Global Burden of Disease, Air Pollution and COVID-19

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The Global Burden of Disease study is a systematic scientific effort to quantify the comparative magnitude of health loss due to diseases, injuries and risk factors by age, sex, geographies for specific points in time. The burden of disease is quantified in terms of health loss through both mortality and morbidity by using the disability-adjusted life years (DALYs) which is measured in terms of years of life lost (YLL) and years lived with disability (YLD). The latest findings of global burden of disease 2019 covers 286 causes of death, 269 diseases and risks, 87 risk factors in 204 countries and territories from 1990 to 2019. Since 1990, there has been a marked shift towards a greater proportion of burden due to YLDs from non-communicable diseases and injuries. In 2019, there were 11 countries where non-communicable disease and injury YLDs constituted more than half of all disease burden.[1]

Among all the causes, air pollution is the second major cause contributing to NCDs related deaths globally.[2] The mortality associated with Particulate Matter under 2.5 micrometers (PM2.5) exposure value is attributable to various NCDs; chronic obstructive pulmonary disease (COPD), cardiovascular disease, ischemic heart disease, respiratory disease and lung cancer. The chronic outdoor exposure to PM2.5 is found associated with increased odds of hypertension, approximately 3/4 of the chronic kidney disease (CKD) burden is attributable to PM2.5 which is linked to concentration of PM2.5 over 10 $\mu g/m^3$ and ambient air is associated with diabetes mellitus.[3-6] According to WHO air quality guidelines, reducing the PM2.5 concentration to 10 $\mu g/m^3$ could reduce the pollution related deaths by 15%.[7]

The coronavirus disease (COVID-19) initially detected in Wuhan, China in December 2019 has become a worldwide pandemic.[8] After its worldwide spread, the World Health Organization (WHO) declared the outbreak COVID-19 as a Public Health Emergency of International concern on January 30, 2020 and Public Health Pandemic on March 11, 2020. The COVID-19 pandemic is a unique global health emergency which has caused significant health, economic and social consequences and millions of morbidity and mortality. The COVID-19 pandemic has suddenly made a paradigm shift in our existing knowledge of the global burden of diseases. The COVID-19 has been added as an additional disease as well as risk factor for other diseases since 2020. Both air pollution and COVID-19 pandemic increase risk and deaths of people having co-morbid conditions with non-communicable diseases especially in low- and middle-income courtiers.[9-12] Study shows that social isolation measures such as lockdown increased physical inactivity and sedentary behavior during the COVID-19 outbreak and thereby increase the global burden of NCDs including of cardiovascular disease.[13]

Air pollution is a risk factor of both COVID-19 and Non-communicable diseases (NCDs). In the context of COVID-19 pandemic, comorbidity with NCDs increases individual risk of serious symptoms and death. COVID-19 has increased mortality of people from cardiovascular diseases (CVD) and COPD, which are closely linked to climate change and air pollution, through effects including extreme heat, ground-level ozone, wildfire smoke, and increased pollen counts over longer seasons.[14,15] The recent studies show that impact of COVID-19 is very high on NCDs causing double epidemic of COVID-19 and NCDs with highest effect on people suffering from hypertension, respiratory system disease and CVD as compared with non-severe diseases.[16-18] Several studies show that air pollution parameters including PM2.5 are highly correlated with COVID-19 infection and mortality rates.[19-22] A nationwide cross-sectional study done in the United States shows that even a small increase in long-term exposure to PM2.5 (1 $\mu g/m^3$ in PM2.5) is associated with an 8% increase in the COVID-19 death.[23] In 2019, the lost output from premature deaths and morbidity attributable to air pollution accounted for economic losses of USD 28.8 billion and USD 8.0 billion respectively, in India in 2019.[24] Beside environmental risk factors, socio-economic factors such as population density, brickfield density and poverty are reported independent predictors of to the COVID-19 infection rate.[20]

During the COVID-19 pandemic, patients with mental problems increase which significantly impact on caregiver distress and several studies have reported high prevalence of psychological distress following COVID-19 outbreak in Nepal.[25-27] Similarly, the COVID-19 has adversely affected maternal, neonatal and child health services.[28,29] The observed nexus between air pollution, COVID-19 and burden of disease as well as impacts of COVID-19 on mental health, maternal, neonatal and child health shows the increasing importance of interdisciplinary research for addressing the COVID-19 pandemic involving a strong collaboration between traditionally distinct disciplines of science, and in particular, virologists, epidemiologists, toxicologists, physicians, psychiatrists, economists, sociologists, anthropologists, aerosol scientists, and meteorologists.[30] The reduction of air pollution could be one of the strategies for reducing NCDs, COVID-19 and overall burden of disease. Similarly, providing routine health services and psychological counselling can reduce disease burden. Hence, preventive measures against COVID-19 should protect the public from the dual burden of communicable and non-communicable diseases including from mental health problems.

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