TEMPORAL VARIATION IN THE BURDEN OF AMBIENT AIR POLLUTION IN ITALY: AN ANALYSIS FROM THE GLOBAL BURDEN OF DISEASE STUDY 1990-2019

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On behalf of the «environmental exposure and shocks» working group of the Italian Global Burden of Disease Initiative.

INTRODUCTION AND AIMS

ITALIAN GBD INITIATIVE

Within the Global Burden of Disease Italian Initiative

In collaboration with the Institute for Health Metrics and Evaluation

Collaborator-led paper

AIMS

To investigate whether the burden of disease from long-term exposure to ambient PM2.5 and ozone significantly varied in Italy from 1990 to 2019.

To separate the contribution of changes in pollutants concentrations from population dynamics.

METHODS

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Risk factors

- Particulate matter <2.5 μm ($PM_{2.5}$)
- Ozone

Exposure assessment

- Worldwide Grid estimates
- National-level population-weighted mean concentrations and the 95% uncertainty interval.

Risk estimation

Risk-attributable disease burden for ambient PM was computed for risk-outcome pairs validated for inclusion using the scientific literature.

Criteria for inclusion of risk-outcome pairs

"Since GBD 2010 we have included risk-outcome pairs that we have assessed as meeting the World Cancer Research Fund (WCRF) grades of ***convincing or probable evidence****."*

Source: GBD 2019 Risk Factors Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet 2020; 396: 1223–49.

METHODS

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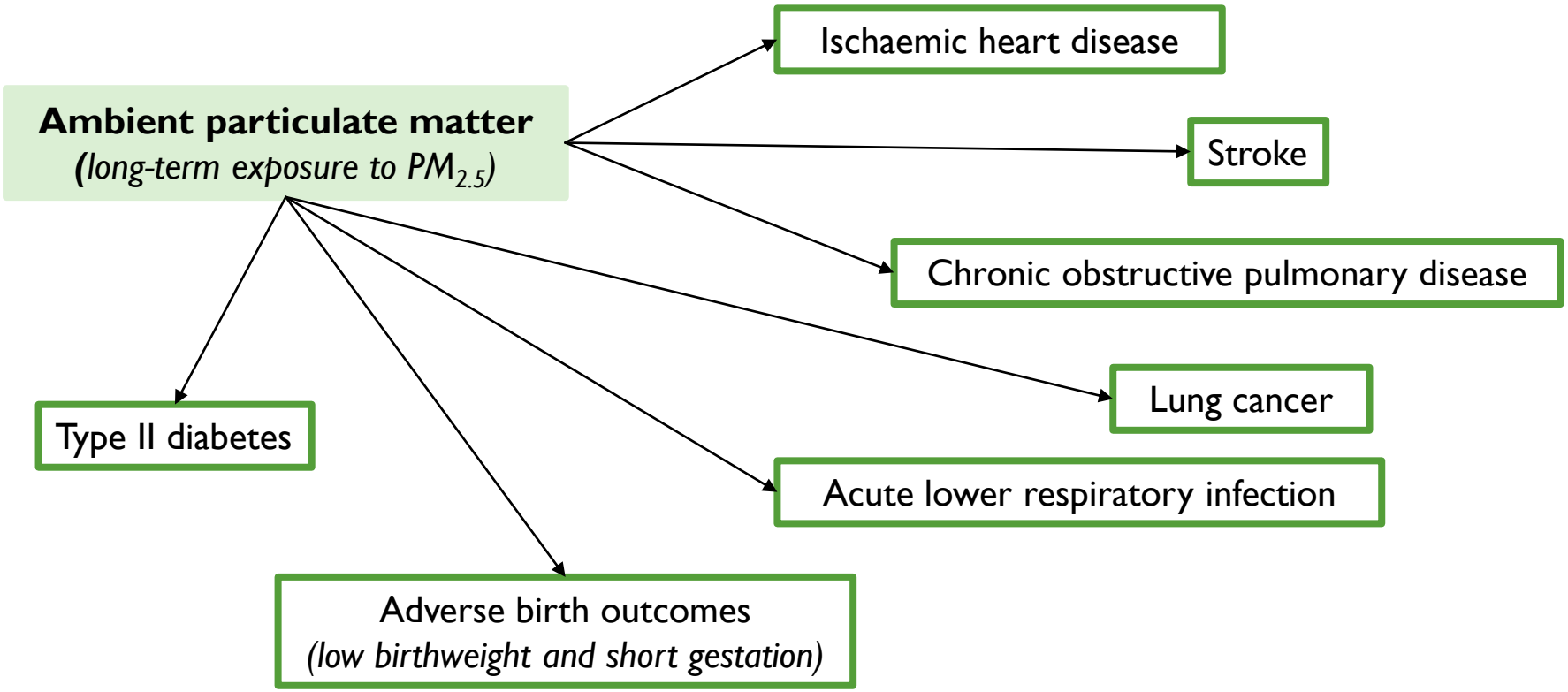
GBD 2019 risk-outcome pairs for environmental risk factors

