Comité Operativo

Revisión de la Norma Primaria de Calidad Ambiental para $MP_{2,5}$

Presentación Comité Operativo | SESIÓN N°2/2023

miércoles 15 de marzo, 2023

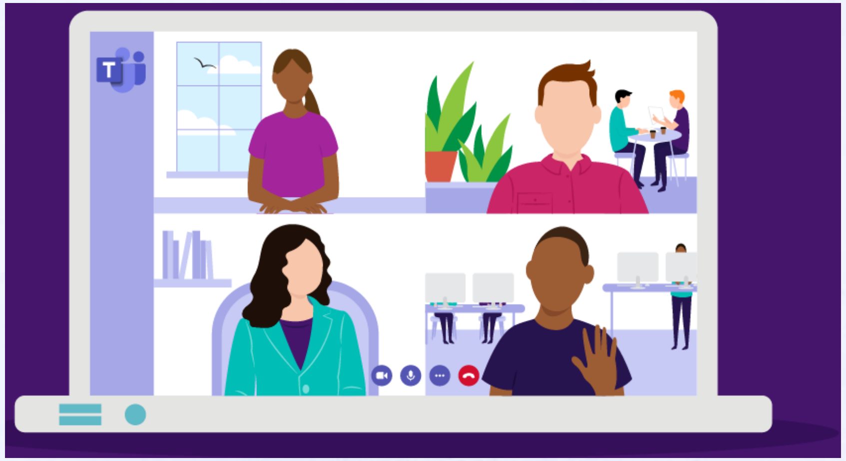
Jonás Muñoz Cordero
División de Calidad del Aire
Ministerio del Medio Ambiente

2da Reunión Comité Operativo

Temas a tratar:

1. Presentación sobre la caracterización de efectos adversos en salud relacionados al $MP_{2,5}$.

2. Discusión de conformación del Comité Operativo Ampliado.



Estudio en curso

"Estudio de Antecedentes para la revisión de la Norma Primaria de Calidad Ambiental para Material Particulado Respirable ($MP_{2,5}$)"

OBJ

Proveer antecedentes al proceso de revisión del Decreto Supremo N°12, de 2011, del Ministerio del Medio Ambiente que establece "Norma primaria de calidad ambiental para material particulado fino respirable $MP_{2,5}$", mediante una evaluación técnica, económica y científica considerando los costos y desafíos asociados a diferentes escenarios regulatorios

Estudio finaliza en mayo de 2023

Expediente electrónico

https://planesynormas.mma.gob.cl/normas/expediente/index.php?tipo=busqueda&id_expediente=939510

Normas de Calidad | Normas de Emisión | Planes | Búsqueda

Normas de Calidad > Revisión Norma de Calidad Primaria de MP2.5, D.S. N°12 de 2011 > Expediente

Según el reglamento de las normas y planes es necesario cumplir con mantener un expediente en el cual se incluya toda la informacion generada en el proceso de elaboración o revisión de normas..

Ficha | Expediente

Nombre Revisión Norma de Calidad Primaria de MP2.5, D.S. N°12 de 2011

Estado En elaboración

Documentos Publicados

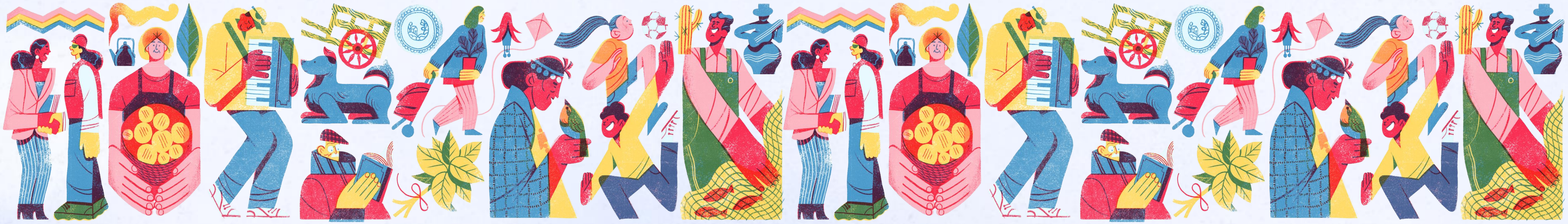
N°	N° Folio	Documento	Materia	Remitido por	Fecha de Publicación
1	1 - 2	Resolución Inicio Anteproyecto	Resolución N° 1319	Ministerio del Medio Ambiente	22-11-2021
2	3	Rectifica Resolución N°1319	Resolución N° 1382	Ministerio del Medio Ambiente	09-12-2021
3	4-5	Publicación Diario Oficial	Publicación D.O.	Ministerio del Medio Ambiente	24-12-2021
4	6	Publicación Diario Oficial	Publicación D.O.	Ministerio del Medio Ambiente	24-12-2021

Próxima Reunión

Actividad	Objetivo actividad	Fecha tentativa
3° reunión C.O.	Obj: (1) Análisis normativo del MP2,5 en Chile. (2) Cierre del COA.	1ra semana de abril

