Air quality and health: an introduction
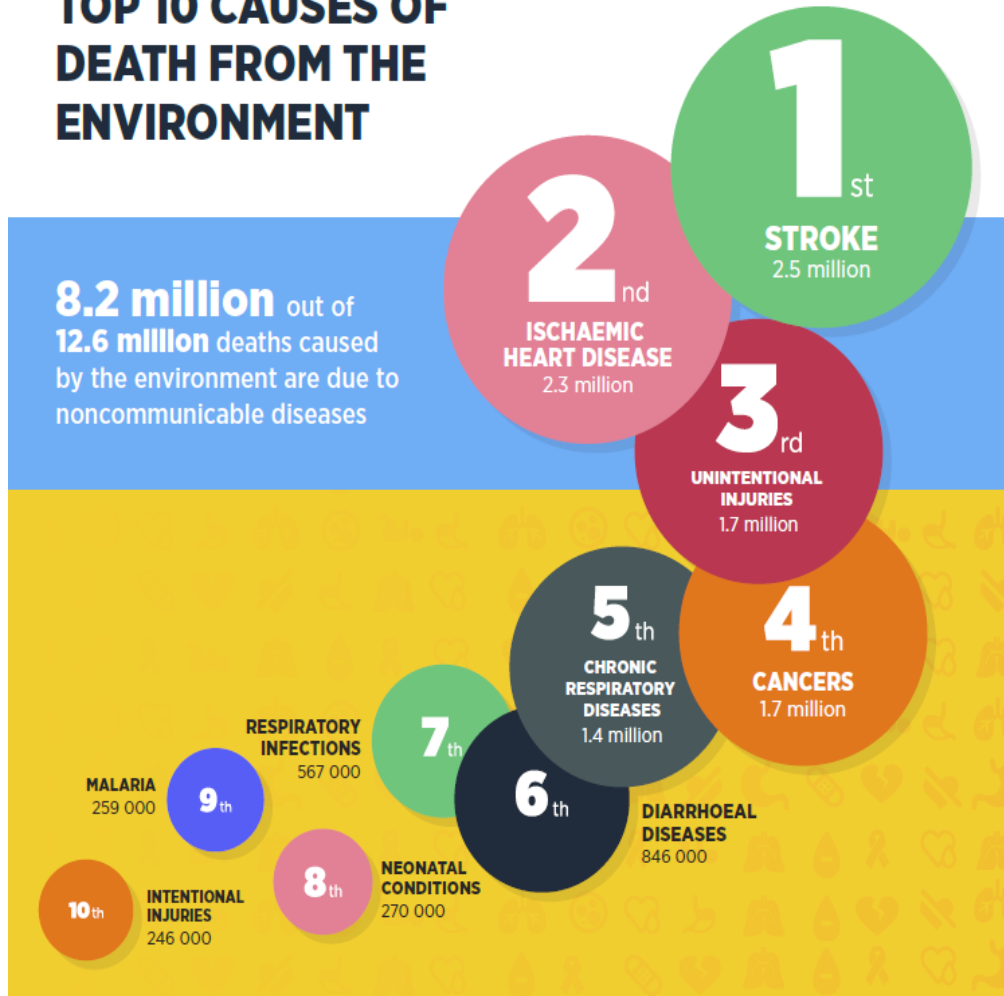
Francesca Racioppi, Head WHO European Centre for Environment and Health

Rimini, 5 November 2024

World Health Organization
European Region

Environmental burden of disease

World Health Organization
REGIONAL OFFICE FOR **Europe**

TOP 10 CAUSES OF DEATH FROM THE ENVIRONMENT

8.2 million out of **12.6 million** deaths caused by the environment are due to noncommunicable diseases

1st STROKE 2.5 million

2nd ISCHAEMIC HEART DISEASE 2.3 million

3rd UNINTENTIONAL INJURIES 1.7 million

4th CANCERS 1.7 million

5th CHRONIC RESPIRATORY DISEASES 1.4 million

6th DIARRHOEAL DISEASES 846 000

7th RESPIRATORY INFECTIONS 567 000

8th NEONATAL CONDITIONS 270 000

9th MALARIA 259 000

10th INTENTIONAL INJURIES 246 000

- Globally, 23% of all deaths are linked to environmental conditions

- **Every year, at least 1.4 million Europeans still die prematurely because of polluted environments.**

- This is at least 15% of Europe's total deaths.

- 50 million heathy life years are lost in the European Region due to environmental hazards.

