# Using Burden of Disease Studies of Air Pollution to guide decision-making in South Africa

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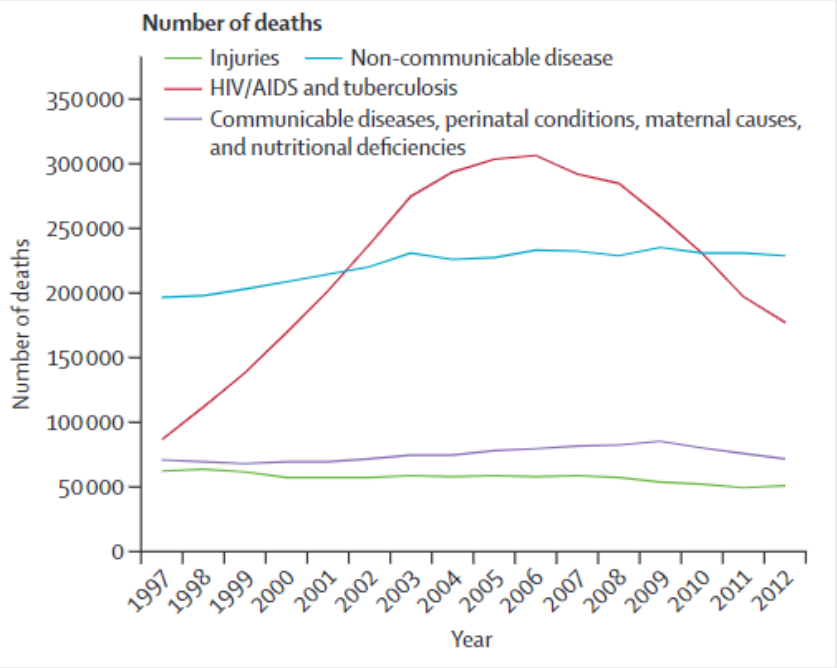
# NATIONAL BURDEN OF DISEASE STUDY FOR 2012

| 2012 leading causes of death | Deaths (%) | Years of life lost (%) |
|---|---|---|
| **Persons** | | |
| 1 HIV/AIDS | 153 661 (29·1%) | 3576 809 (35·7%) |
| 2 Cerebrovascular disease | 39 830 (7·5%) | 476 955 (4·8%) |
| 3 Lower respiratory infections | 25 977 (4·9%) | 464 304 (4·6%) |
| 4 Ischaemic heart disease | 24 969 (4·7%) | 306 181 (3·1%) |
| 5 Tuberculosis | 23 817 (4·5%) | 461 024 (4·6%) |
| 6 Diabetes | 18 894 (3·6%) | 255 509 (2·5%) |
| 7 Hypertensive heart disease | 18 755 (3·5%) | 209 219 (2·1%) |
| 8 Interpersonal violence | 18 741 (3·5%) | 460 180 (4·6%) |
| 9 Road injuries | 17 597 (3·3%) | 422 715 (4·2%) |
| 10 Diarrhoeal diseases | 16 349 (3·1%) | 369 289 (3·7%) |
| Top 10 causes | 358 590 (67·8%) | 7 002 185 (69·8%) |
| **Total** | **528 947 (100·0%)** | **10 032 887 (100·0%)** |




Pillay-van Wyk, Victoria, et al. "Mortality trends and differentials in South Africa from 1997 to 2012: second National Burden of Disease Study." The Lancet Global Health 4.9 (2016): e642-e653.