Level 3 – Particulate matter pollution



METHODS

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GBD 2019 risk-outcome pairs for environmental risk factors

Level 3 – Ambient ozone pollution

Chronic obstructive pulmonary disease

METHODS

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Analysis

From GBD results tool

- Crude and age-standardized rates per 100,000 person-years for deaths, DALYs, YLLs and YLDs attributable to ambient particulate matter pollution and ozone pollution in Italy from 1990 to 2019.
- Percent rate variation (95% UI) in the attributable burden from 1990 to 2019, 1990 to 2010, 2010 to 2019.
- Percent rate variation (95% UI) in the overall burden of all outcomes associated with the two pollutants of interest from 1990 to 2019, 1990 to 2010, 2010 to 2019.

METHODS

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Analysis

1. Role of population ageing

Comparison of temporal variations of crude with age-standardized rates attributable to ambient PM and ozone pollution.

2. Role of disease dynamic

Comparison of temporal variations in the overall burden (age-standardized rates) of each disease with those attributable to ambient PM and ozone

RESULTS

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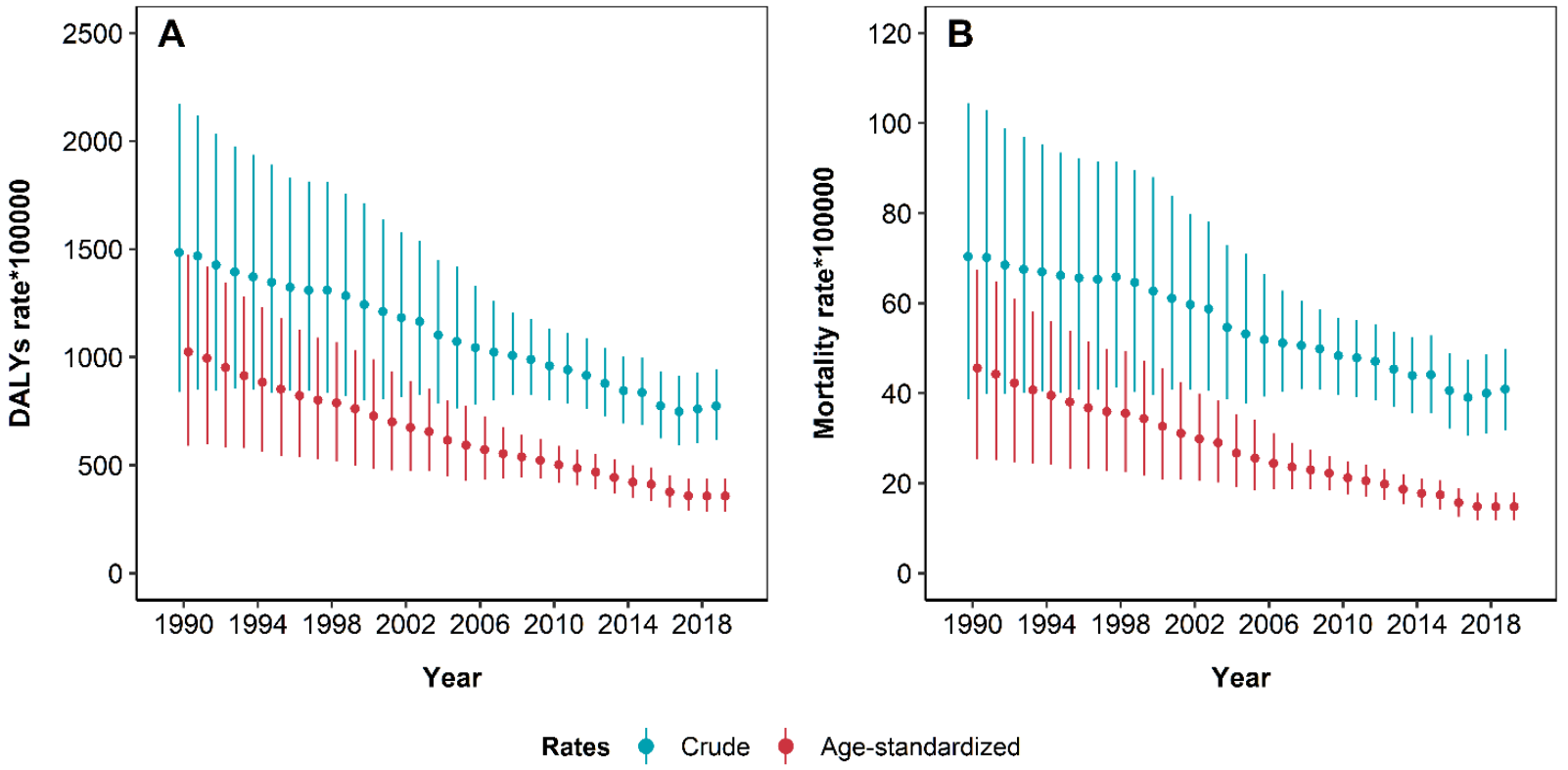

Figure 1. Time-series of the estimated crude and age-standardized rates (per 100,000 inhabitants) of disability adjusted life years (DALYs) (A), mortality (B), years lived in disability (YLDs) (C), and years of life lost (YLLs) (D), due to ambient particulate matter pollution, from 1990 to 2019.

