PLANET 4HEALTH

POLICY BRIEF

Air Pollution and Mortality in South Africa's Priority Areas: Evidence for Urgent Action

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Ambient air pollution remains a major public health threat in South Africa, particularly in designated air quality Priority Areas: the Highveld, Vaal Triangle Airshed, and Waterberg–Bojanala. This study provides robust epidemiological evidence linking short-term exposure to key pollutants, especially nitrogen dioxide (NO_2) and fine particulate matter ($PM_{2.5}$) to increased mortality.

Analysis of over 1 million deaths (2011–2018) shows that air pollution significantly elevates risks of pneumonia, lower respiratory infections, and non-communicable diseases. Vulnerability is not uniform: children and older adults are disproportionately affected depending on location.

Despite existing air quality management frameworks, pollutant levels frequently exceed World Health Organization (WHO) 2021 guidelines, highlighting gaps in implementation and enforcement. Immediate, targeted interventions are needed to reduce exposure, strengthen health system preparedness, and protect vulnerable populations.

The Problem

Air pollution in South Africa is driven by industrial emissions (e.g., coal-fired power generation), pollution from vehicles, domestic fuel burning for cooking and heating, and mining and heavy industry activities. These sources are concentrated in three Air Pollution Management Priority Areas where large populations are chronically exposed to harmful pollutants.

Key findings from this study include:

- Persistent exceedance of WHO air quality guidelines
- Strong associations between pollution and mortality
- Significant seasonal variation, with worse pollution in winter
- High burden of respiratory and cardiovascular disease linked to exposure

Air pollution contributes to both **acute health events** (e.g., infections, hospitalisation) and **chronic conditions** (e.g., cardiovascular disease, COPD), placing sustained pressure on the health system.

Key Evidence

01. Scale of the Health Burden

- **1,012,388 deaths analysed** between 2011 and 2018 across three Priority Areas
- Non-communicable diseases dominate mortality
- Pneumonia and lower respiratory infections are major contributors

02. Pollutants of Greatest Concern

- **NO_2 and $PM_{2.5}$** show the most consistent and strongest associations with mortality
- PM_{10} shows weaker but still significant effects
- SO_2 associations are less consistent

03. Disproportionate Impacts on Vulnerable Groups

- **Children:** Increased risk of lower respiratory infections (e.g., +6% mortality risk in Vaal Triangle)
- **Older adults (65+ years):** Elevated pneumonia mortality
- **Sex differences:**
  - Females more affected in the Highveld
  - Males more affected in Waterberg–Bojanala

04. Geographical Inequality

- Waterberg–Bojanala shows the **highest and most variable risks**, likely linked to rapid industrial expansion
- Highveld shows persistent but more stable pollution-health relationships
- Vaal Triangle shows strong impacts in children

05. Temporal Variability

- Pollution–health relationships fluctuate yearly
- Strongest effects seen for:
  - Pneumonia
  - Lower respiratory infections

Policy Implications

The findings highlight systemic gaps in South Africa's air quality management:

1. Implementation gap: Policies exist but are not effectively enforced
2. Monitoring limitations: Uneven spatial coverage of air quality data
3. Health system disconnect: Limited integration of air quality data into health surveillance
4. Equity gap: Vulnerable populations are not adequately protected

Without intervention, air pollution will continue to increase mortality and morbidity; widen health inequalities; strain healthcare systems; and undermine National Development Goals.

Recommended Actions

1. Strengthen Air Quality Governance

- Enforce compliance with South African National Ambient Air Quality Standards
- Align standards with WHO 2021 Air Quality Guidelines
- Strengthen regulatory oversight in Priority Areas

2. Reduce Emissions at Source

- Accelerate transition away from coal-based energy
- Implement stricter industrial emission controls
- Promote cleaner household energy alternatives

3. Protect Vulnerable Populations

- Develop targeted interventions for:
  - Children (schools, childcare settings)
  - Older adults
- Implement community-level exposure reduction strategies

4. Integrate Health and Air Quality Systems

- Link air quality monitoring with health surveillance systems
- Use early warning systems to trigger public health responses
- Train healthcare workers on pollution-related health risks

5. Improve Data and Monitoring

- Expand and modernise air quality monitoring networks
- Develop high-resolution exposure datasets
- Support long-term epidemiological surveillance

6. Enhance Public Awareness and Risk Communication

- Communicate air pollution risks clearly to communities
- Promote behavioural changes to reduce exposure
- Engage civil society in monitoring and accountability

Conclusions

This study provides compelling, locally-relevant evidence that air pollution is a major and preventable driver of mortality in South Africa's industrial regions. The consistent associations with NO_2 and $PM_{2.5}$, combined with clear evidence of vulnerable populations, demand urgent and targeted policy action. Strengthening air quality management, integrating health and environmental systems, and prioritising equity-focused interventions are critical to reducing the burden of disease and achieving national and global health goals.

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