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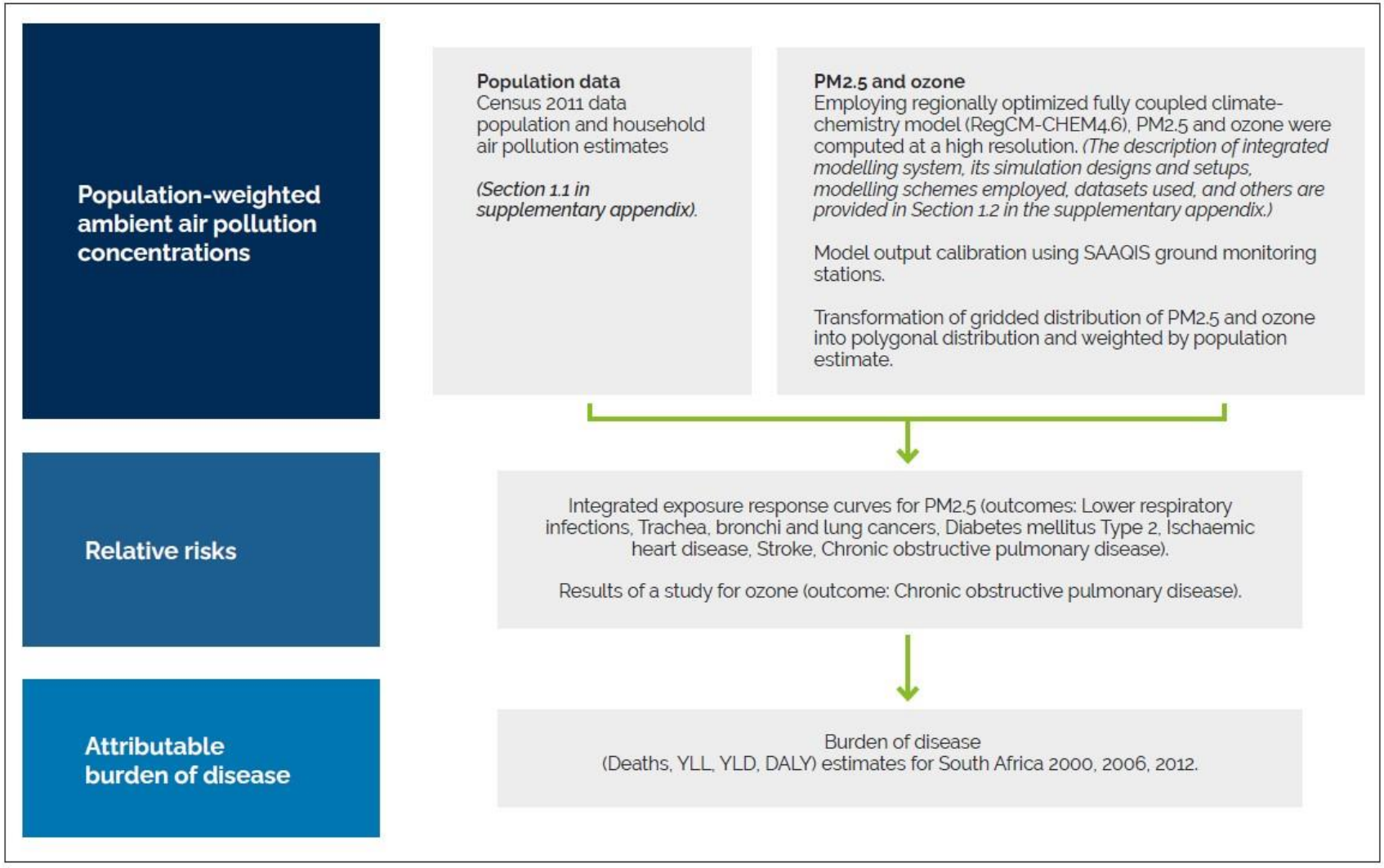



*Fig. 1. Data sources for calculating the burden of disease attributable to ambient air pollution ($PM_{2.5}$ and ozone) for 2012. (HAP = household air pollution; SAAQIS = South African Air Quality Information System; YLL = year of life lost, YLD = year of life lived with a disability, DALY = disability-adjusted life year.)*

