in carbon dioxide emissions when economic activity started picking up.⁹ It is reported that global carbon dioxide emissions from fossil-fuel combustion and cement production grew 5.9% in 2010, and more than offset the 1.4% decrease in 2009. The impact of the 2008–2009 global financial crisis on emissions was short-lived owing to strong emissions growth in emerging economies, a return to emissions growth in developed economies, and an increase in the fossil-fuel intensity of the world economy. We have seen similar patterns in many historical events such as the 1914–1918 First World War, the 1918 Spanish Flu, the 1929–1939 Great Depression, and the 1939–1945 Second World War. Thus, we should not repeat previous mistakes and must combat emissions of greenhouse gas emissions, using the stimulus packages implemented to address COVID as a critical window of opportunity.

The intersection of COVID-19 and climate change is complex and further modified by social conditions (Figure 2). Climate change may increase or decrease the likelihood of infectious disease

outbreaks—through affecting the survival, reproduction, or distribution of disease pathogens and hosts, changes in the geographic range and habitats of disease vectors, and increased inter-species contact resulting from deforestation, urbanization, and behavioral changes. Many disease-causing organisms are strongly influenced by environmental factors such as temperature, rainfall, and humidity, which are in turn influenced by climate change.^{10,11} Climate change is projected to affect infectious disease patterns. For example, global climate suitability for the transmission of dengue increased by 8.9% for *Aedes aegypti* and 15.0% for *Aedes albopictus*.¹² In 2015–2019, suitability for malaria transmission in highland areas was 38.7% higher in the African region and 149.7% higher in the Western Pacific region compared with a 1950s baseline.

Deforestation, urbanization, and land-use change have significantly contributed to climate change and have also favored the insurgence of the COVID-19 pandemic.¹³ They have altered the composition of wildlife communities, greatly increased the contacts of humans with wildlife, and altered niches that harbor pathogens, increasing their chances to come in contact with humans.

In addition, the increasing intensity, frequency, and duration of climate-related disasters (e.g., heatwaves, bushfires, flooding, storms, and droughts) may jeopardize disease control efforts. Since early 2020, many countries have been combating the dual challenge of COVID-19 and climate disasters. For instance, during the onset of the coronavirus pandemic, the small Pacific Island countries of Fiji, Vanuatu, Tonga, and the Solomon Islands were slammed by Category 5 Tropical Cyclone Harold.¹⁴ Up to 90% of homes and 60% of schools in Vanuatu were destroyed. Critically at this time of COVID-19, 20% of health centers were also destroyed. An estimated 160,000 people needed assistance, more than half of the country's population. Similar impacts were observed in Fiji, Tonga, and the Solomon Islands. In South Africa, local authorities are struggling with how to maintain social distancing during flooding in informal settlements where the policy to contain the spread of SARS-CoV-2 is already extremely difficult to implement.¹⁵

Both the pandemic and climate change disproportionately harm the health of vulnerable and economically disadvantaged people, including those affected by structural racism.¹⁶ What has