Noncommunicable diseases - NCDs - heart and lung diseases, stroke, cancer and diabetes - are THE BIGGEST KILLERS WORLDWIDE

5 main NCD risks

Unhealthy diet
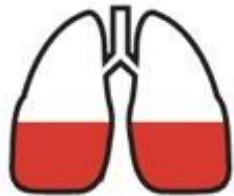
Tobacco use

Air pollution

Harmful use of alcohol

Physical inactivity

1 in 8 deaths
worldwide from air pollution, mainly from NCDs

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THE
INVISIBLE KILLER

Air pollution may not always be visible, but it can be deadly.

29%
OF DEATHS FROM
LUNG CANCER

24%
OF DEATHS FROM
STROKE

25%
OF DEATHS FROM
HEART DISEASE

43%
OF DEATHS FROM
LUNG DISEASE

Population attributable fraction (PAF) for mortality attributable to the joint effects of household and ambient air pollution in 2016

World Health Organization

In the WHO European Region in 2019:
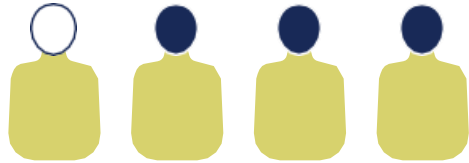
97% of the population
were exposed to $PM_{2.5}$
concentrations above the
WHO air quality guidelines.
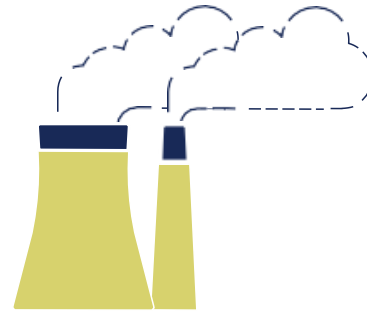
569 000 premature
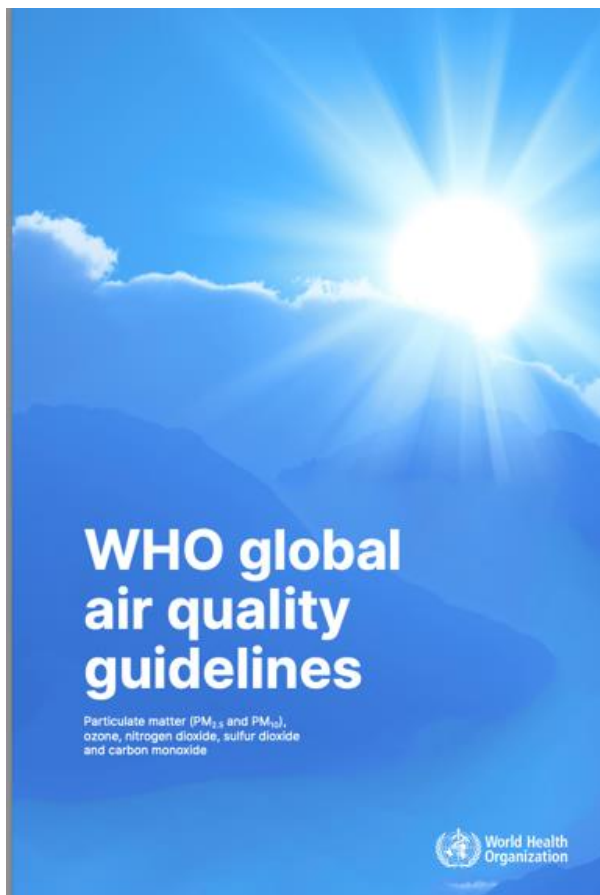**deaths** can be attributed
to ambient air pollution.

154 000 deaths
can be attributable to
household air pollution.

World Health
Organization

European Region

Air pollution and health

- Around **7 million premature deaths** are attributable to the joint effects of ambient and household air pollution and of these, more than **550 000 happen in the WHO European Region**.

- Air pollution is now recognized as the single biggest environmental threat to human health, along with climate change.

- Air pollution affects:

  - NCDs,

  - cardiovascular and respiratory diseases,

  - lower respiratory tract infections,

  - preterm birth,

  - and other causes of death in children and infants.

The updated WHO Air Quality Guidelines: a new tool to support action and save lives

WHO global air quality guidelines

Particulate matter (PM₂.₅ and PM₁₀), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide

- Since the last 2005 global update, there has been a marked increase in the quality and quantity of evidence that shows how air pollution affects different aspects of health.

- There are also now clearer insights about sources of emissions and the contribution of air pollutants to the global burden of disease.

- For that reason, and after a systematic review of the accumulated evidence, **several of the updated AQG levels are now lower than 15 years ago.**

- New features include new AQG levels for peak-season O_3 and 24-h NO_2 and CO, as well as new interim targets.