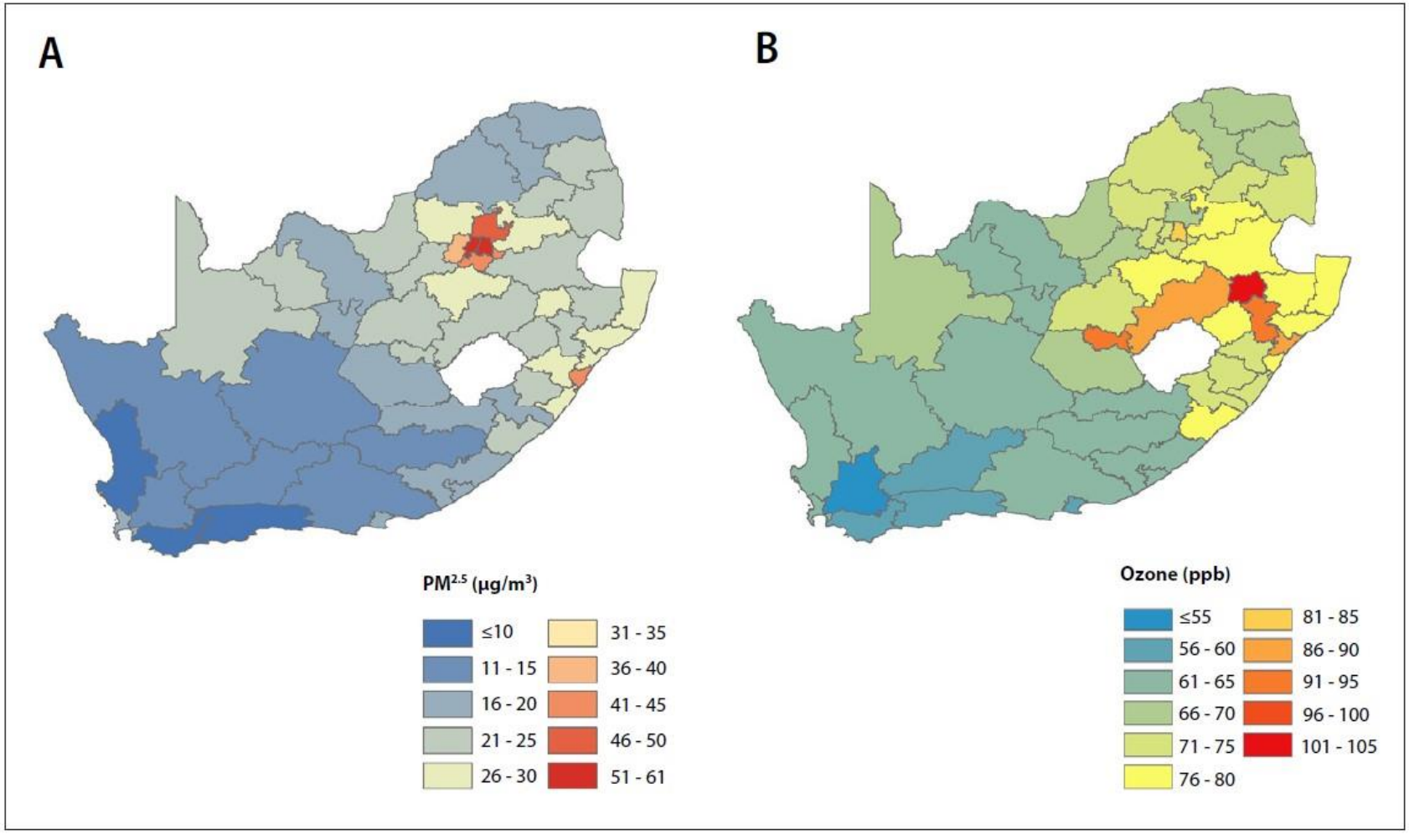



*Fig. 2. Population-weighted (A) annual mean concentration of $PM_{2.5}$ (µg/m³), (B) mean of the 6-month period with highest mean 8-hour daily maximum ozone concentrations ambient ozone concentrations (ppb), at district scale in South Africa for 2012.*

