Air Pollution and Health in Africa

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Workshop on Air Pollution and Health in East Africa - 29 March 2023
Session: Health effects of air pollution: context, evidence and policy applications
Africa in context

Inequity, inequality, poverty

Development trajectory
Population-weighted annual average PM$_{2.5}$ exposures in countries across Africa
Table 0.1. Recommended AQG levels and interim targets

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging time</th>
<th>Interim target</th>
<th>AQG level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>PM$_{2.5}$, μg/m$^3$</td>
<td>Annual</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>24-hour$^a$</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>PM$_{10}$, μg/m$^3$</td>
<td>Annual</td>
<td>70</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>24-hour$^a$</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>O$_3$, μg/m$^3$</td>
<td>Peak season$^b$</td>
<td>100</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>8-hour$^b$</td>
<td>160</td>
<td>120</td>
</tr>
<tr>
<td>NO$_2$, μg/m$^3$</td>
<td>Annual</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>24-hour$^a$</td>
<td>120</td>
<td>50</td>
</tr>
<tr>
<td>SO$_2$, μg/m$^3$</td>
<td>24-hour$^a$</td>
<td>125</td>
<td>50</td>
</tr>
<tr>
<td>CO, mg/m$^3$</td>
<td>24-hour$^a$</td>
<td>7</td>
<td>–</td>
</tr>
</tbody>
</table>

$^a$ 99th percentile (i.e. 3-4 exceedance days per year).

$^b$ Average of daily maximum 8-hour mean O$_3$ concentration in the six consecutive months with the highest six-month running-average O$_3$ concentration.
<table>
<thead>
<tr>
<th>Country</th>
<th>Population-Weighted PM$_{2.5}$ (µg/m$^3$) (Uncertainty Intervals)</th>
<th>National Ambient Air Quality Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niger</td>
<td>80.1 (42.2–145)</td>
<td>✗</td>
</tr>
<tr>
<td>Nigeria</td>
<td>70.4 (45.4–105)</td>
<td>✓</td>
</tr>
<tr>
<td>Egypt</td>
<td>67.9 (47.8–67.9)</td>
<td>✓</td>
</tr>
<tr>
<td>Mauritania</td>
<td>66.8 (37.6–108)</td>
<td>✗</td>
</tr>
<tr>
<td>Cameroon</td>
<td>64.5 (43.8–92.6)</td>
<td>✗</td>
</tr>
<tr>
<td>Mali</td>
<td>60.6 (33.7–103)</td>
<td>✗</td>
</tr>
<tr>
<td>Senegal</td>
<td>60.2 (37.6–92.7)</td>
<td>✓</td>
</tr>
<tr>
<td>Chad</td>
<td>59.3 (34.6–94.8)</td>
<td>✗</td>
</tr>
<tr>
<td>The Gambia</td>
<td>58.1 (35–92.6)</td>
<td>✓</td>
</tr>
<tr>
<td>Côte d’Ivoire</td>
<td>55.6 (32.7–90.3)</td>
<td>✓</td>
</tr>
</tbody>
</table>
Change in population-weighted annual average PM2.5 exposure for the five countries of interest, 2010–2019
Contribution of key sources to PM$_{2.5}$ exposures in 2019

- **South Africa**
- **DRC**
- **Kenya**
- **Ghana**
- **Egypt**

Breakdown of percentage contribution to ambient PM$_{2.5}$:
- Windblown dust
- Waste
- International shipping
- Anthropogenic dust
- Agriculture
- Energy
- Industry
- Fires
- Other
- Transport
- Residential

*SOGA, 2022*
“Air pollution is a climate and health emergency, in Africa and around the world.”
Almost all organs, systems and processes in the human body may be impacted by air pollution.

Lungs, heart, brain, vascular system, metabolism, reproduction system are all affected.

Air pollution affects people from the beginning until the end of life
Air pollution impacts on human health

• Short-term exposure to air pollution can lead to a range of diseases including:
  • Aggravated asthma
  • Lower respiratory infections
  • Emergency room visits
  • Ear, nose throat irritation, breathing difficulties
  • Chronic obstructive pulmonary disease
  • Heart attacks among people with heart disease

• Long-term exposure to air pollution can lead to a range of diseases including:
  • Pre-term birth, low birth weight
  • Heart disease, stroke
  • Trachea, bronchus and lung cancers (IARC has classified PM$_{2.5}$ as carcinogenic)
  • Cataract
  • Type 2 diabetes, obesity, systemic inflammation
  • Alzheimer’s disease, dementia
Air pollution and vulnerable groups