Ministerio del Medio Ambiente

Gobierno de Chile

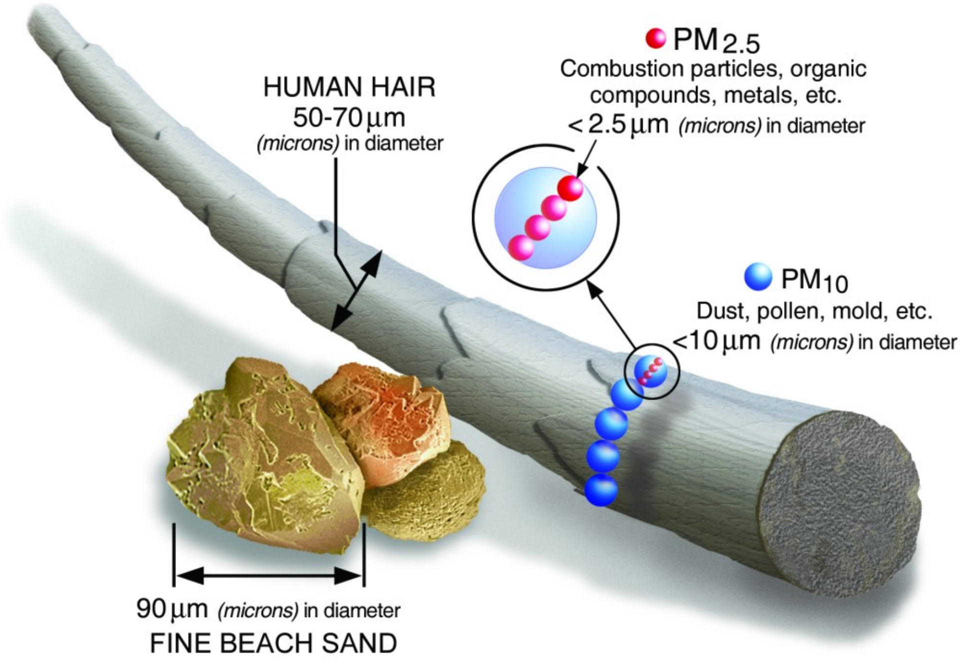


$MP_{2,5}$

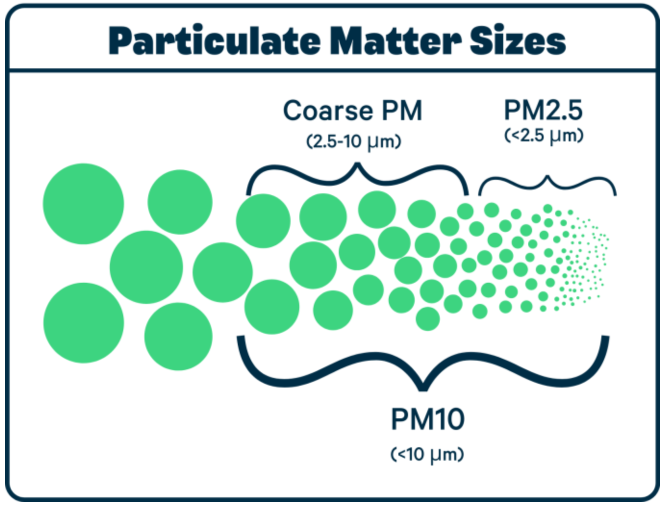
Marzo, 2023

Andrés Henríquez, Ph.D.
andhencor@gmail.com

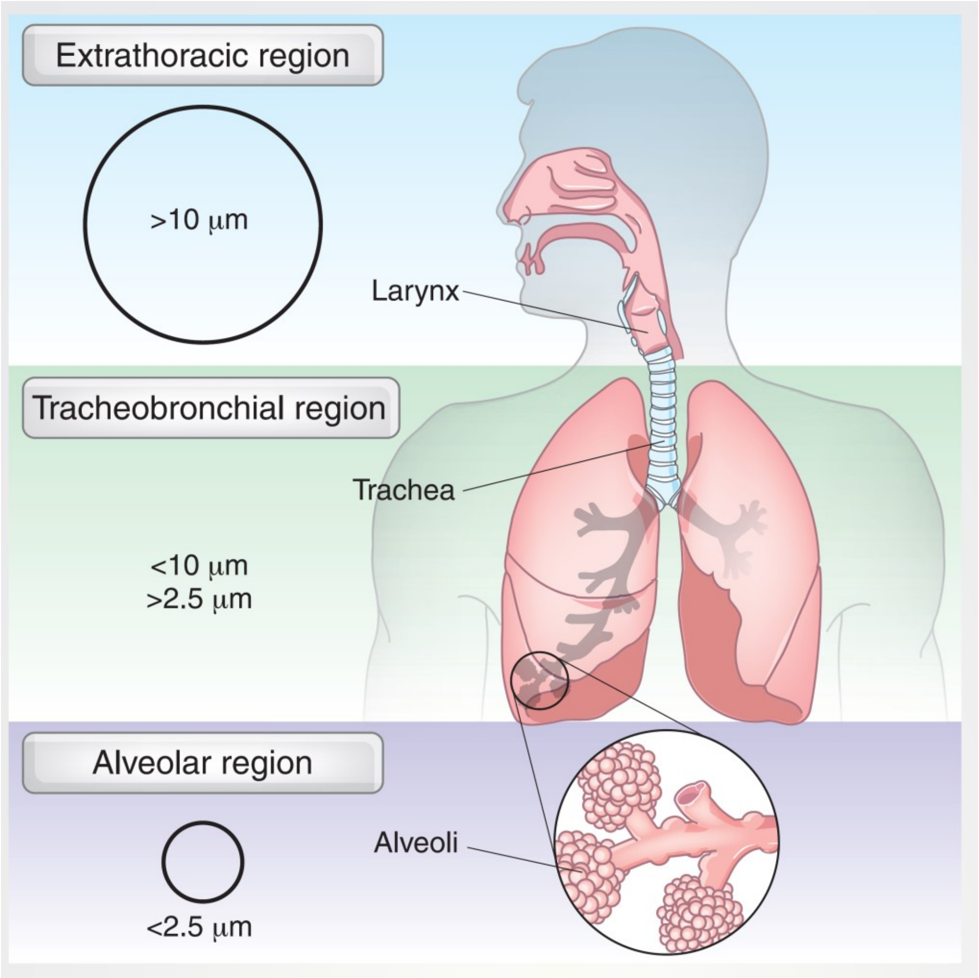
$PM_{2.5}$



https://www.epa.gov/sites/production/files/2016-09/pm2.5_scale_graphic-color_2.jpg