Table 0.1. Recommended AQG levels and interim targets

Pollutant	Averaging time	Interim target				AQG level
		1	2	3	4	
PM$_{2.5}$, µg/m³	Annual	35	25	15	10	5
	24-hour[a]	75	50	37.5	25	15
PM$_{10}$, µg/m³	Annual	70	50	30	20	15
	24-hour[a]	150	100	75	50	45
O$_3$, µg/m³	Peak season[b]	100	70	–	–	60
	8-hour[a]	160	120	–	–	100
NO$_2$, µg/m³	Annual	40	30	20	–	10
	24-hour[a]	120	50	–	–	25
SO$_2$, µg/m³	24-hour[a]	125	50	–	–	40
CO, mg/m³	24-hour[a]	7	–	–	–	4

[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.

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New evidence syntheses on long-term exposure to air pollutants

PM$_{2.5}$, PM$_{10}$ & mortality

106 studies (46 AQG, 60 new)

Higher estimates for most of associations

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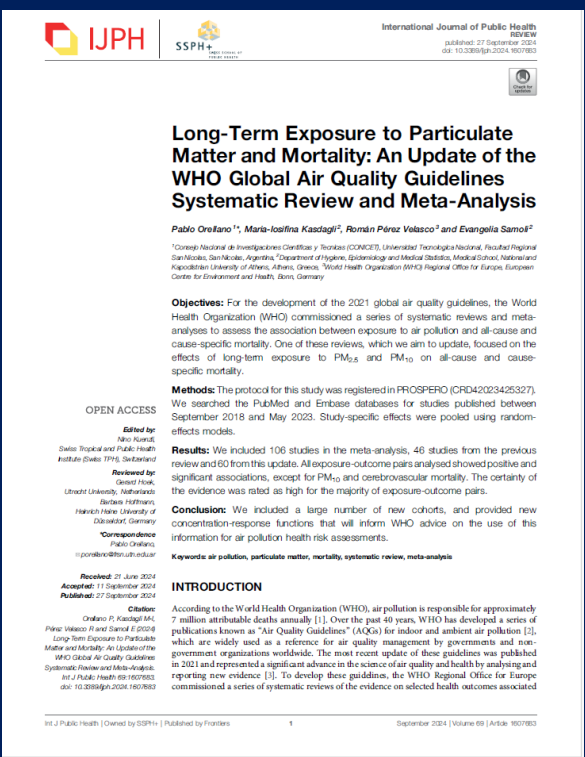
NO$_2$, O$_3$ & mortality

90 studies (45 AQG, 45 new)

Higher estimates for many of the associations

New significant, positive associations for NO$_2$ and circulatory, IHD and lung cancer mortality
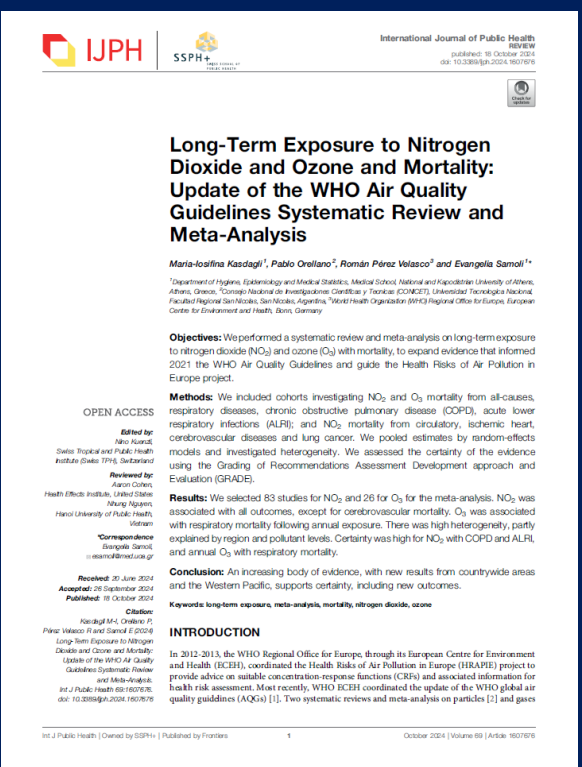
10.3389/ijph.2024.1607676

PM$_{2.5}$, NO$_2$ and morbidity

Not considered in AQG (only short-term exposures)

List A (reliable quantification): PM$_{2.5}$ – asthma in children, COPD, IHD, stroke, hypertension, lung cancer; NO$_2$ – asthma in children and adults, ALRI in children)