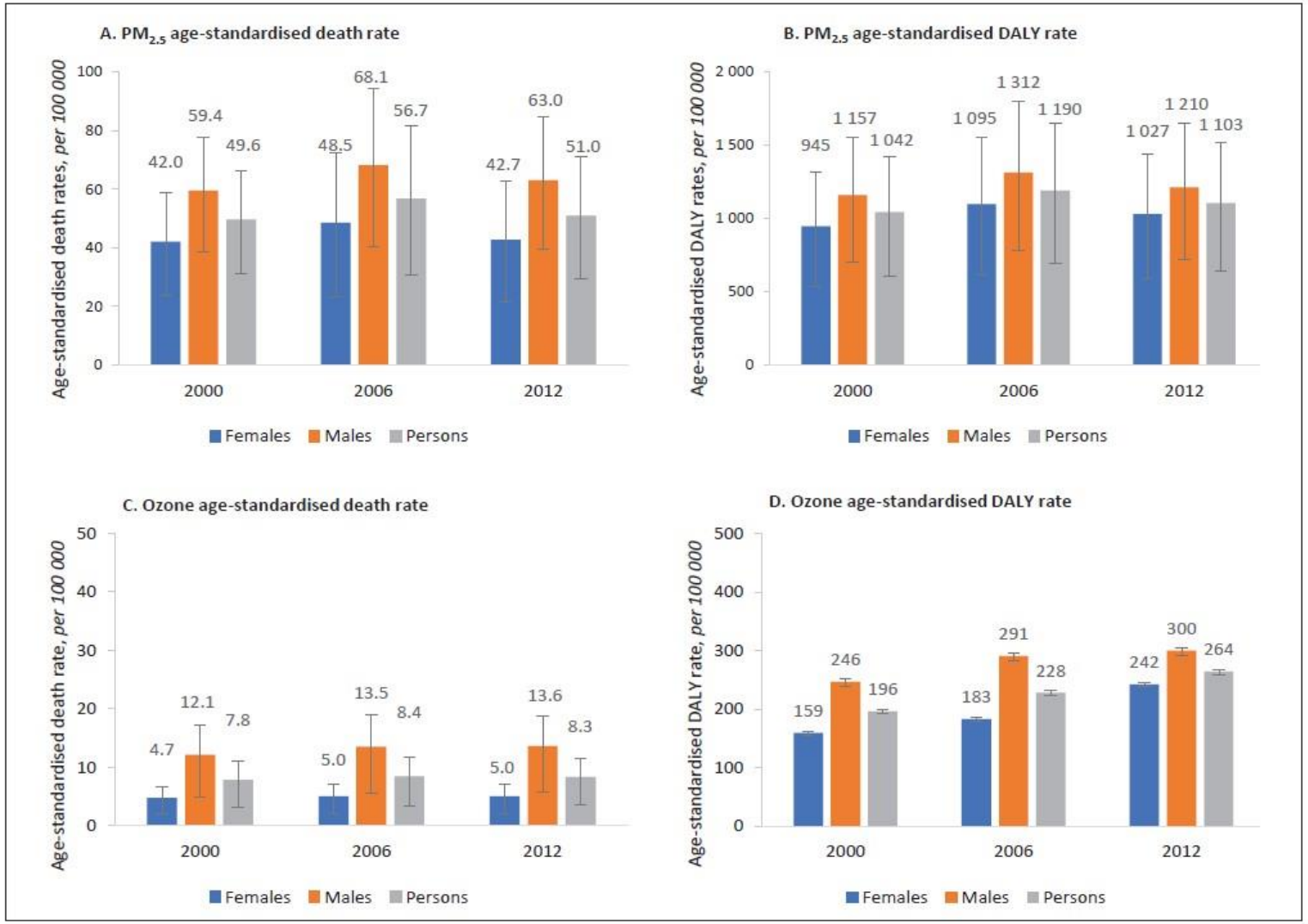



*Fig. 3. $PM_{2.5}$ age-standardised (A) death and (B) disability-adjusted life year (DALY) rates per 100 000 population. Ambient ozone age-standardised (C) death and (D) DALY rates per 100 000 population. (All graphs exhibit the national outcomes for South Africa for 2000, 2006 and 2012.)*