https://learn.kaiterra.com/en/air-academy/particulate-matter-pm



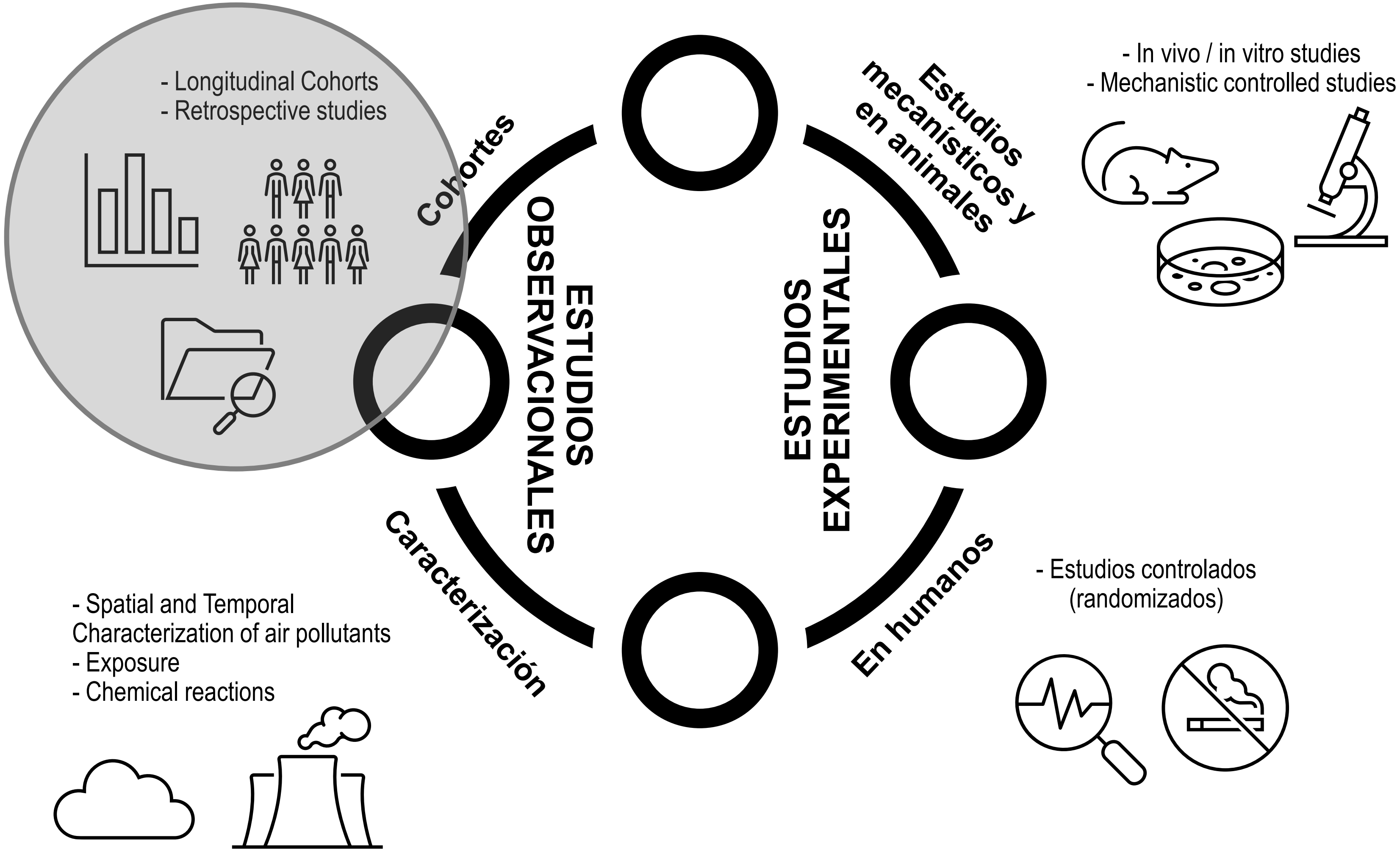
Lippmann 2010

Size → Particle Deposition

$PM_{2.5}$ (and air pollution)-induced Health Effects

Research

Meta-analysis



Modified from, Burns et al et al. 2022

$PM_{2.5}$ (and air pollution) **CAUSAL** effects on human health

000061 VTA

Bradford Hill criteria in next-generation epidemiology

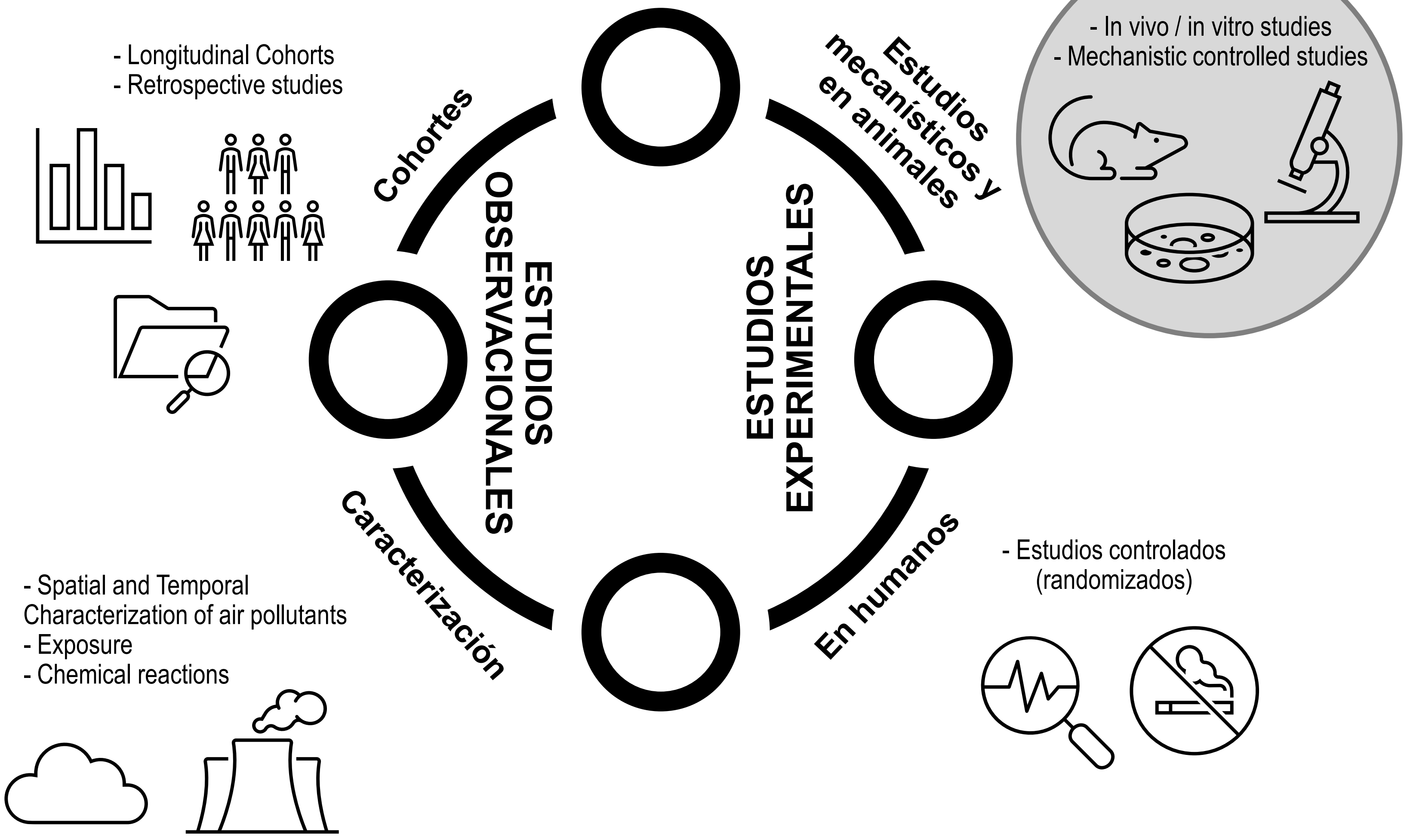
Bradford Hill criterion	Consideration in next-generation epidemiology
Strength	Size of the estimated effect
Consistency	Consistency of evidence across studies
Specificity	How specific the mechanisms of the effect are
Temporality	Whether the temporal relationship between exposure and outcome is plausible
Biological gradient	Whether there is evidence of a biological gradient (dose–response)
Plausibility	Whether a plausible mechanism between exposure and outcome can be established
Coherence	Whether other types of coherent evidence exist
Experiment	Whether experimental evidence supports the observational data
Analogy	Whether similar exposures are expected to lead to similar outcomes