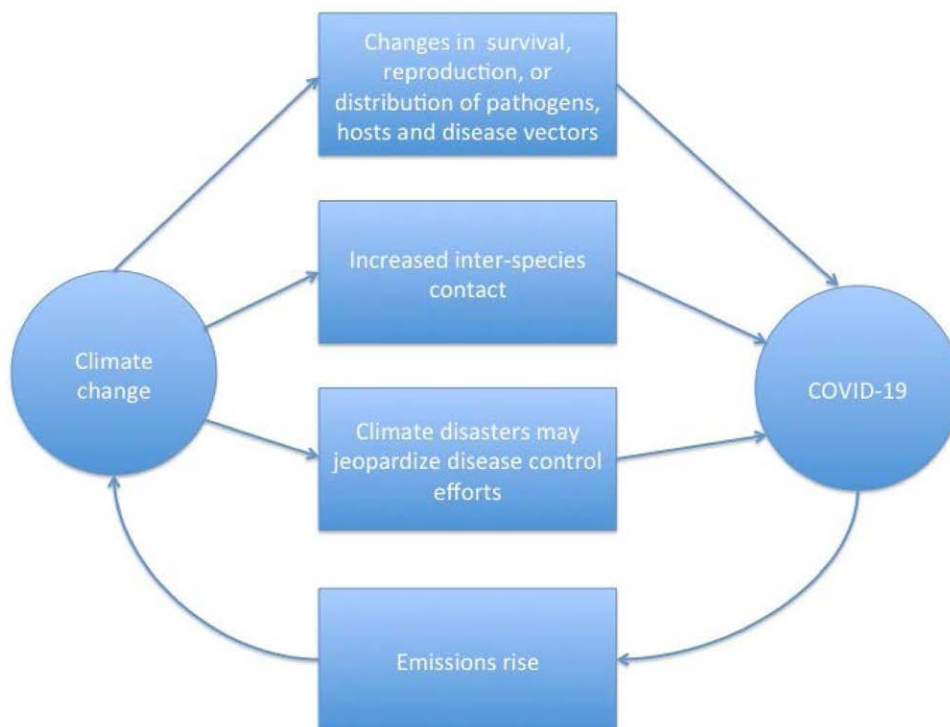


Figure 2. Intersection of climate change and COVID-19.

been happening in United States exemplifies this aspect as black and brown Americans suffer higher incidence and mortality from COVID-19 than the general population.¹⁷ Understanding the challenges posed by this conjunction is essential if we are to devise effective and equitable strategies to protect and improve health. Recently, Dr. Horton even argued that COVID-19 is a syndemic rather than a pandemic to stress its social origins.¹⁸

In 2000, Pearl wrote boldly in his famous book “Causation” “Put simply, causality has been mathematized.”¹⁹ While this may be true, it should not lead us to think we are in a situation where we can base valid predictions on existing data.

Similar to COVID-19, climate change affects deprived and vulnerable communities most, which implies that effectively designed policies that mitigate these risks may also reduce the increasing vulnerability and widening inequalities that they cause and deepen. To tackle the challenges posed by climate change and the COVID-19 pandemic, all governments should rethink their strategies for protecting residents from the impacts of the pandemic. For example, during heat events, how can we best implement social distancing in cooling centers when both the pandemic and a heatwave occur simultaneously? Another important issue is that, when an epidemic occurs, with or without a disaster (e.g., wildfires), we need to collect personal data to develop strategies for diagnosis, treatment, and prevention. For COVID-19, we need to identify high-risk groups and disease transmission pathways that can be blocked, plus much more. These data are often sensitive, so it is important that accepted rules for storing and use of these data are properly applied.²⁰

As most African countries have been combating the impacts of climate change and infectious diseases for decades, there is a serious concern about the possible devastating effects of COVID-19 on the continent. Fortunately, there have been relatively fewer cases and much lower-case fatality rate in Africa than Asia, Europe, and America to date, and several reasons may explain this phenomenon:^{21,22} (1) Quick action: The first African case was reported in Egypt on 14 February. There were fears that SARS-CoV-2 could quickly spread due to fragile health systems on the continent. So, most African governments took prompt and drastic actions to contain the virus. (2) Public support: measures such as social distancing, washing hands, and wearing of facemasks have been well implemented in most African countries. (3) Better immunity against infections: since infectious diseases are still prevalent on the continent, people have strong immune response to infections. (4) Young population: Africa has the world’s youngest population, with a median age of 19 years, while most of those who died from COVID-19 were aged over 80. (5) Low detection rate: as the large number of cases are asymptomatic and testing facilities are lacking, under-reporting is inevitably an issue. Clearly, the duality of COVID-19 and the climate crisis has resulted in a tough balance between pandemic prevention and disaster response in many African countries. If the world continues to ignore the warnings, failure to take prompt and ambitious action to reduce carbon emissions and strengthen emergency response to disasters (including disease outbreaks), could result in health consequences and socioeconomic impacts that would be hard to cope with.

A planetary health perspective that cuts across different domains of knowledge, disciplines, governance, and socioeconomic sectors is needed to properly address the dual challenge posed by climate change and COVID-19. A broad consensus is that we cannot continue doing business-as-usual as the world is rapidly changing. The pressing challenge is that climate change will worsen later this century if emissions immediately rise in a rate greater than before after the pandemic. We must integrate climate action for health into COVID-19 recovery plans,²³ and therefore call on world leaders to ensure that economic stimulus packages tackle both the impacts of COVID-19 and the escalating climate crisis. Governments at all levels, from local to international, can chart a greener, healthier, and equitable course for the future, investing in strategies and technologies that minimize and prevent risks, including those posed by climate change

and the pandemic, promoting obligation to drastically reduce emissions, enhancing societal equality, improving community resilience, and achieving sustainable development goals. Only by doing so, we can leave a safe planet to future generations.

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