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EDITORIAL

Pandemics and climate change

In 2015, Microsoft founder Bill Gates argued that the threat of a pandemic was more probable than a nuclear war. He wrote in the *New England Journal of Medicine* on 9 April 2015 that we must prepare for future epidemics of diseases that may spread more effectively than Ebola. He said 'There is a significant chance that an epidemic of a substantially more infectious disease will occur sometime in the next 20 years'. In February 2015, the President of the United States of America Obama wanted a report on 'Lessons learned from Ebola outbreak'. The report said 'It is sobering to note the odds are increasing that the United States will be called upon again in the not too distant future to respond to another health crisis that threatens global security'.

When a new administration came to power in the US in January 2017, these lessons were forgotten. On 15 May 2017, the cover page of the *TIME* magazine screamed 'We are not ready for next epidemic'. The lead article said 'the longer a virus spends in humans, the better the chance that it might mutate to become more contagious – and once that happens, it's only a matter of time before it hops on a plane out of China and onto foreign soil, where it could spread through the air like wildfire. A combination of rapid urbanization and deforestation increases the chances that a zoonotic virus can jump from animals to human beings. Hence the number of new diseases (per decade) has increased nearly fourfold over the past 60 years, and since 1980, the number of outbreaks per year has more than tripled' (*TIME* magazine 15 May 2017).

Politicians had forgotten that the 1918 flu epidemic had killed more than 50 million people around the world and the SARS epidemic in 2003 had caused a loss of more than US$ 50 billion to the global economy. The Trump administration in USA ignored these warnings and disbanded the National Security Council's 'Global health task force' in 2018. One can imagine the frustration of Anthony Fauci, the director of the National Institute of Allergy and Infectious Diseases in USA who had been advocating the development of new vaccines for emerging viruses.

The inability of the political leaders to act based on the opinion of the experts will be familiar to those who were involved in the attempt to convince the world leaders to adopt aggressive ways to control global warming. The threat of global warming was highlighted more than 30 years ago by James Hansen, Director, Goddard Institute of Space Sciences in a hearing in the US Senate in 1988. He predicted that global mean temperature will increase by 0.6°C by 2018 and his prediction came true. In 1988, most American politicians dismissed his warning and claimed he was crying wolf. Many climate sceptics argued that a gas like carbon dioxide, with concentration in parts per million cannot influence the global climate. They may change their mind now because they find that a virus, whose size around 100 nanometers, can perturb the global economy.

There are many reasons why politicians ignore the advice of scientists. In the case of global warming, the US senate was told by the powerful fossil-fuel lobby that the climate change science has many uncertainties. Hence the US senate was influenced more by the fossil-fuel lobby than the authentic reports of the Inter-governmental Panel on Climate Change (IPCC) established by the United Nations or the eloquent voice of Al Gore, the former vice-president of United States. Politicians did not want to decelerate the economic growth driven by the use of fossil fuels. The transition from an economy based on fossil fuels to the one based on renewable energy would cause short-term pain but will lead to long-term gains. In countries governed by electoral politics the long-term gains are not found to be attractive by the political leaders. In the case of development of drugs and vaccines to tackle a future epidemic, the long term benefits are not visible but the immediate costs are found to be prohibitive. The politicians were reluctant to spend a few billion dollars to develop new drugs and vaccines in the last decade but are now willing to spend trillions of dollars to prevent a catastrophic collapse of the world economy.

The politicians are not short-sighted all the time. The Montreal Protocol initially agreed to in 1988, to prevent the depletion of ozone in the stratosphere, was an amazing achievement. Ambassador Richard Benedick, the Chief Negotiator for the US at the Montreal Protocol has hailed the agreement as 'one of the great international achievements of the 20th century'. This was possible because of the rapid depletion of ozone layer in the

