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The cost of air pollution in South Africa

Developing countries like South Africa have a heavy reliance on fossil fuels, resulting in productivity losses and mortality due to high concentrations of air pollution, namely, fine particulate matter (PM). A recent IGC study indicates that 7.4% of all deaths in South Africa in 2012 were due to chronic exposure to fine PM, costing the country up to 6% of its GDP. High rates of TB and HIV/AIDS infection mean there is a critical need for South Africa-specific studies on the association between air pollution and mortality.

The high cost of air pollution

The Global Burden of Disease (GBD) reported in 2012 that three million people die prematurely each year around the globe due to ambient air pollution (WHO, 2012), with low- and middle-income countries suffering the worst effects. Developing countries, that have a heavy reliance on fossil fuels, like South Africa and China, face the bulk of the health and productivity losses as well as mortality associated with high concentrations of air pollution.

The associated economic costs can also be high. For China, which relies on coal for 75% of its primary energy, the economic burden of air pollution is estimated at 3.8% of their GDP (World Bank, 2007). The WHO estimates that air pollution costs European economies US$ 1.6 trillion a year in mortality and morbidity (WHO European Region, 2015).

The South African case

South Africa relies on coal for 97% of its primary energy. The costs of air pollution on human health and economic growth in South Africa are as of yet unknown. Fine particulate matter (PM) is one of the most lethal pollutants, and higher concentrations are known to cause increased mortality.

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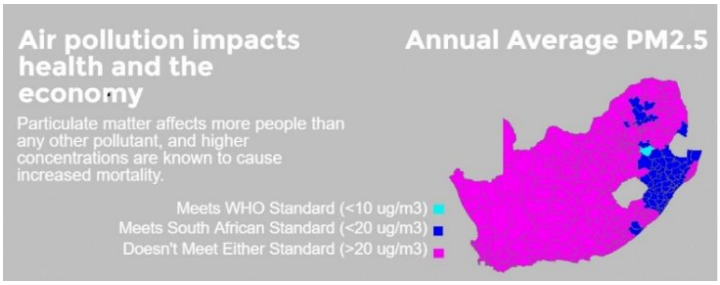
The GBD study estimated that South Africa had 1800 deaths in 2012 attributable to fine PM. This number was based on global satellite and modelling views on the severity of air pollution in the country. However, measured PM values are 3-4 times higher than the GBD estimates. Moreover, at monitoring stations where the PM data was available, only one station met the health guidelines recommended by the World Health Organization.

In our recent IGC study ('**Human Health Costs of Energy-Related Air Pollution in South Africa**'), we set out to calculate the number of premature mortalities due to the actual air pollution levels in South Africa, and to quantify the associated economic costs.

Using the United States Environmental Protection Agency's Environmental Benefits Mapping and Analysis Program (BenMAP), they developed a South African BenMAP model with local data. This required spatially-explicit information on the population, mortality rates, locally measured air pollution values, and economic data.

Air pollution monitoring data, provided by the South African Air Quality Information Service, was compared to background values. Background values indicate the concentrations that would be expected if there was no human-derived pollution.



Because fine PM associated mortality derives from chronic exposure, the BenMAP analysis uses annual averages. For the year 2012, the South African National Standards annual average fine PM limit of 20 $\mu g/m^3$ was exceeded at 13 stations. All stations except one exceeded the more stringent WHO guideline of 10 $\mu g/m^3$.

Stations with consistently high PM concentrations typically occurred near townships, which are commonly poor, overcrowded and inadequately serviced areas. The main sources of PM included domestic combustion, pollution emanating from highly industrialized areas such as Secunda (a town built

amidst the coalfields of the Mpumalanga province of South Africa and the largest source point of CO_2 in the world), coal yards and commonly adjacent coal burning power stations, many of which were previously moth-ball producing plants that have since been re-commissioned due to power shortages.

Key results

The South African BenMAP model calculated that 27,000 premature mortalities across South Africa are currently due to high levels of fine PM. This is in stark contrast to the 1800 deaths estimated by the GBD study.

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Therefore, this work indicates that 7.4% of all deaths in South Africa are due to chronic exposure to fine PM. Densely populated regions such as Cape Town, Durban, and the Johannesburg-Pretoria mega city area suffer the largest loss of life. These premature deaths cost the economy $20 billion (2011 International $), or 6% of South Africa's 2012 GDP. This is the first estimate of the significant economic costs incurred by the air pollution health burden in South Africa.

Policy lessons

Due to a lack of local epidemiological studies, this study relied on information from the developed world. While there is a plethora of epidemiological studies that quantify the relationship between mortality due to air pollution in North America, Europe, and China, there is a dearth of similar data for developing countries in Africa.

Local differences in the composition of PM, living conditions, when and how people are exposed to pollution, and most pressingly, vulnerability due to high rates of TB and HIV/AIDS infection, suggest there is a critical need for South Africa-specific studies on the association between air pollution and mortality.

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Therefore, this study highlights the need for increased fine PM monitoring around South Africa. The South African BenMAP model developed in this study is a tool for policy makers that can be used for health impact assessments and cost-benefit analyses of air pollution reduction policies.