- Unborn children
- Infants
- Children under 5 year
- Pregnant women
- The elderly
- People with pre-existing diseases
- Minority groups
### TABLE 2: Death rates linked to PM$_{2.5}$ across African regions in 2019

<table>
<thead>
<tr>
<th>Region/Focus Country</th>
<th>PM$_{2.5}$ Death Rate* (UI)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Africa</td>
<td>55.8 (46.7 – 65.1)</td>
</tr>
<tr>
<td>Egypt</td>
<td>91.4 (67.5 – 118)</td>
</tr>
<tr>
<td>Southern Africa</td>
<td>38.6 (29.8 – 47.3)</td>
</tr>
<tr>
<td>South Africa</td>
<td>44.6 (35.4 – 53.8)</td>
</tr>
<tr>
<td>Western Africa</td>
<td>27.4 (16.7 – 40.7)</td>
</tr>
<tr>
<td>Ghana</td>
<td>39.8 (25.5 – 56.2)</td>
</tr>
<tr>
<td>Central Africa</td>
<td>15.6 (7.9 – 27)</td>
</tr>
<tr>
<td>Democratic Republic of the Congo</td>
<td>12.6 (5.3 – 23.8)</td>
</tr>
<tr>
<td>Eastern Africa</td>
<td>9.8 (5.3 – 15.8)</td>
</tr>
<tr>
<td>Kenya</td>
<td>10.9 (6.5 – 17)</td>
</tr>
</tbody>
</table>

*Death rate refers to the number of deaths per 100,000 people per year.

**UI: Uncertainty interval refers to the 95% uncertainty interval.

### TABLE 3: Top 10 countries with the highest number of deaths linked to PM$_{2.5}$ across Africa in 2019

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Number of PM$_{2.5}$-Linked Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>90,600 (66,800 – 116,900)</td>
</tr>
<tr>
<td>Nigeria</td>
<td>68,500 (41,500 – 101,700)</td>
</tr>
<tr>
<td>Morocco</td>
<td>27,000 (20,300 – 34,000)</td>
</tr>
<tr>
<td>South Africa</td>
<td>25,800 (19,700 – 30,000)</td>
</tr>
<tr>
<td>Algeria</td>
<td>21,600 (15,300 – 29,000)</td>
</tr>
<tr>
<td>Sudan</td>
<td>16,600 (10,200 – 24,400)</td>
</tr>
<tr>
<td>Ghana</td>
<td>12,500 (8,000 – 17,800)</td>
</tr>
<tr>
<td>Democratic Republic of the Congo</td>
<td>11,000 (4,700 – 20,900)</td>
</tr>
<tr>
<td>Cameroon</td>
<td>10,200 (6,100 – 14,800)</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>9,000 (4,200 – 16,200)</td>
</tr>
</tbody>
</table>
## TABLE 5 Top 10 countries with the highest number of deaths linked to household air pollution across Africa in 2019

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Number of PM$_{2.5}$-Linked Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>128,200 (88,700–171,600)</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>67,800 (52,700–82,400)</td>
</tr>
<tr>
<td>Democratic Republic of the Congo</td>
<td>58,000 (41,200–77,500)</td>
</tr>
<tr>
<td>United Republic of Tanzania</td>
<td>39,200 (29,200–49,900)</td>
</tr>
<tr>
<td>Somalia</td>
<td>27,600 (19,600–39,00)</td>
</tr>
<tr>
<td>Niger</td>
<td>26,500 (18,300–35,600)</td>
</tr>
<tr>
<td>Mozambique</td>
<td>25,000 (18,800–32,000)</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>24,300 (17,500–32,100)</td>
</tr>
<tr>
<td>Uganda</td>
<td>23,000 (16,900–29,300)</td>
</tr>
<tr>
<td>Mali</td>
<td>22,600 (15,900–29,700)</td>
</tr>
<tr>
<td>Madagascar</td>
<td>21,500 (15,800–27,900)</td>
</tr>
</tbody>
</table>
Deaths attributable to communicable and non-communicable disease in Africa, 1990–2019

Deaths attributable to household air pollution and ambient particulate matter (PM)$_{2.5}$ air pollution in Ethiopia, Ghana, Rwanda, and overall, in Africa, 1990–2019

Data sources for Africa: air pollution and health impacts

• Global Durden of Disease (https://www.healthdata.org/gbd)


• WHO Global Health Data Observatory (https://apps.who.int/gho/data/node.main-afro.127?lang=en)

• Country networks (e.g., https://saaqis.environment.gov.za/ in South Africa)

• AirQo (https://airqo.africa/explore-data)

• Satellite data
South Africa

Air Pollution and Health Factsheet

Air pollution was among the top 10 risk factors for death in South Africa in 2019, accounting for nearly 6% of all deaths (more than 50 thousand). Considered separately, ambient particulate matter (PM$_{2.5}$) ranked as the first leading risk factor for deaths, and household air pollution (HAP) ranked fifth. Ozone was not in the top 10 risk factors.