Antarctic. This sudden depletion of ozone came as a total surprise to the scientists who had expected a gradual depletion of the ozone in the stratosphere. The scientists were able to show that the rapid depletion of the ozone layer in the Antarctic was related to release of chlorofluorocarbons by the developed countries far away from the Antarctic. In 1988 the world was a different place. The United States was the dominant superpower and Ronald Reagan, the president of United States was not standing for re-election that year. He was able to a take a long-term view of this issue and decided that the United States will stop the production of chlorofluorocarbons that depleted the ozone layer in the stratosphere. Countries like China and India were given time to reduce the production of chlorofluorocarbons. During the last 30 years there is some evidence that the ozone hole in the Antarctic is slowly healing and may reach the pre-1980 value in another 30 years. This international agreement did not promise an immediate solution to the problem but was still able to get the support of all the countries. This was not possible in the case of limiting the emission of carbon dioxide through the Kyoto Protocol (for a more detailed discussion on the difference between Montreal and Kyoto protocols, see Ahuja and Srinivasan, *Curr. Sci*., 2009, **97**, 1531–1534). Both chlorofluorocarbons and carbon dioxide were considered to be harmless by engineers because they were inert odourless gases that were non-flammable, non-toxic and non-corrosive. When chlorofluorocarbons reached the stratosphere, they were dissociated by ultraviolet rays from the sun to produce chlorine. Chlorine is a highly reactive compound that destroyed the ozone layer. Since carbon dioxide is an inert gas, it remains in the atmosphere for hundreds of years. The ability of carbon dioxide to absorb the thermal radiation emitted by the earth's surface leads to global warming. The increase in carbon dioxide in the atmosphere can be halted if and only if we move away from our dependence on fossil fuels and ensure that all economic activity is driven through renewable energy (solar, wind and hydro power). This transition can be achieved over 30 to 50 years but will involve abandoning assets created by the fossil fuel industry.

In the case of COVID-19, politicians in many countries made mistakes because they were forced to make important decisions over a very short time with inadequate data on the incidence and virulence of the disease. The models used to predict the evolution of the pandemic had many uncertain parameters but politicians had to depend upon them to make their difficult decisions. In the case of global warming, the models used to predict the future are not perfect. This lack of accuracy in the predictions of the future was used as an excuse to postpone difficult policy decisions. The politicians had more time to understand the global warming problem than the pandemic tsunami but were hampered by misleading information peddled by the powerful fossil fuel lobby (see Oreskes, N. and Conway, E. M., *Merchants of Doubt*, Bloomsbury Press, 2010).

Climate change occurs slowly when compared to a pandemic like COVID-19 but poses a larger existential risk than the pandemic. We cannot look for a vaccine to control climate change but need go through the difficult transition to a world economy not dependent on fossil fuels. The struggle to control the pandemic can be treated like a war wherein the short-term damage exists for a few months but to reduce the emissions of carbon dioxide we need sustained efforts over many decades.

As global mean temperature continues to increase, soils frozen for thousands of years (called permafrost) will release new viruses and bacterial trapped in the soil (Yashina, S. *et al*., *Proc. Natl. Acad. Sci.*, 6 March 2012). The threat posed by new bacteria and viruses cannot be taken lightly anymore. More than 200,000 Saiga antelope died of a virulent infection over a 3-week period in May 2015 in Kazakhstan. Analysis by Richard Kock at the Royal Veterinary College in London identified a bacterium which caused extensive internal bleeding. This bacterium does not normally affect the antelope. They found that the attack by bacteria occurred when the daily temperatures and humidity levels were high. Hence there is a link between climate change and the virulence of a pathogen. We do not know if the virulence of COVID-19 has any connection to climate change but we must be prepared for surprises as we continue to indulge in the degradation of the air, soil, water and the oceans. In the last one year, we have had deadly bush fires in Australia, the worst locus infestation in Kenya and the global COVID-19 pandemic.

The global pandemic and the threat of climate change demand global cooperation and response. They demand changes in behaviour today to avoid more suffering in the future. Two courageous school children Ms Licypriya Kangujam of India and Ms Greta Thuneberg of Sweden have warned the world leaders on various occasions about the dire consequences of climate change and environmental degradation. The sudden appearance of the deadly COVID-19 pandemic this year should persuade the world leaders to take the repercussions of environmental degradation seriously.

J. Srinivasan

Divecha Centre for Climate Change,
Centre for Atmospheric and Oceanic Sciences,
Indian Institute of Science,
Bengaluru 560 012, India
e-mail: jaysri@gmail.com