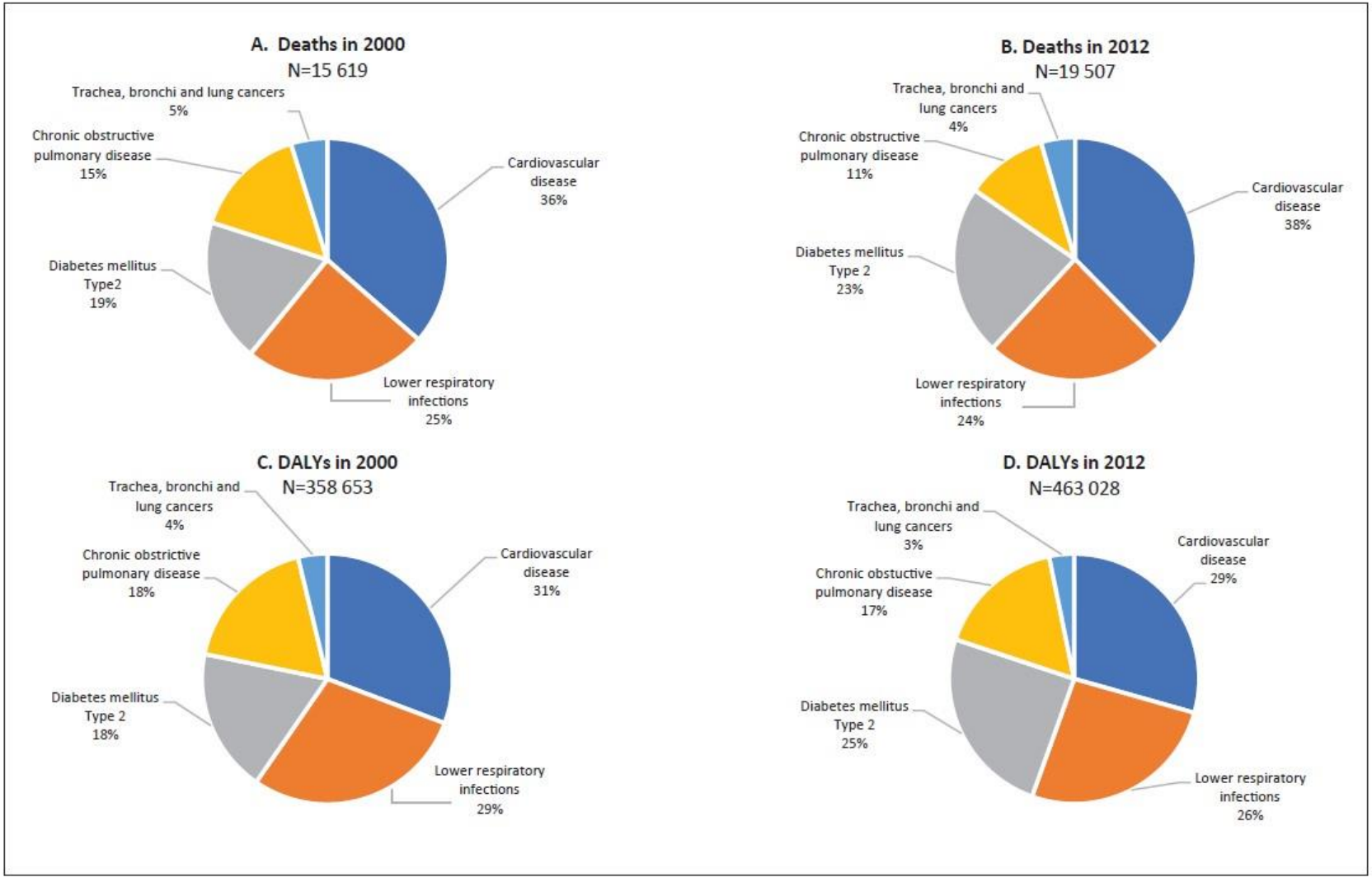



*Fig. 4. Deaths attributable to $PM_{2.5}$ by disease condition for (A) 2000 and (B) 2012. Disability-adjusted life years (DALYs) attributable to $PM_{2.5}$ by disease condition for (C) 2000 and (D) 2012. (Cardiovascular disease is the addition of ischaemic heart disease and stroke. Lower respiratory tract infections were a disease outcome for all ages.)*