https://link.springer.com/article/10.1007/s00125-020-05246-w

PM$_{2.5}$ (and air pollution)-induced Health Effects

Research

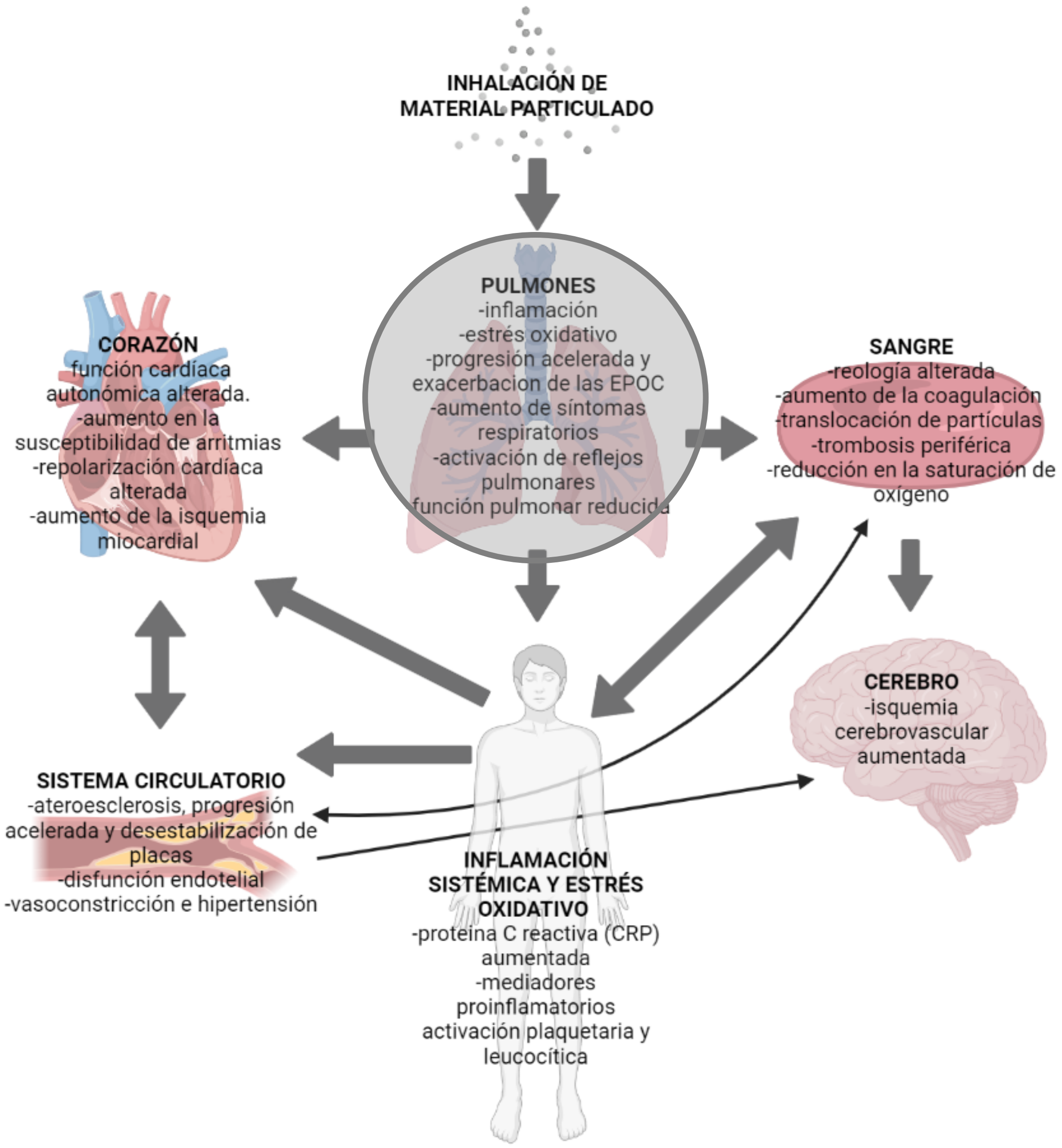
Meta-analysis



Modified from, Burns et al et al. 2022

$PM_{2.5}$ (and air pollution)-induced Health Effects / Mechanisms

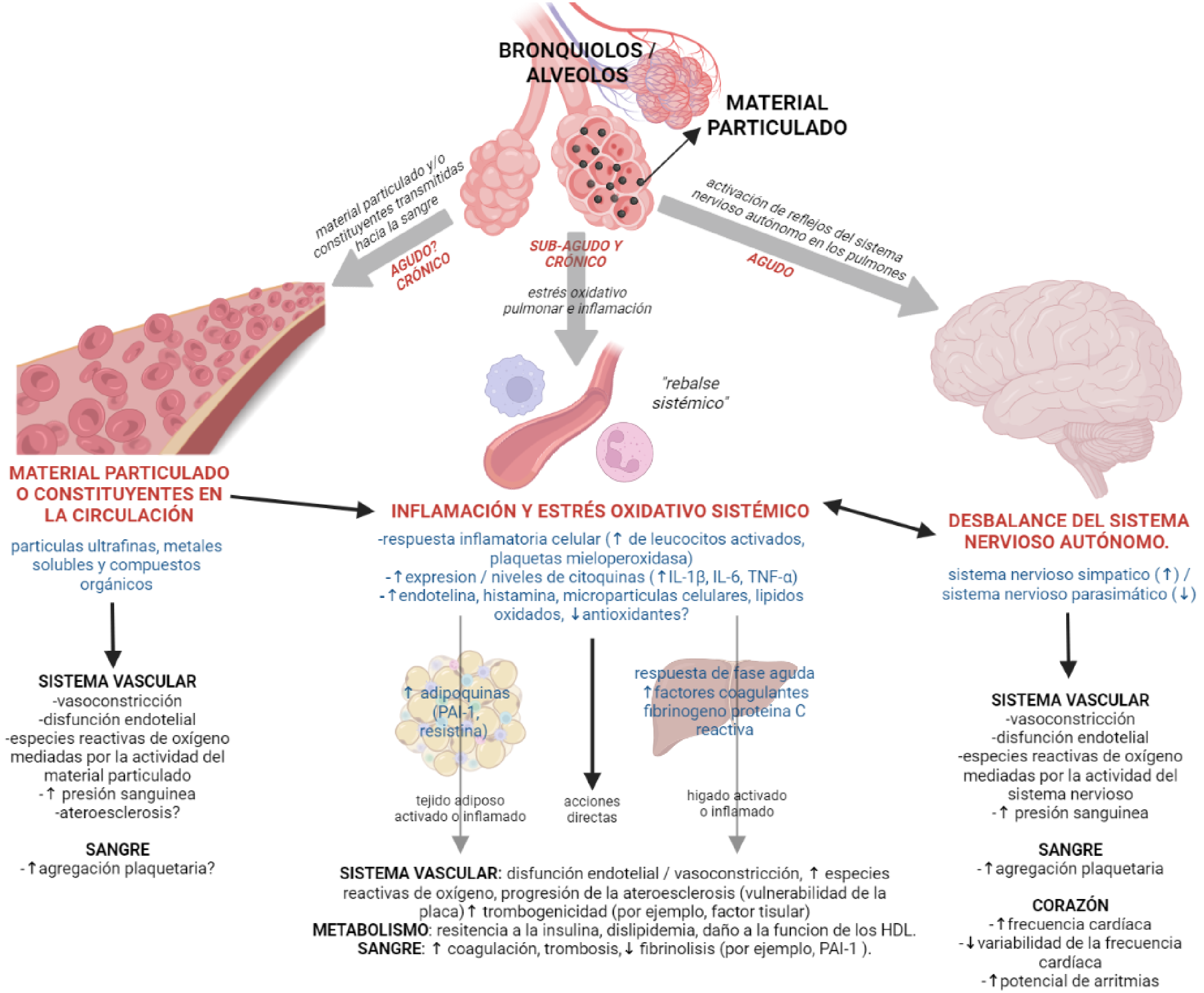
000062 VTA



Material particulado y efectos en la salud pulmonares y extrapulmonares.
Figura adaptada y traducida desde (Pope & Dockery, 2006).

$PM_{2.5}$ (and air pollution)-induced Health Effects / Mechanisms

000063



Pozo sin fondo

Material particulado y efectos en la salud pulmonares y extrapulmonares. Figura adaptada y traducida desde (Brook et al., 2010b)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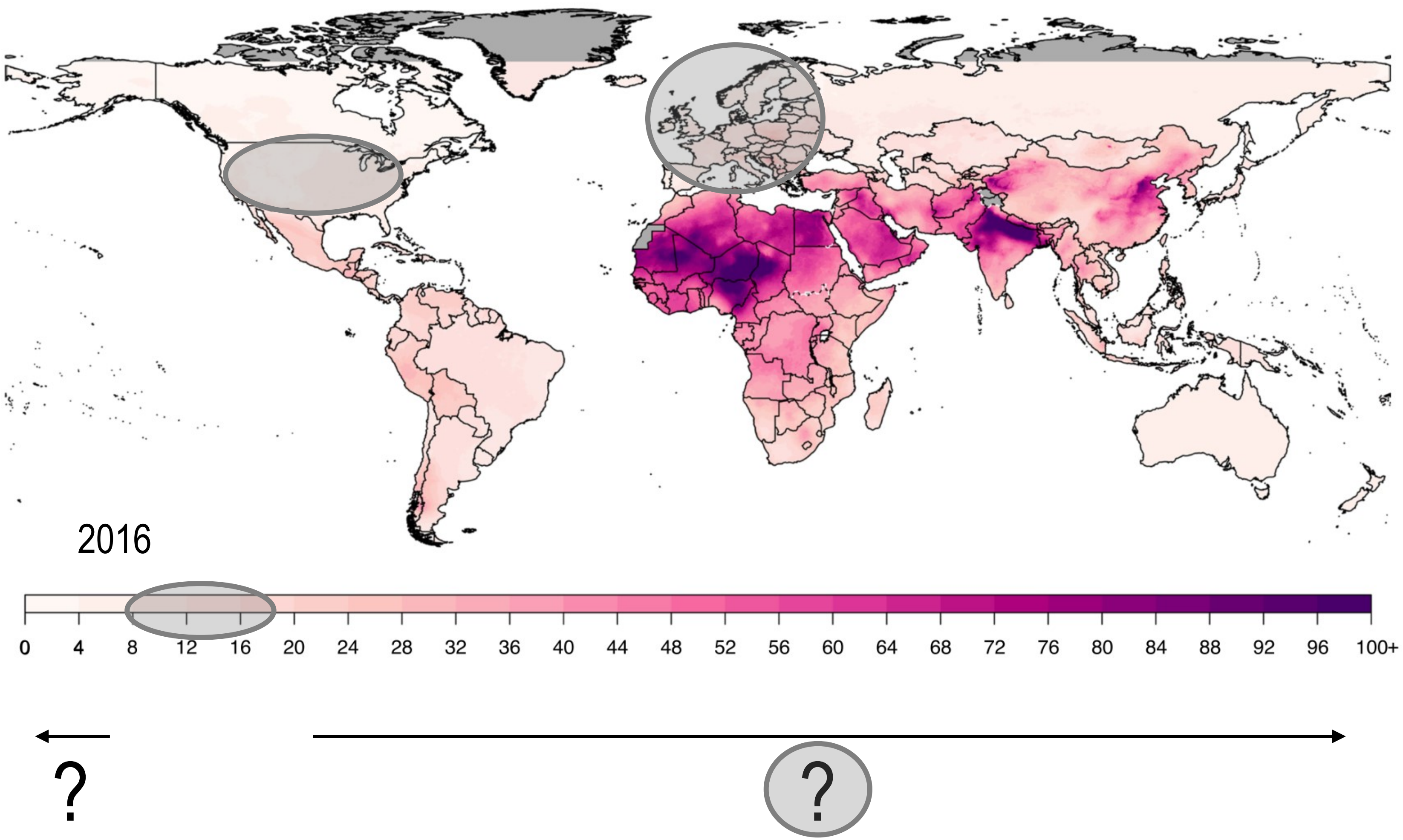
$PM_{2.5}$ levels worldwide