RESULTS

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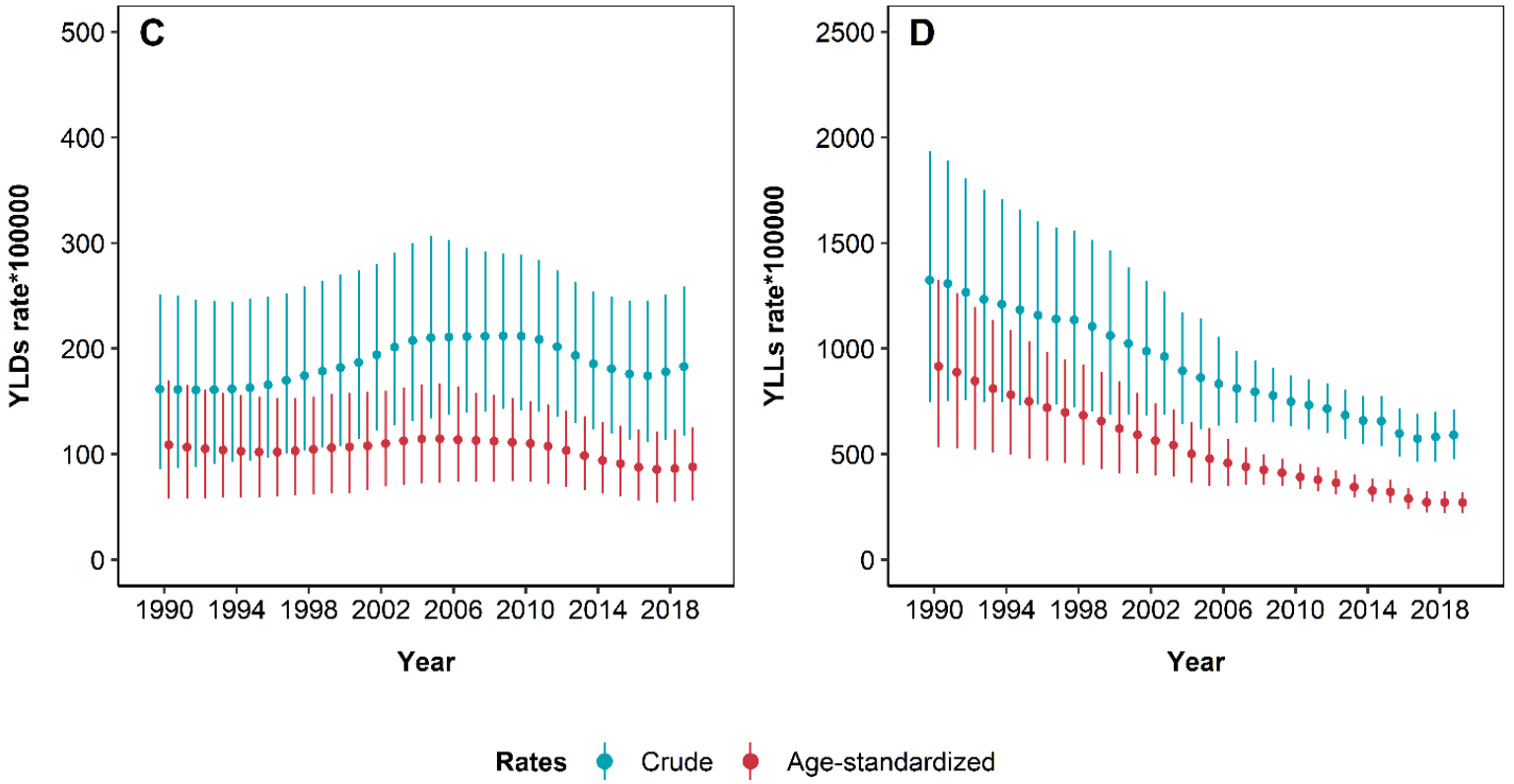

