

DOES LIVING IN A DISTRICT MUNICIPALITY WITH COAL-FIRED POWER STATIONS AFFECT SOUTH AFRICANS HEALTH?



South African Medical Research Council

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AIR POLLUTION KILLS, DEBILITATES LIVES

Death rates from air pollution, 2017



Death rates are measured as the number of deaths per 100,000 population from both outdoor and indoor air pollution. Rates are age-standardized, meaning they assume a constant age structure of the population to allow for comparisons between countries and over time.



Globally, 8 million lives are lost every year





OurWorldInData.org/air-pollution • CC BY

98% of South Africans are exposed to particle pollution that is dangerous* 15 600 people (5% of deaths) die each year Cardiovascular disease are a major cause of these deaths Highest in Gauteng

STEPPING OUTSIDE PUTS YOU AT RISK



 * PM_{2.5} concentrations higher than 10 $\mu g/m^3-$ the 2005 WHO AQG (now it's 5 $\mu g/m^{3\,)}$

Roomaney RA, Cairncross E, Tesfaye M, Kapwata T, Abdelatif N, Olivier C, Mathibela K, Cois A, Neethling I, Botai J, Turawa EB, Awotiwon OF, Chetty K, Nojilana B, Wright CY, Pacella R, Bradshaw D, Pillay-van Wyk V. Estimating the burden of disease attributable to ambient air pollution (ambient PM2.5 and ambient ozone) in South Africa for 2000, 2006 and 2012. S Afr Med J. 2022 Sep 30;112(8b):705-717. doi: 10.7196/SAMJ.2022.v112i8b.16483.













Fifty-six studies were included in the review with most articles published from 2016 to 2023 (n=33, 59%) and 35 were in high income countries (63%).

WHAT DO WE KNOW FROM THE LITERATURE?

- Evidence **show increased odds of negative health outcomes** of individuals living closer to CFPSs
- Significant association between CFPS retirement/closure or installation of emission control systems and reduced health risks

Recommendations from studies:

- Effective regulation of emissions and phaseout of CFPSs can help decrease premature mortality
- **Cleaner energy policies** that favor the replacement of coal with other fuel type should be implemented
- Retirement or closure of CFPSs might improve children's respiratory health
- Energy transition could benefit children who live and attend school near CFPSs





THIS STUDY: WHERE DID THE DATA COME FROM?

- Air quality data from the South African Air Quality Information System (SAAQIS).
- Mortality data collected from death certificates and received from Statistics South Africa.
- Pneumonia clinic visits from District Health Information System (DHIS) from National Department of Health.







Location of the air quality monitoring stations, the coal-fired power stations, and the district municipalities with and without coal-fired power stations.

PEOPLE LIVING NEAR CFPS ARE AT RISK

- Number of deaths were higher in district municipalities with CFPSs compared to district municipalities without CFPSs for the following causes:
 - All-causes of death was higher in district municipalities with CFPSs.
 - Deaths from diseases of the arteries, arterioles and capillaries in the cardiovascular system

🚧 UK International

Development

Prosperity

Progress

Partnership

Deaths from chronic obstructive pulmonary disease and tuberculosis





"Overall people living in district municipalities with CFPSs had a **6% higher chance of dying** compared to those people living in district municipalities without CFPSs."

For every one unit change in count of mortality per district municipality, the odds of the death occurring in an exposed district versus non-exposed district increased by 6%.

> Note: These findings were statistically significant. We did not calculate excess deaths.



PEOPLE LIVING NEAR CFPS ARE AT RISK

• The average pneumonia case fatality rate for children under 5 years of old was higher in district municipalities with CFPSs compared to district municipalities without CFPSs.



Note: These findings were not statistically significant. The confounder HIV antenatal prevalence needs to be considered in our revised analyses.





AIR POLLUTION EXPOSURE AND CHILDREN UNDER 5 YEARS

"For all four district municipalities where the analyses were conducted, there was a linear increase in new cases of pneumonia in children under 5 years with every increase in 10ppb of nitrogen dioxide and sulphur dioxide."



Note: These findings were not statistically significant



BABIES ARE NEGATIVELY AFFECTED EVEN BEFORE THEY ARE BORN

For 2006 to 2020, the median cleft lip and palate birth anomaly prevalence per 100 000 population was higher in district municipalities with CFPSs. We used actual cases of cleft lip and palate for these analyses.

No CFPSs 5 birth anomalies per 100 000

With CFPSs



8 birth anomalies per 100 000



Oliver Conway, with permission



Note: These findings were statistically significant



WHAT IS THE AIR QUALITY LIKE IN THESE DISTRICT MUNICIPALITIES?