**Key statistics at a glance for 2019**

- 28% of the population of South Africa lives in areas where PM$_{2.5}$ levels are above the least stringent WHO guideline for healthy air (35 µg/m$^3$).
- 46% of outdoor PM$_{2.5}$ comes from fossil-fuel combustion (i.e., coal, oil, and gas).
- 8% of deaths due to air pollution are in children under 5.

**Exposure to Air Pollution**

- PM$_{2.5}$ (presented as population-weighted annual average concentration):
  - No Change in 2019 (29 µg/m$^3$) than in 2010 (29 µg/m$^3$).
  - Equal or below the global average (44 µg/m$^3$).
  - South Africa ranks first among 6 Southern Sub-Saharan African countries.
  - More than 100 stations monitored for PM$_{2.5}$ in South Africa**.

- Ozone (presented as population-weighted seasonal average concentration):
  - Higher in 2019 (40 ppb) than in 2010 (35 ppb).
  - Equal or below the global average (50 ppb).

- HAP (% of population relying on solid fuels for cooking):
  - Lower in 2019 (12%) than in 2010 (21%).

**Health Impacts of Air Pollution**

- Air pollution is among the top 10 risk factors for death in South Africa; more than 30 thousand in 2019 deaths were linked to air pollution.
- There are 73 deaths per 100,000 people due to air pollution in South Africa which is lower than the global average (86 deaths per 100,000), adjusted for differences in age.
- 8% of total air-pollution-attributable deaths in South Africa are in children under 5, and 9% are in adults over 70.
- Air pollution reduced life expectancy in South Africa by 1 years.

**Percentage of Deaths (by Cause) Due to Air Pollution in South Africa in 2019**

- 19% of stroke deaths.
- 20% of dementia deaths.
- 19% of ischemic heart disease deaths.
- 25% of COPD deaths.
- 18% of lung cancer deaths.
- 17% of lower respiratory infections deaths.
- 12% of nosocomial deaths.

**Top 5 Sources of Outdoor PM$_{2.5}$ and Associated Health Burden in South Africa in 2019**

- Residential: 16%
- Industry: 7%
- Energy: 22%
- Anthropogenic: 8%
- Agriculture: 6%

**Number of PM$_{2.5}$ linked deaths**

- 4,006 deaths
- 1,752 deaths
- 5,508 deaths
- 2,003 deaths
- 1,502 deaths

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*Please note that PM$_{2.5}$ concentrations reported here are estimated using a combination of satellite data, ground air quality monitoring data, and chemical transport models. These estimates can be more uncertain where ground monitoring data are limited or not available. In South Africa, the best estimate of the annual average exposure is 29 µg/m$^3$, but it may range from 0.04 to 29 µg/m$^3$.

**Based on data from GBD-HAP - Global Project. Find out more.**

**Based on data from OpenAQ.**

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For More Information:
For the full report and additional data, please visit [www.stateofglobalair.com](http://www.stateofglobalair.com).

Additional Resources:
For open access, real-time air quality data, visit [OpenAQ](http://openaq.org).

International Day for the Elimination of Child Labor.

The State of Global Air website is a collaboration between the Geospatial Health Institute and the Institute for Health Metrics and Evaluation, with expert input from The University of British Columbia.
A call to action

- Adoption of a global compact on air pollution
- Need political leadership and partnerships
- Many policy and technological solutions to reduce harmful products of combustion exist
- Effective policies and technologies need to be shared
- Share success stories in controlling air pollution
- Optimize the costs and benefits of actions
- Sufficient monitoring of key pollution metrics
- Mobilize finance and investment in opportunities to reduce air pollution
Acknowledgements

• Health Effects Institute
• Stockholm Environment Institute (SEI Africa)
• World Resources Institute (WRI Africa)
• Eastern Africa GEO Health Hub (Kenya)
• AirQo
• Victor Nthusi and Pallavi Pant
• South African Medical Research Council

“Be the change”