Annual concentrations (ug/m^3) of $PM_{2.5}$ for 2016



Shaddick et al. 2020

atmosphere
MDPI

Article

Relative Risk Functions for Estimating Excess Mortality Attributable to Outdoor $PM_{2.5}$ Air Pollution: Evolution and State-of-the-Art

Richard Burnett [1,*] and Aaron Cohen [1,2]

1 Institute for Health Metrics and Evaluation, University of Washington, Seattle, WA 98121, USA; acohen@healtheffects.org
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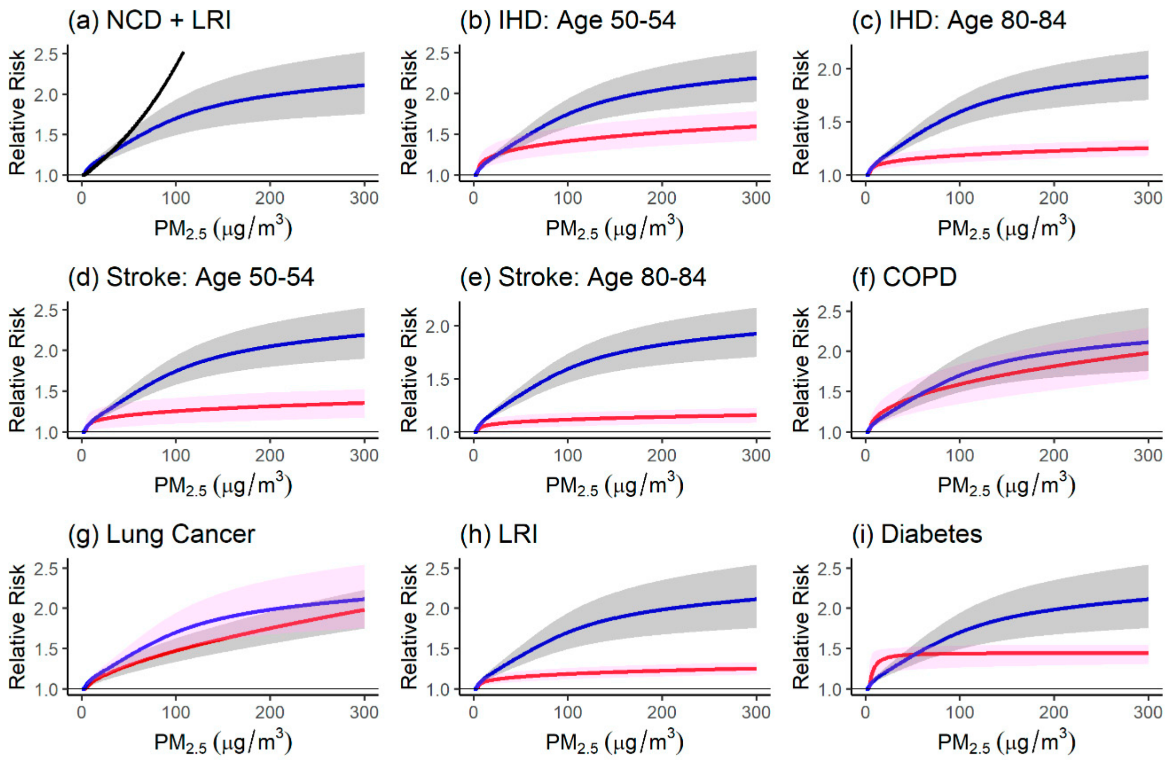


3. Estimators of the PM2.5 Mortality Relative Risk over the Global Concentration Range

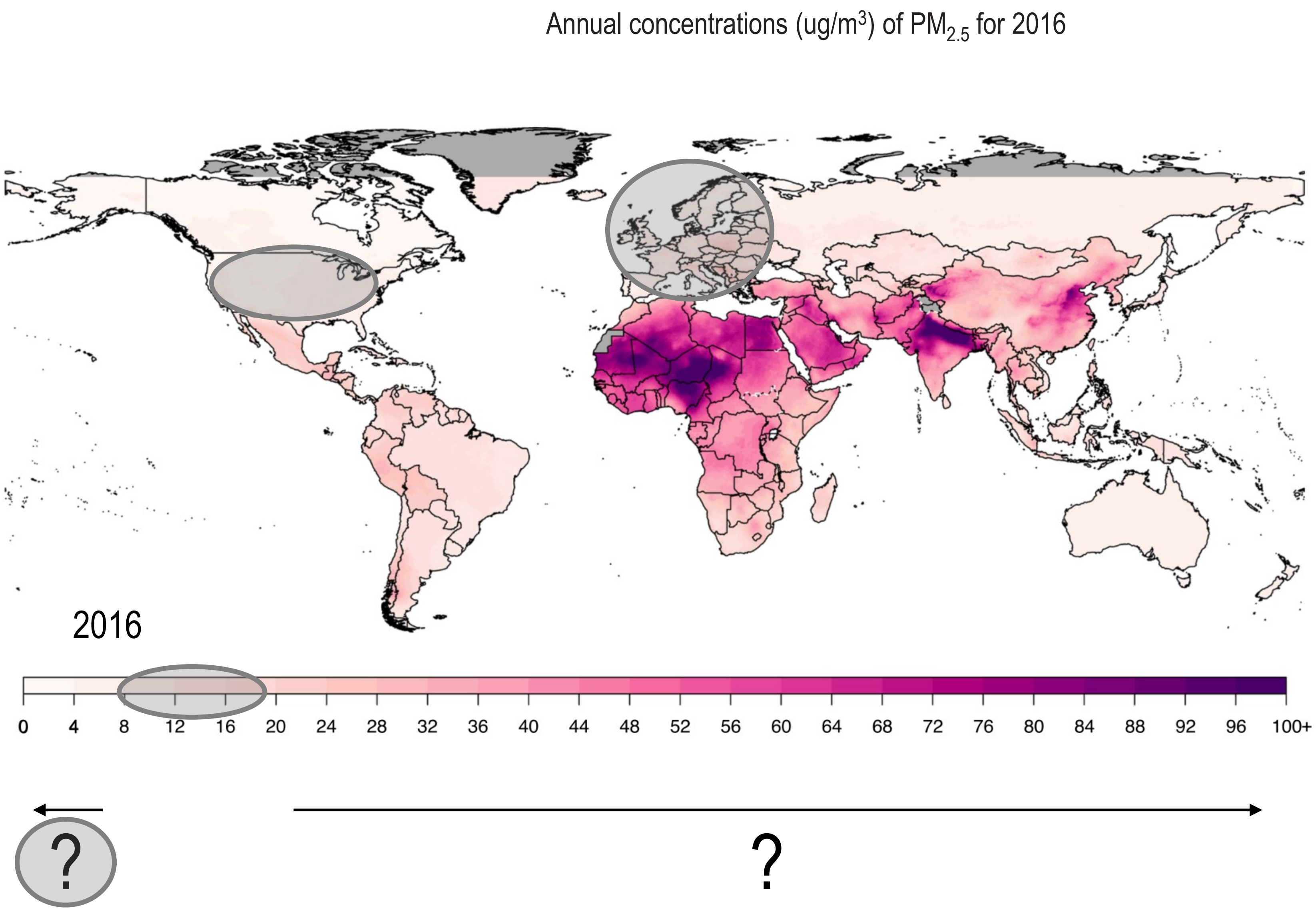
3.1. The Integrated Exposure-Response (IER) Relative Risk Model