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RESULTS

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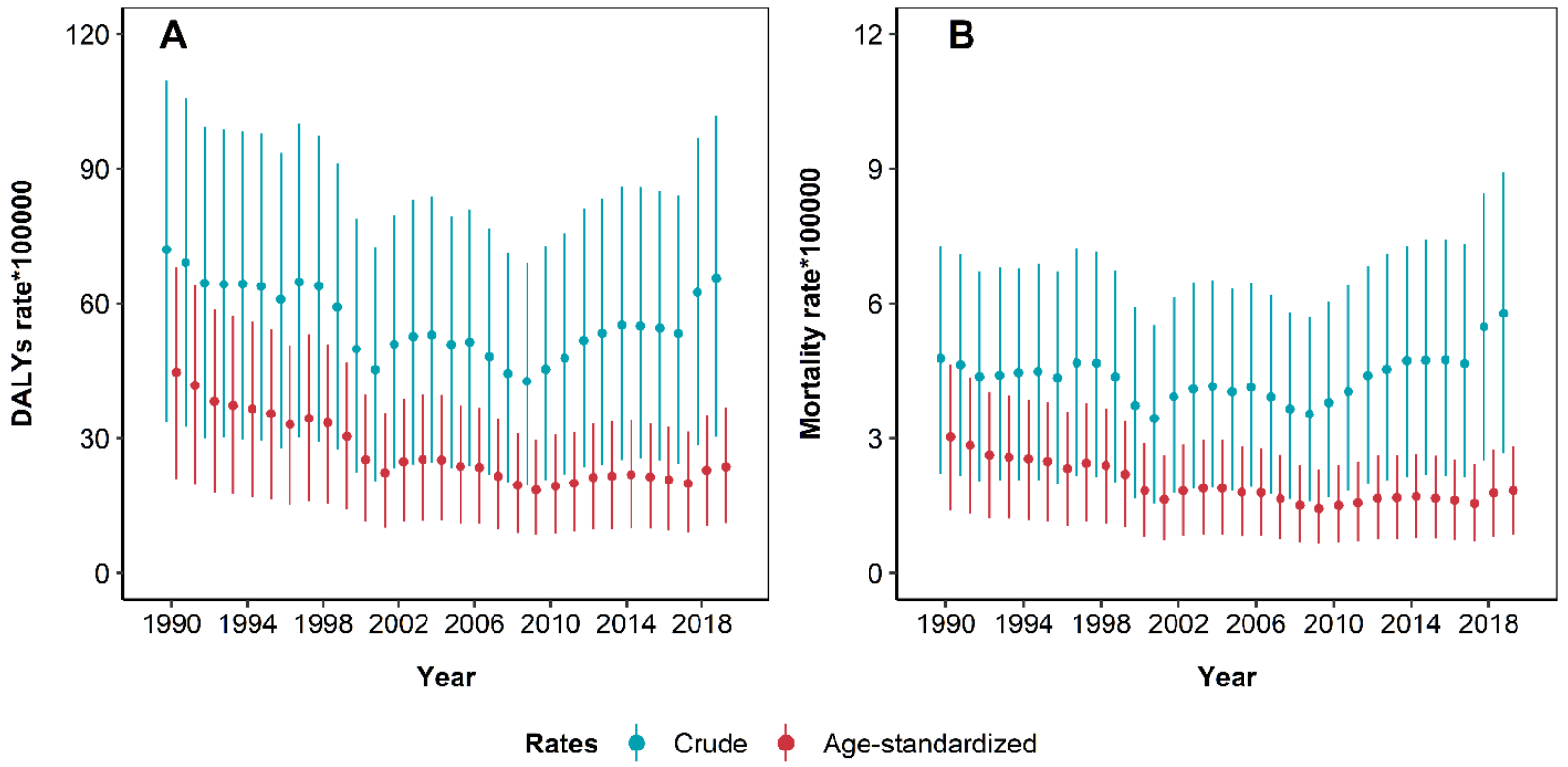

Figure 2. Time-series of the estimated crude and age-standardized rates (per 100,000 inhabitants) of disability adjusted life years (DALYs) (B)* and mortality (A) due to ambient ozone pollution, from 1990 to 2019.