List B+ (quantification with uncertainty): PM$_{2.5}$ – diabetes (type 2), dementia, autistic spectrum disorder)
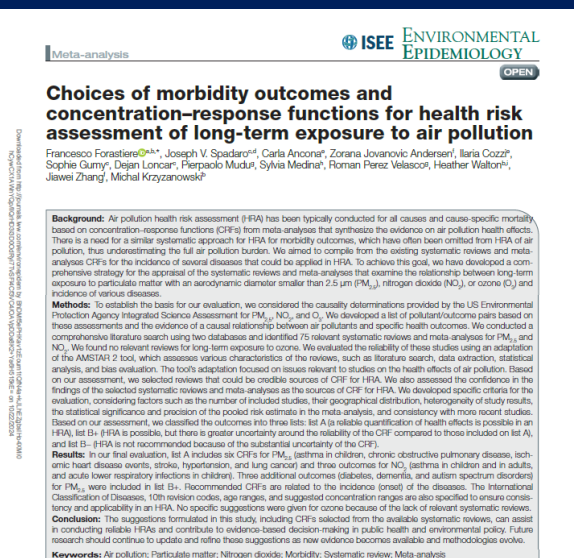
10.1097/EE9.0000000000000314

Comparison between SR/MAs for PM (2020 and 2024)
(examples for selected mortality causes)

Pollutant	Outcome (mortality)	Current systematic review			Chen and Hoek [4]		
		N	RR (95% CI)	Certainty of the evidence	N	RR (95% CI)	Certainty of the evidence
$PM_{2.5}$	All-cause	53	1.095 (1.064–1.127)	High	25	1.08 (1.06, 1.09)	High
	Circulatory	42	1.127 (1.102–1.152)	Mod.	21	1.11 (1.09, 1.14)	High
	IHD	34	1.143 (1.102–1.186)	High	22	1.16 (1.10, 1.21)	High
	Cerebrovascular	28	1.146 (1.101–1.192)	Mod.	16	1.11 (1.04, 1.18)	High
	ALRI	12	1.204 (1.095–1.325)	High	4	1.16 (1.01, 1.34)	High
	Lung cancer	26	1.093 (1.053–1.135)	High	15	1.12 (1.07, 1.16)	High
	Respiratory	28	1.136 (1.079–1.197)	High	17	1.10 (1.03, 1.18)	Mod.
	COPD	19	1.138 (1.080–1.198)	High	11	1.11 (1.05, 1.17)	High
PM_{10}	All-cause	28	1.081 (1.052–1.110)	High	17	1.04 (1.03, 1.06)	High
	Circulatory	26	1.080 (1.042–1.120)	High	15	1.04 (0.99, 1.10)	Mod.
	IHD	16	1.055 (1.019–1.092)	High	13	1.06 (1.01, 1.10)	Mod.
	Cerebrovascular	15	1.049 (0.973–1.131)	Mod.	9	1.01 (0.83, 1.21)	Low
	Lung cancer	17	1.101 (1.052–1.152)	High	13	1.08 (1.04, 1.13)	High
	Respiratory	21	1.122 (1.076–1.169)	High	13	1.12 (1.06, 1.19)	High
	COPD	7	1.215 (1.027–1.438)	High	5	1.19 (0.95, 1.49)	Mod.

N, number of estimates; RR, pooled relative risks; 95% CI, 95% confidence interval; IHD, ischaemic heart disease; ALRI, acute lower respiratory infection; COPD, chronic obstructive pulmonary disease; Mod., moderate.

Budapest Declaration

7ᵗʰ Ministerial Conference on Environment & Health
5–7 July 2023

Budapest Declaration and its
Road Map to 2030 aim to accelerate
progress and action towards addressing
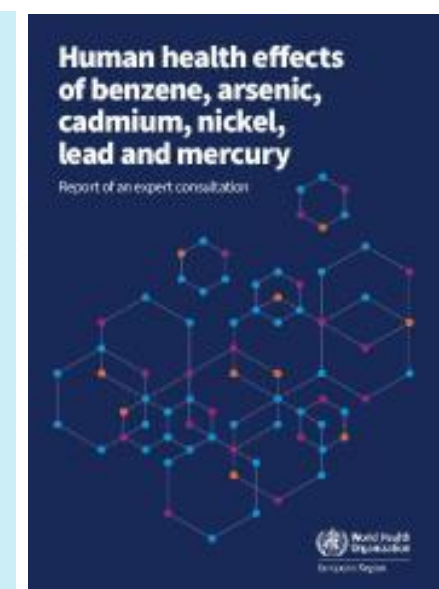health challenges related to

- **climate change**

- **environmental pollution**

- **loss of biodiversity**

while recovering from the COVID-19 crisis.

Supporting implementation of the Air Quality

- Resource package – tools and instruments for AQ management

- Public health messages and personal interventions to reduce exposure to air pollution

- Update of the methods to assess health risks of air pollution in Europe (HRAPIE 2)

- Science-policy dialogues in Member States

- UNECE – LRTAP Convention TFH meetings & workplan

- Capacity building

Thank you

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https://www.who.int/europe/health-topics/environmental-health