# KEY FINDINGS

- Approximately 70% of the total population lived in areas exposed to $PM_{2.5}$ concentrations above the current national standard (20 $\mu g/m^3$)

- 51 million people (97%) were exposed to harmful concentrations of $PM_{2.5}$ above 10 $\mu g/m^3$

- For ozone, we estimated that more than 49 million South Africans (94%) were exposed above the 61 ppb SA 8-h standard during the 6-month high-ozone season.

# HAP IN SOUTH AFRICA

- Post-1994 the SA government adopted policies to redress apartheid inequalities by improving access to basic services
  - Electrification programmes were successful in raising overall access to electricity, but rural areas & informal settlements tend to lag behind.

- Electrification does not necessarily translate into electricity use.
  - Households may not be able to afford electricity.
  - **Energy switching & energy stacking** describe energy use patterns where household members change which energy source they prefer for specific needs or use various energy sources simultaneously for different needs.

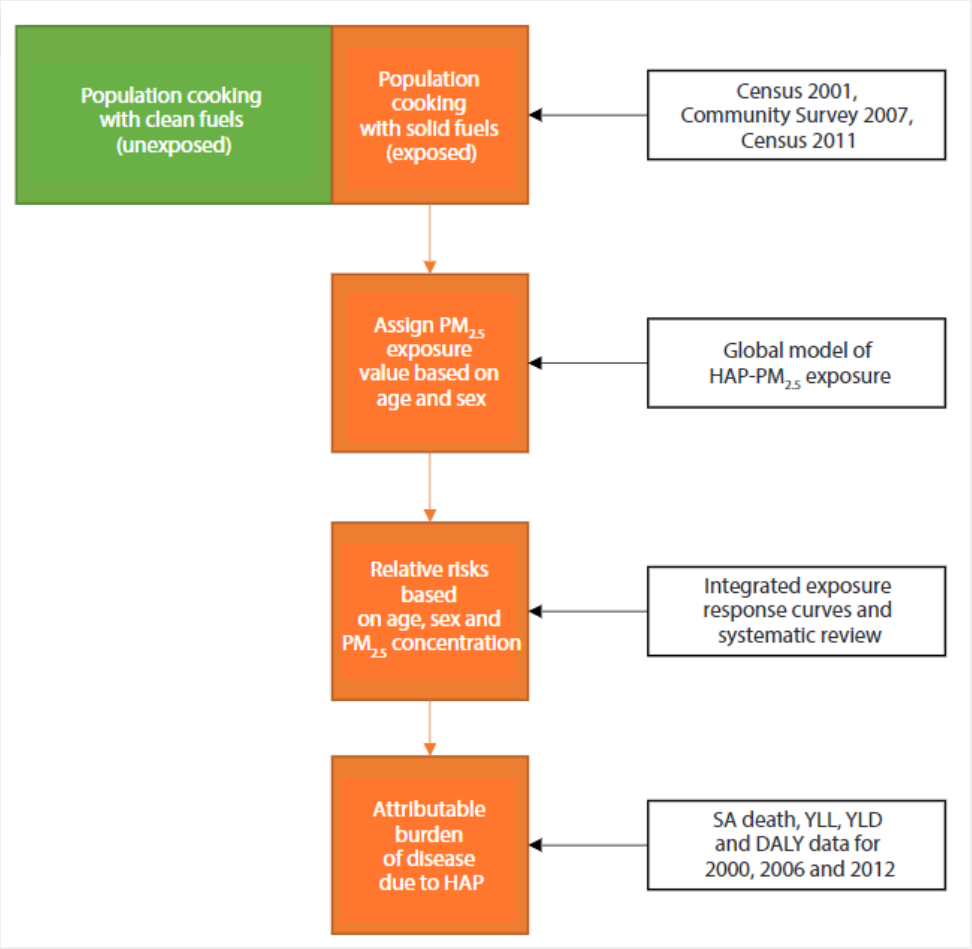
- Electricity costs continue to increase as the nation deals with rolling blackouts.