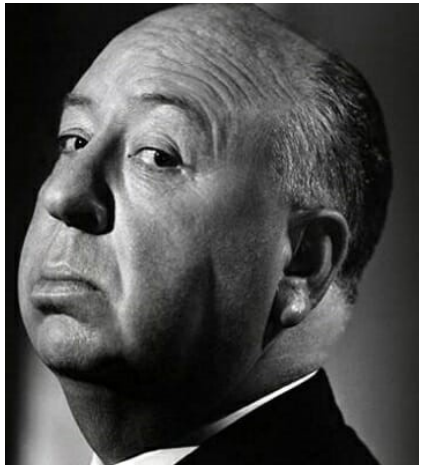
Although the number of outdoor fine particulate air pollution cohort studies increased since 2004, **all of the new studies have been conducted at low levels of exposure in high-income countries;** thus, the GBD still faced the same problem as it planned an updated set of estimates for GBD 2010 [15,18]. In those studies, **the estimated annual-average population-weighted exposure rarely exceeded 50 µg/m3, with most below 30 µg/m3.**

A solution was suggested from an analysis by Pope and colleagues [24,25] which linked relative risks of cardiovascular and lung cancer deaths to other sources of PM2.5, including those from **secondhand and active smoking, which result in much higher PM2.5 exposure than observed outdoors**. They placed outdoor PM2.5 air pollution as well as secondhand and active smoking relative risks on the same dose scale: **total inhaled PM2.5 mass.** Graphically displaying all the relative risks on the total mass scale revealed a **non-linear shape with the change in relative risk decreasing as total mass increased**. However, this non-linear shape was much more pronounced for cardiovascular mortality than for lung cancer [25].

The analysis presented by Pope and colleagues [24,25] paved the way for the GBD to develop the integrated exposure-response (IER) relative risk function. In addition to the three types of PM2.5 exposures considered by Pope and colleagues, the GBD added a **fourth type: household pollution from heating and cooking sources** [17]. This enabled the GBD to estimate attributable mortality from three combustion-derived risk factors, **outdoor fine particulate air pollution, secondhand smoking, and household burning of solid fuels, using a single risk function**.

$PM_{2.5}$ levels worldwide





Suspenso

Shaddick et al. 2020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Foreword

Clean air is fundamental to health. Compared to 15 years ago, when the previous edition of these guidelines was published, there is now a much **stronger body of evidence to show how air pollution affects different aspects of health at even lower concentrations than previously understood**. But here's what hasn't changed: every year, exposure to air pollution is still estimated to cause millions of deaths and the loss of healthy years of life. The burden of disease attributable to **air pollution is now estimated to be on a par with other major global health risks such as unhealthy diets and tobacco smoking**.

In 2015, the World Health Assembly adopted a landmark resolution on air quality and health, recognizing air pollution as a risk factor for noncommunicable diseases such as ischaemic heart disease, stroke, chronic obstructive pulmonary disease, asthma and cancer, and the economic toll they take. The global nature of the challenge calls for an enhanced global response.

These guidelines, taking into account the **latest body of evidence on the health impacts of different air pollutants**, are a key step in that global response. The next step is for policy-makers around the world to use these guidelines to inform evidence-based legislation and policies to improve air quality and reduce the unacceptable health burden that results from air pollution.

We are immensely grateful to all the scientists, colleagues and partners around the world who have contributed time and resources to the development of these guidelines. As with all WHO guidelines, a global group of experts has derived the new recommendations based on a robust and comprehensive review of the scientific literature, while adhering to a rigorously defined methodology. This process was overseen by a steering group hosted and coordinated by the WHO European Centre for Environment and Health.

Although the burden of air pollution is heterogeneous, its impact is ubiquitous. These guidelines come at a time of unprecedented challenges, in the face of the ongoing COVID-19 pandemic and the existential threat of climate change. Addressing air pollution will contribute to, and benefit from, the global fight against climate change, and must be a key part of the global recovery, as prescribed by the WHO Manifesto for a healthy recovery from COVID19.

A guideline is just a tool. What matters is that countries and partners use it to improve air quality and health globally. The health sector must play a key role in monitoring health risks from air pollution, synthesizing the evidence, providing the tools and resources to support decision-making, and raising awareness of the impacts of air pollution on health and the available policy options. But this is not a job for one sector alone; it will take sustained political commitment and bold action and cooperation from many sectors and stakeholders. The payoff is cleaner air and better health for generations to come.

Dr Tedros Adhanom Ghebreyesus
WHO Director-General
Dr Hans Henri P. Kluge
WHO Regional Director for Europe

2021

WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide.

ISBN 978-92-4-003422-8 (electronic version) ISBN 978-92-4-003421-1 (print version)

Table 2.5. Eight steps in formulation of long-term AQG levels

Step	Description
Step 1	Assess RR estimates and, when available, CRF for each critical health outcome per pollutant as provided by the systematic review. In its first meeting in 2016, based on an initial survey, the GDG decided that the following health outcomes are critical (depending on air pollutant): (i) all-cause mortality (or all, natural-cause mortality, excluding accidental deaths); (ii) respiratory mortality; (iii) cardiovascular mortality, associated with both long- and short-term exposures; (iv) short-term, day-to-day variations in hospital admissions and emergency room visits related to asthma; and (v) myocardial infarction. The GDG recommends AQG levels for all pollutant–outcome pairs identified in 2016 except for those associations not meeting at least moderate levels of certainty. This includes pairs with different likelihoods of causality, according to authoritative reviews by COMEAP, Health Canada, International Agency for Research on Cancer, US EPA and others
Step 2	Determine the lowest level of exposure measured in the studies included in the systematic review or in the subset of studies in the systematic review that estimate risk at this lowest level. For individual studies that used statistical models to evaluate the shape of the CRF, ensure that the lowest level of exposure is associated with a monotonic increase of the CRF curve
Step 3	Determine the minimal relevant increase in health outcomes
Step 4	Determine the starting point for AQG level determination as the long-term concentration of pollutant from which the minimal relevant amount of the health outcome will result
Step 5	Compare the AQG levels for a specific pollutant across critical health outcomes. Take as the final AQG level the lowest AQG level found for any of the critical health outcomes
Step 6	Assess the certainty of the evidence at low levels of exposure. The adapted GRADE assessment is for the entire body of evidence, not the subset of studies conducted at the lowest exposure levels. The evidence provided by these latter studies needs to be discussed, starting from the RoB assessment that was conducted at individual study level
Step 7	Consider new relevant evidence not included in the systematic reviews in a qualitative or, where possible, quantitative manner
Step 8	Reconsider causality of associations between pollutants and outcomes, taking into account whether or not associations have been classified as causal or likely causal in recent reviews by COMEAP, Health Canada, US EPA, WHO or other authoritative bodies

Assess the literature
(RR, CRF).
Mortality (total, respiratory, cardiovascular, hospital admissions (asthma) and myocardial infarction.