**YLLs account for the whole DALYs amount*

RESULTS

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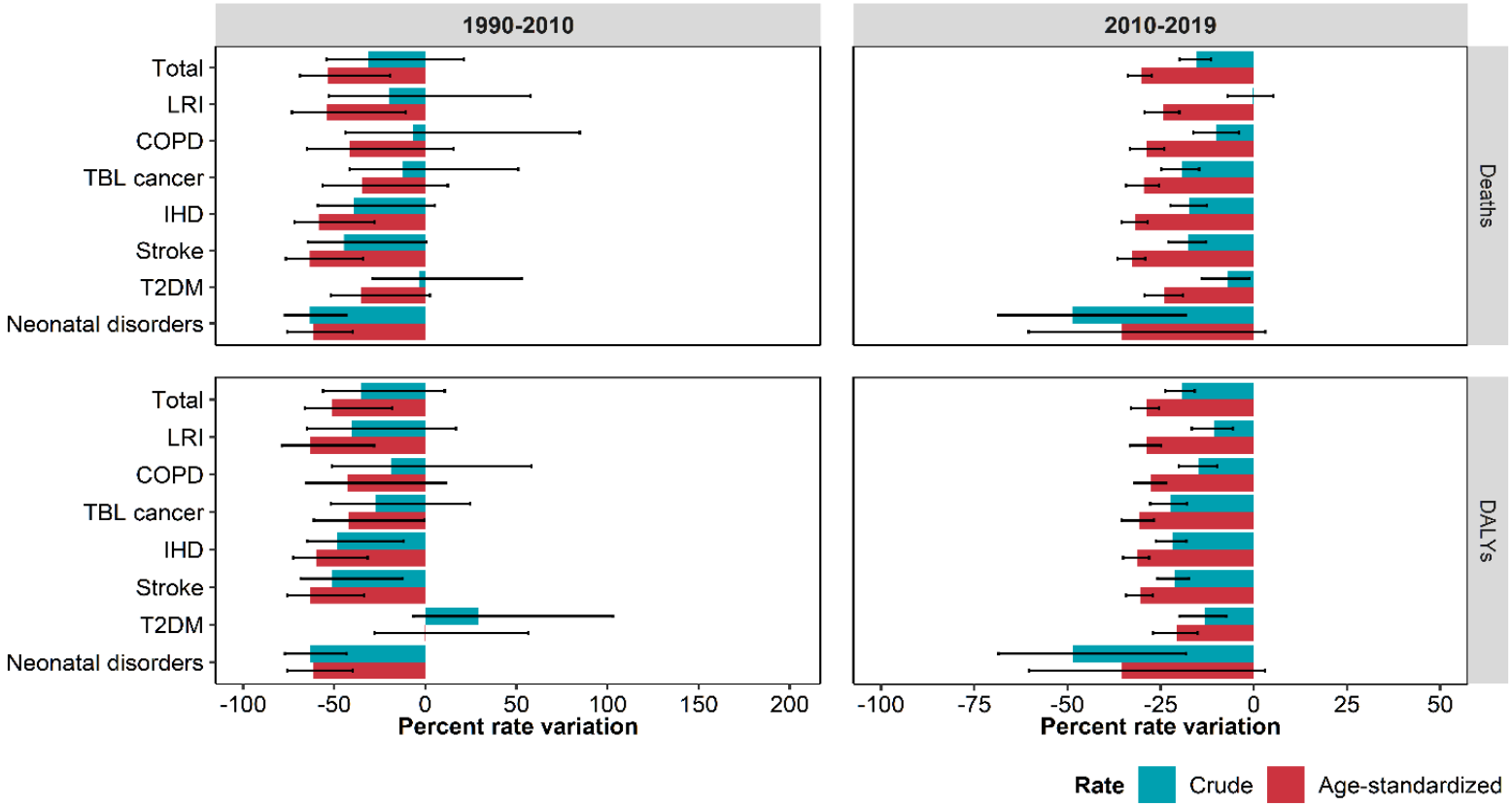

LRI: Lower respiratory infections, COPD: Chronic obstructive pulmonary disease, TBL: Tracheal, bronchus and lung, IHD: Ischemic heart disease, T2DM: Type 2 diabetes mellitus

Figure 3. Estimated percent variation in crude and age-standardized rates (per 100,000 inhabitants) of mortality (deaths) and disability adjusted life years (DALYs) due to ambient particulate matter pollution, from 1990 to 2010 and from 2010-2019, stratified by cause.