The study aimed to estimate the disease burden attributable to HAP in South Africa, for three time points:

- 2000, 2006 and 2012.

Burden of disease consists of:

- Deaths
- YLLs: years of life lost
- YLDs: years lived with disability
- DALYs: Disability-adjusted life years



# ESTIMATING THE BURDEN OF DISEASE

- Attributable fractions were calculated for males and females by age group and disease condition.
  - These were multiplied by disease burden estimates (including deaths, YLLs, YLDs and DALYs) for SA for the respective year using SA national burden of disease estimates

- Age-standardised attributable death, YLL, YLD and DALY rates were calculated using alternative mid-year estimates for each respective year and the WHO population standard.

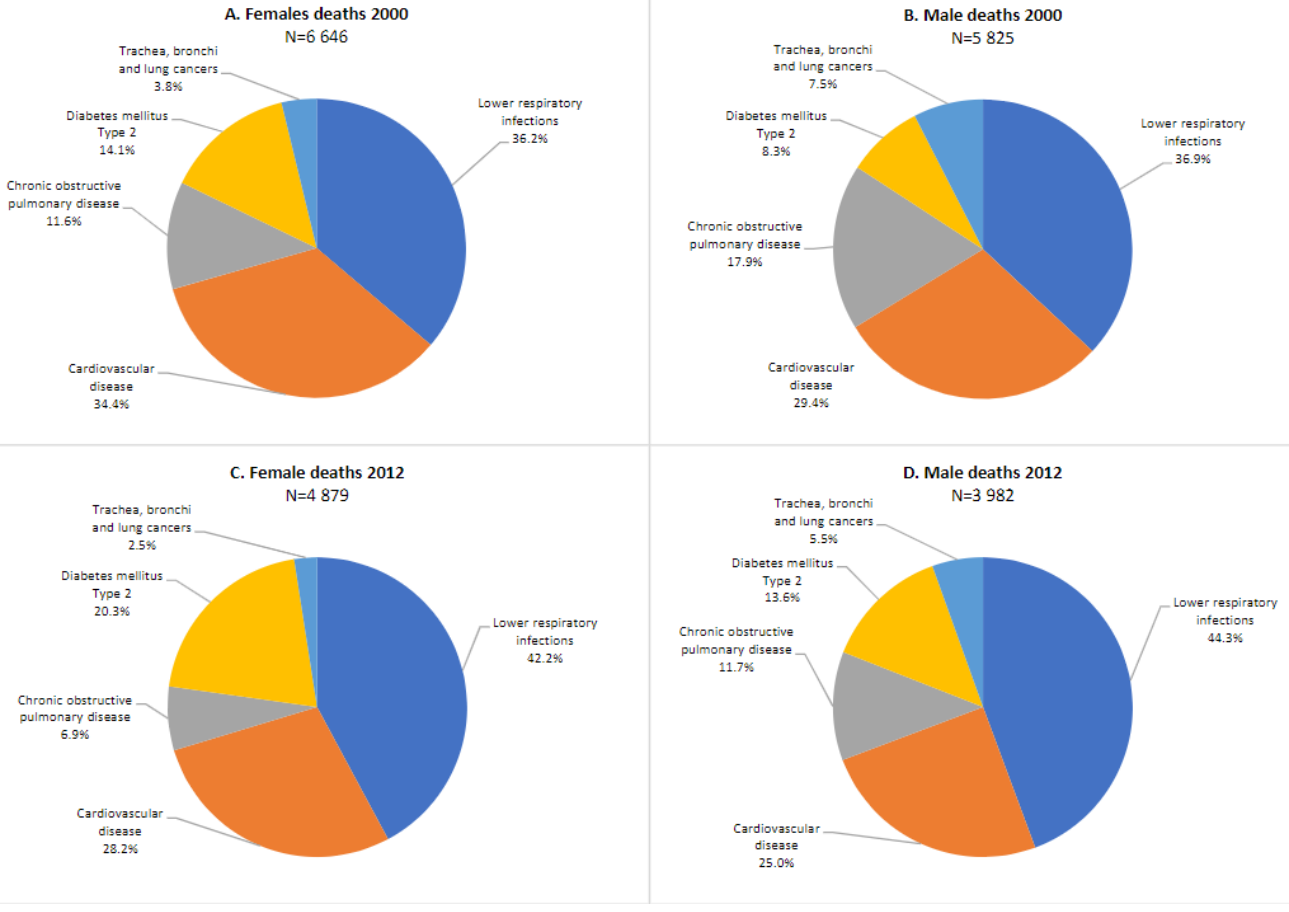
- Monte Carlo simulation techniques, using Ersatz software version 1.35 (Epigear, Australia), were used to present uncertainty ranges around the attributable burden estimates.