Lowest level of exposure

Minimal increase in health outcome

Long Term > Short Term

Critical health outcomes

Assess the evidence

Consider new evidence

Reconsider causality

WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Page 61

Contaminante	Efectos en la salud usados en la guía del año 2005	Efectos en la salud seleccionados y actualizados para la guía del 2021	Determinación de causalidad
		Exposiclón de Largo Plazo	
$PM_{2.5}$ y PM_{10}	Mortalidad total, cardiopulmonar y de cancer al pulmón.	***Mortalidad por todas las causas** ***Mortalidad cardiovascular (total, cerebrovascular, de las arterias coronarias)** ***Mortalidad Respiratoria (cualquiera, enfermedad obstructiva pulmonar crónica [EPOC], Infecciones respiratorias agudas de las vías aereas inferiores)** ***Mortalidad por cáncer pulmonar**	**$PM_{2.5}$** *Causal para mortalidad cardiovascular y respiratoria (US EPA, 2009) *Causal para mortalidad cardiovascular y total (Health Canada, 2013) **PM** *Causal para mortalidad total en relación a PM (Health Canada, 2013) *Grupo 1b para cáncer pulmonar (Straif et al. 2013) *Probablemente causal para mortalidad por cáncer pulmonar (Health Canada, 2013) **Consideraciones adicionales** *PM_{10} --> Efectos en la salud apoyadas por evidencia provenientes del PM2.5 y PM10 **Otras determinaciones causales relevantes** *$PM_{2.5}$ --> Probablemente causal para efectos respiratorios (US EPA, 2009) *$PM_{2.5}$ --> Probablemente causal para efectos respiratorios (Health Canada, 2013)
		Exposición de Corto Plazo	
$PM_{2.5}$ y PM_{10}	Niveles de carboxihemoglobina menor al 2% in la sangre de no-fumadores (WHO Regional Office for Europe, 200a, 2010)	***Mortalidad por todas las causas** ***Mortalidad cardiovascular** ***Mortalidad Respiratoria**	**$PM_{2.5}$** *Causal para mortalidad por todas las causas, cardiovascular y respiratoria (US EPA, 2009) *Causal para mortalidad por todas las causas, cardiovascular y respiratoria (Health Canada, 2013) **PM (Fracción de cualquier tamaño)** *Causal para mortalidad por todas las causas (Health Canada, 2013) **Consideraciones adicionales** *Mortalidad cardiovascular y respiratoria también considerada en la determinación causal de efectos respiratorios y cardiovasculares (US EPA, 2009) *PM_{10}, apoyado por la evidencia del $PM_{2.5}$ **Otras determinaciones causales relevantes** *Probablemente causal para efectos respiratorios (US EPA, 2009) *Causal para efectos cardiovasculares (US EPA, 2009) *Causal para efectos respiratorios (Health Canada, 2013) *Causal para efectos cardiovasculares (Health Canada, 2013)

$PM_{2.5}$ (and air pollution) induced Health Effects

Select, Select, Select !!!!

Table 0.1. Recommended AQG levels and interim targets

Pollutant	Averaging time	Interim target 1	Interim target 2	Interim target 3	Interim target 4	AQG level	
$PM_{2.5}$, μg/m^3	Annual	35	25	15	10	5	Long Term
	24-hour[a]	75	50	37.5	25	15	Short Term
PM_{10}, μg/m^3	Annual	70	50	30	20	15	
	24-hour[a]	150	100	75	50	45	
O_3, μg/m^3	Peak season[b]	100	70	–	–	60	
	8-hour[a]	160	120	–	–	100	
NO_2, μg/m^3	Annual	40	30	20	–	10	
	24-hour[a]	120	50	–	–	25	
SO_2, μg/m^3	24-hour[a]	125	50	–	–	40	
CO, mg/m^3	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.

2021

WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide.

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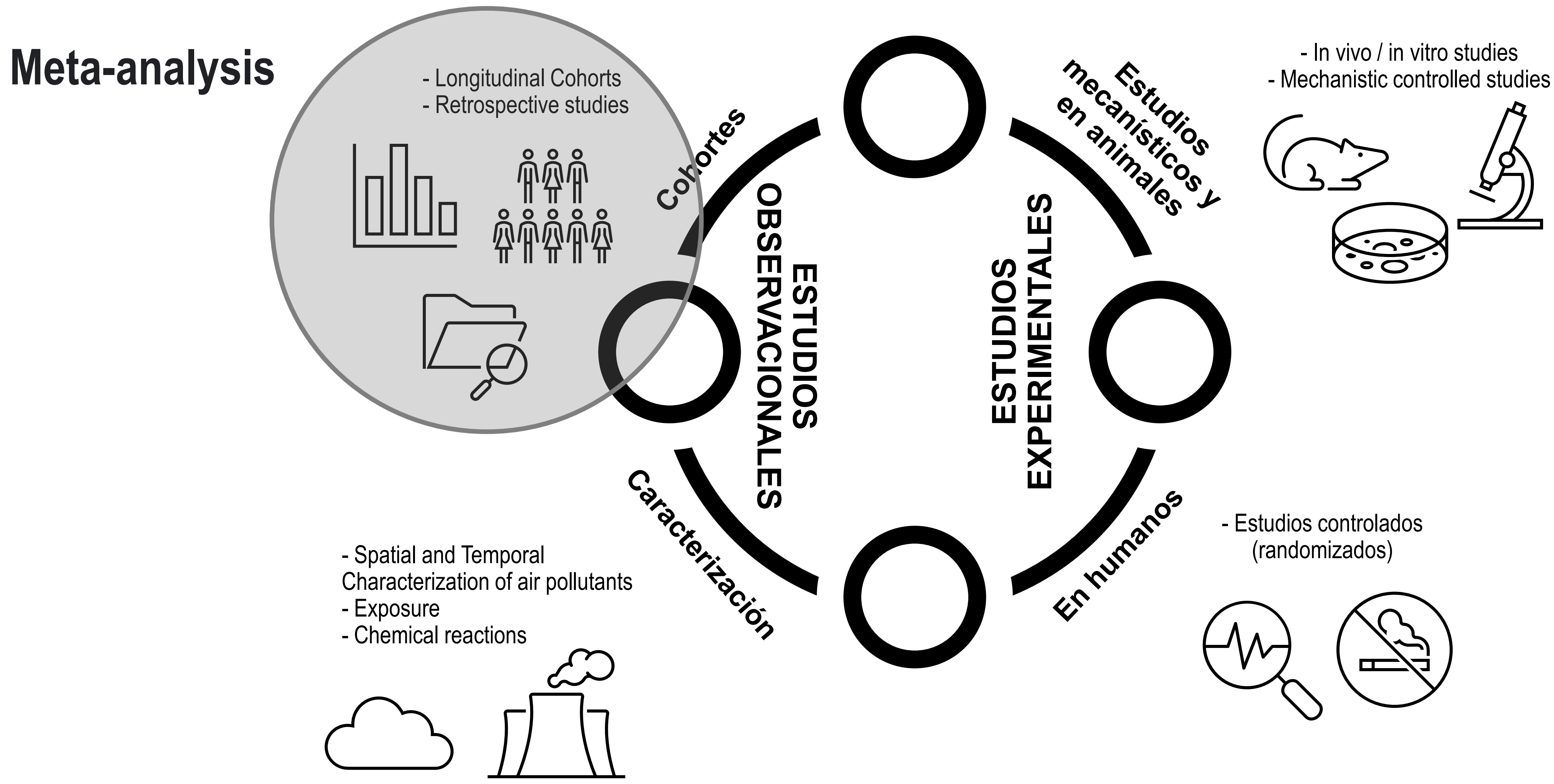
$PM_{2.5}$ (and air pollution)-induced Health Effects

Research



Modified from, Burns et al et al. 2022

WHO (Long Term, Annual)[000068 VTA]

Environment International 143 (2020) 105974

Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Review article

Long-term exposure to PM and all-cause and cause-specific mortality: A systematic review and meta-analysis

Jie Chen*, Gerard Hoek

Institute for Risk Assessment Sciences, Utrecht University, the Netherlands

↑ 10 ug/m^3 → RR: 1.08

Table 2
Pooled effect estimates for all pollutant-outcome combinations.