RESULTS

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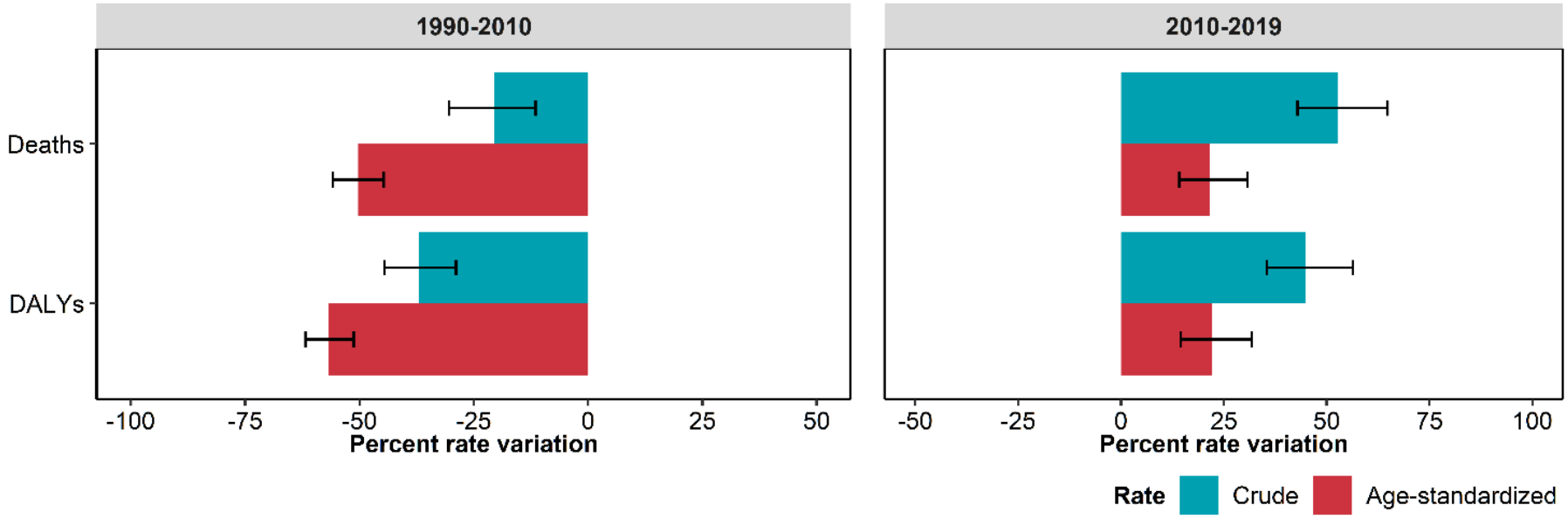

Figure 4. Estimated percent variation in crude and age-standardized rates (per 100,000 inhabitants) of mortality (deaths), and disability adjusted life years (DALYs*) due to ambient ozone pollution, from 1990 to 2010 and from 2010-2019.