WHAT DID WE FIND WHEN WE COMPARED HEALTH TO AIR QUALITY IN THE DISTRICT MUNICIPALITY?

- We used air quality data from the South African Air Quality Information System for stations located within the district municipalities with CFPSs.
- For the health data, we used new cases of pneumonia for children under 5 years.
- The output is the relative risk of an increase in new cases of pneumonia for children under the age of 5 within the district municipality when an increase of 10ppb of SO₂ or NO₂ occurs.
- Lag effects between exposure and the health outcome were included.



AS AIR POLLLUTION GOES UP, SO DOES THE RISK OF CHILDREN UNDER 5 SUFFERING FROM PNEUMONIA



The relative risk for the increase in incidence of new cases of pneumonia for under 5 children with every increase in 10ppb of NO_2 and SO_2 respectively. Gert Sibande DM is within the region with CFPSs.

WHAT DID WE FIND WHEN WE ADDED OTHER VARIABLES TO THE ANALYSES?

- We used Census data on household fuel use.
- Household fuel use included electricity, gas, paraffin, wood, solar.
- We were trying to see whether household fuel use type affected the risk of exposure to NO₂ and SO₂ over and above the risk posed from exposure to air pollution in district municipalities with CFPSs.
- This work is ongoing.



- There was no statistically significant differences to our first set of findings when we included the type of household fuel used in the houses in district municipalities with and without CFPSs.
- This does not mean that differences do not exist. They might.
- The results may also be affected by the temporal and spatial scales of the air quality data and the household fuel use data that we used.



WHAT DID WE NOT DO?

- We did not do source apportionment to identify all the sources in the district municipalities or to identify how much pollution came from each source.
- We did not do any modelling. All the data are actual data.
- We did not take into account the regional effect of emissions from CFPSs. They may have gone into district municipalities without CFPSs.
- Our current findings are not yet population-weighted. This work will be completed by end of March 2025.





HEALTH IMPACT CONCLUSIONS

- Overall people living in district municipalities with CFPSs had a 6% higher chance of dying compared to those people living in district municipalities without CFPSs.
 - While other factors likely play into these findings, it does not discredit that there is a difference in the mortality rates in district municipalities with and without CFPS.
- There was some evidence that pneumonia case fatality rates in children under 5 years of age were greater in district municipalities with CFPSs compared to those without CFPSs
 - However, these findings were not statistically significant.
- There was evidence that the **birth outcome**, orofacial cleft lip and palate, occurred more in district municipalities with CFPSs compared to those district municipalities without CFPSs.



RECOMMENDATIONS

- CFPSs should be **decommissioned** and replaced with alternative sources of electricity production that rely on renewable energy sources such as solar, wind, hydropower etc.
 - Our study shows that exposure to pollution from coal-fired power stations has negative impacts on health, therefore eliminating this risk will also reduce the burden placed on healthcare facilities.
- People living in proximity to CFPSs should be made **aware** of the health threats that living in proximity to CFPSs present to their health.





RECOMMENDATIONS

- The South African National Air Quality Standards need to be implemented in a more stringent manner to prevent mortality and morbidity, especially in district municipalities with CFPSs.
- Air quality management in Air Pollution **Priority Areas** should be scaled up.
- **Surveillance** of air pollution-related health outcomes in district municipalities with CFPSs should be scaled up.
- **Health data** (for example, mortality data, hospital admissions, ambulance call outs) should be made available for tracking of air pollution exposure-associated health outcomes in district municipalities with CFPSs.





RECOMMENDATIONS

- Researchers should continue to **study** the health and environmental impacts of living in proximity to CFPSs, especially in LMICs, to ensure that the baseline evidence exists to lobby and advocate for decommissioning of CFPSs.
- **Children** are most vulnerable to the health effects of exposure to air pollution from CFPSs due to their developing organs and body system. Therefore, energy transition will benefit children living near CFPSs.
- Engagement with all **stakeholders** is made to ensure the severity of the situation regarding health impacts associated with living in proximity to CFPSs is made apparent.





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DISCLAIMER

UK FCDO is the funder of the project but has no say over the study findings. They have agreed that the study may form part of a PhD for a student, i.e., the employed scientist, and fully agree to publication in a journal. A contract agreement has been entered into between SAMRC and UK FCDO that states that the subject matter will be worked on by the SAMRC and all intellectual property produced by the SAMRC will be the property of the SAMRC. But in return for the funding provided by FCDO, they can use and quote from the research being undertaken for non-commercial purposes in order to further the improvement of public health and learning in South Africa.



