

# Research brief

## Reducing exposure to PM<sub>2.5</sub> in South Africa leads to significant avoided premature mortalities and has large associated economic benefits

Katye Altieri<sup>1,2</sup> and Samantha Keen<sup>1</sup>

<sup>1</sup>Energy Research Centre, University of Cape Town, Rondebosch 7700, South Africa

<sup>2</sup>Department of Oceanography, University of Cape Town, Rondebosch 7700, South Africa

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Exposure to high levels of fine particulate matter (PM<sub>2.5</sub>) is a health and environmental concern in many areas across South Africa. Chronic exposure to PM<sub>2.5</sub> is associated with increased mortality risks, and there is a link between high concentrations of air pollutants and large health costs. The Global Burden of Disease (GBD) estimates that chronic exposure to PM<sub>2.5</sub> in South Africa leads to 14,356 total deaths annually. A World Bank study estimated 19,802 deaths annually due to air pollution in South Africa, with a total welfare loss equivalent to 3.12% of South Africa's GDP. However, these international studies rely on a combination of global models, satellite retrievals, and national level statistics to conduct a national-scale analysis of what is a highly geospatially explicit problem.

This study addresses the same question as the GBD and World Bank study – how many premature mortalities are due to chronic exposure to PM<sub>2.5</sub> annually in South Africa, and what is the associated cost to the economy? The difference here is that we apply a spatially explicit approach using a tool developed by the US EPA, the environmental Benefits Mapping and Analysis Program (BenMAP; <https://www.epa.gov/benmap>). BenMAP was initialized with South Africa-specific shape files, census and mortality data from StatsSA, air pollution data from SAAQIS, and a variety of health impact functions from the literature. Instead of one national-level calculation, a calculation was conducted for each municipality across South Africa, using municipality-specific input data for the year 2012.

We estimate 28,000 premature mortalities associated with chronic exposure to PM<sub>2.5</sub> across South Africa, with a total welfare loss equivalent to 4.5% of South Africa's GDP. This is significantly higher than the estimates produced by the international community and highlights the importance of accounting for regional heterogeneity within a country.

In a more policy-relevant analysis, we also estimated the total premature mortalities avoided if every monitoring station across South Africa met the annual average NAAQS for PM<sub>2.5</sub>. We find that 14,000 premature mortalities could be avoided if existing standards were met across the country, with an associated economic cost equivalent to 2.2% of South Africa's GDP. Meeting the NAAQS in 2012 would have saved 155.8 billion

Rands (2019 ZAR). This study provides additional motivation for the importance of meeting existing standards. There is an economic cost of reducing air pollution, but it is important to remember that there is also an economic cost of not reducing air pollution.

### Reference

Altieri, KE, Keen, S. Public health benefits of reducing exposure to ambient fine particulate matter in South Africa. *Sci Total Environ* 2019, 684: 610-620