**The burden of ozone is limited to chronic obstructive pulmonary disease mortality.*

RESULTS

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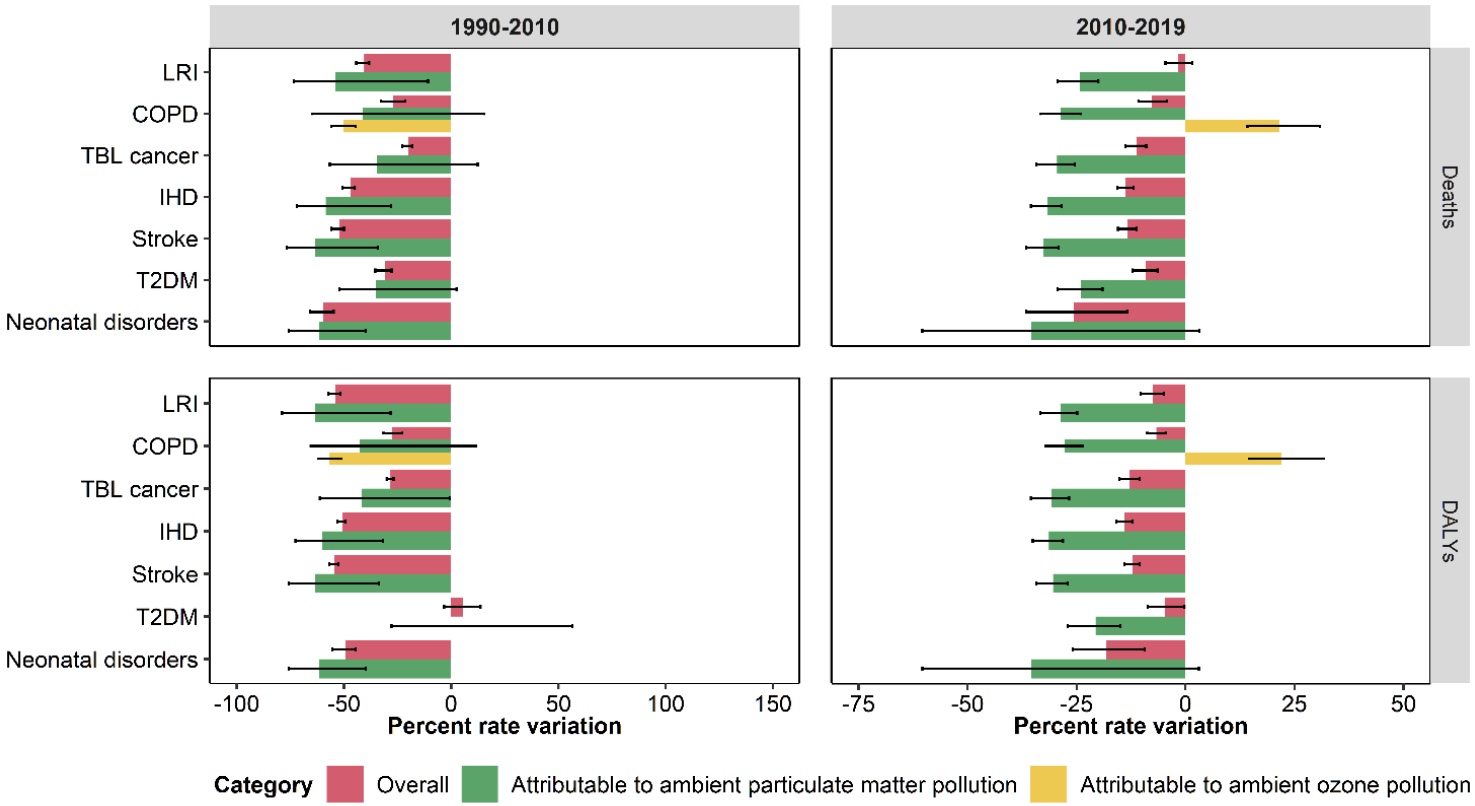

LRI: Lower respiratory infections, COPD: Chronic obstructive pulmonary disease, TBL: Tracheal, bronchus and lung, IHD: Ischemic heart disease, T2DM: Type 2 diabetes mellitus

Figure 5. Estimated percent variation in age-standardized rates (per 100,000 inhabitants) of mortality (deaths) and disability adjusted life years (DALYs) for each cause associated with ambient air pollution. Comparison among overall variations and variations in rates due to ambient particulate matter and ozone pollution, from 1990 to 2010 and from 2010-2019.

CONCLUSIONS

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Our study showed an overall decrease in the burden of ambient PM2.5 and gave strong evidences that regulations aimed at reducing the exposure had a beneficial effect on public health.

However, it also highlighted that these regulations are currently still effective in controlling the burden of PM, while ozone concentrations are on the rise.

Finally, they underline how population ageing leads to an increase in susceptible population, that partially counterbalanced the aforementioned beneficial effects.

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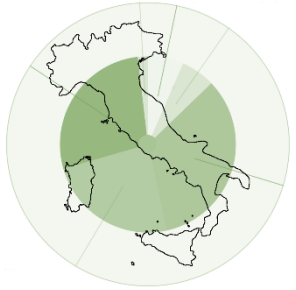

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THANK YOU FOR YOUR ATTENTION!