# PREVALENCE

- In 2012, approximately 9 million people (17.6% of the SA population) were exposed to HAP as a result of cooking with solid fuels.
- Between 2000 and 2006, the proportion of people exposed decreased by 26.0%.
- A more modest decrease (18.5%) was observed between 2006 and 2012

| HAP- PM2.5 | Deaths | | | DALYS | | |
|---|---|---|---|---|---|---|
| | 2000 | 2006 | 2012 | 2000 | 2006 | 2012 |
| Lower respiratory infections | 4 554 | 4 080 | 3 821 | 123 001 | 103 805 | 96 958 |
| Trachea, bronchi and lung cancers | 689 | 552 | 339 | 11 731 | 8 993 | 5 593 |
| Diabetes mellitus | 1 415 | 1 511 | 1 532 | 28 899 | 30 199 | 35 622 |
| Ischaemic heart disease | 2 003 | 1 730 | 1000 | 35 432 | 30 257 | 18 541 |
| Stroke | 1 993 | 1 677 | 1 369 | 34 876 | 28 362 | 22 725 |
| COPD | 1 816 | 1 372 | 801 | 45 245 | 36 104 | 28 132 |
| Cataract | 0 | 0 | 0 | 1 492 | 1 299 | 1 144 |
| ***Total attributable burden*** | **12 471** | **10 921** | **8 862** | **280 676** | **239 018** | **208 816** |

# DEATHS BY DISEASE CONDITION



# KEY FINDINGS

- An estimated 17.6% of the SA population was exposed to HAP through cooking in 2012.
  - Almost 9000 people died due to exposure to HAP in 2012.

- The number of people using solid fuels for cooking decreased between 2000 and 2012.
  - The main factor driving this decrease appears to be the increased access to electricity.
  - May have also arisen from increased use of clean fuels (e.g., solar).
  - How does this differ by province?

- While access to electricity may have increased, its affordability and reliability may restrict its use, especially in rural and informal dwellings.
  - A continued transition to cleaner fuels, such as electricity or gas, for cooking would lead to a decrease in HAP exposure.

# CONCLUSIONS

- Burden of Disease & Comparative risk Assessment studies are useful tools in helping policy makers decide where to focus.
  - It is useful to think of the disease burden in terms of lives lost as well as disability caused.

- Researchers can make recommendations, advocate for change and interventions.

# RECOMMENDATIONS

Sustain & amplify efforts to monitor and reduce ambient pollutant concentrations in the country.

A comprehensive system of monitoring stations measuring ambient air quality will provide important information in this effort.

Urgent strengthening & enforcement of air-quality-related legislation is needed to reduce both the concentrations of pollutants and consequent burden of disease.

In the longer term, the sources of pollution should be addressed, phased out and replaced with sustainable and clean energy sources, which do not produce emissions that are harmful to human health and the environment.

Regionally, efforts should also be made to establish multi-country southern African cooperation to reduce air pollution.

*"Dr Gwaze said that the work is very important.*

*She said it shows how critical the work of the air quality managers is & that they need to up the quality of their reporting/monitoring sites.*

*She said they have a lot of work to do still.*

*Dr Gwaze agreed with the recommendations & would be taking them up to the next level."*