	$PM_{2.5}$			
	N	pooled RR per 10 μg/m^3	I^2 (%)	Prediction interval
Natural-cause	25	1.08 (1.06, 1.09)	88.9	(1.05, 1.11)
Circulatory	21	1.11 (1.09, 1.14)	72.1	(1.06, 1.17)
IHD	22	1.16 (1.10, 1.21)	77.5	(1.04, 1.29)
Stroke	16	1.11 (1.04, 1.18)	84.7	(0.98, 1.25)
Respiratory	17	1.10 (1.03, 1.18)	83.6	(0.95, 1.29)
COPD	11	1.11 (1.05, 1.17)	49.6	(1.02, 1.21)
ALRI	4	1.16 (1.01, 1.34)	83.0	(0.88, 1.54)
Lung cancer	15	1.12 (1.07, 1.16)	39.4	(1.05, 1.18)

N = number of studies

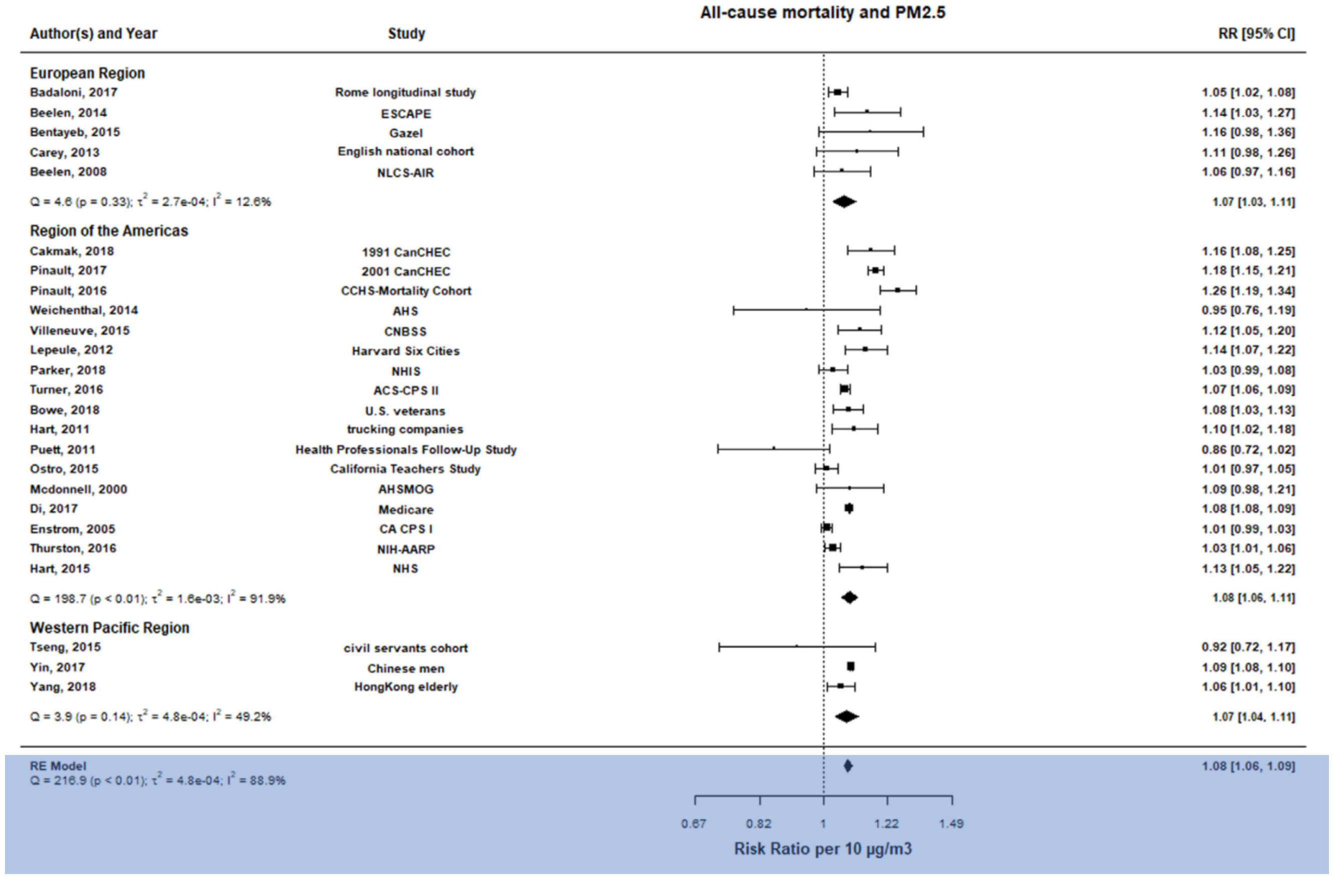


Fig. 6. Meta-analysis of $PM_{2.5}$ and natural-cause mortality: by geographical regions.

Select, Select, Select !!!!

WHO (Short Term, 24-h) 000069

Environment International 142 (2020) 105876

Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Review article

Short-term exposure to particulate matter (PM_{10} and $PM_{2.5}$), nitrogen dioxide (NO_2), and ozone (O_3) and all-cause and cause-specific mortality: Systematic review and *meta*-analysis

Pablo Orellano[a,*], Julieta Reynoso[b], Nancy Quaranta[c,d], Ariel Bardach[e], Agustin Ciapponi[e]

[a] Centro de Investigaciones y Transferencia San Nicolás, Universidad Tecnológica Nacional (CONICET), San Nicolás, Argentina
[b] Hospital General "San Felipe", San Nicolás, Argentina
[c] Facultad Regional San Nicolás, Universidad Tecnológica Nacional, San Nicolás, Argentina
[d] Comisión de Investigaciones Científicas de la Provincia de Buenos Aires, La Plata, Argentina
[e] Instituto de Efectividad Clínica y Sanitaria (IECS-CONICET), Buenos Aires, Argentina

↑ 10 ug/m^3 → RR: 1.007

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Table 1
Exposures, outcomes and pooled effect sizes.

Pollutant	Outcome	Number of effect sizes	RR (95% CI)	p-value	PI	Egger's test (p-value)
PM_{10}	All-cause mortality	66	1.0041 (1.0034–1.0049)	< 0.0001	1.0013–1.0070	< 0.001
PM_{10}	Cardiovascular mortality	44	1.0060 (1.0044–1.0077)	< 0.0001	1.0016–1.0105	0.024
PM_{10}	Respiratory mortality	41	1.0091 (1.0063–1.0119)	< 0.0001	1.0017–1.0166	0.209
PM_{10}	Cerebrovascular mortality	20	1.0044 (1.0022–1.0066)	0.0005	1.0001–1.0087	< 0.001
$PM_{2.5}$	All-cause mortality	29	1.0065 (1.0044–1.0086)	< 0.0001	1.0017–1.0114	0.015
$PM_{2.5}$	Cardiovascular mortality	28	1.0092 (1.0061–1.0123)	< 0.0001	1.0026–1.0158	0.803
$PM_{2.5}$	Respiratory mortality	20	1.0073 (1.0029–1.0116)	0.0023	0.9998–1.0148	0.606
$PM_{2.5}$	Cerebrovascular mortality	7	1.0072 (1.0012–1.0132)	0.0257	0.9953–1.0192	N/A
NO_2 (24-hour average)	All-cause mortality	54	1.0072 (1.0059–1.0085)	< 0.0001	1.0031–1.0113	0.048
NO_2 (1-hour max.)	All-cause mortality	10	1.0024 (0.9995–1.0053)	0.0892	0.9985–1.0064	0.154
O_3	All-cause mortality	48	1.0043 (1.0034–1.0052)	< 0.0001	1.0013–1.0073	0.001

RR, pooled relative risks; 95% CI, 95% confidence interval; p-value, significance of the association or statistical tests; PI, 80% prediction interval; N/A, not applicable (< 10 studies).

WHO AQG ($PM_{2.5}$ Long Term, Annual)

↑ 10 ug/m^3 → RR: 1.08

000069 VTA

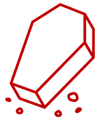
Step 2. Determine the lowest level of exposure measured

In 18 of the 25 studies included in the meta-analysis, a 5th percentile of the exposure distribution was reported or could be calculated from the reported mean and standard deviation (Table 3.2). As the concentration distributions are often lognormal, this calculation is not straightforward. Therefore, preference was given to actual reports of the relevant numbers obtained from the published papers or upon request from the study authors. This is indicated in Table 3.2, Table 3.3, Table 3.4 and Table 3.5. The five lowest levels reported or estimated in these studies were 3.0 µg/m³ Pinault et al., 2016, 3.2 µg/m³ Cakmak et al., 2018, 3.5 µg/m³ Pinault et al., 2017, 4.8 µg/m³ Villeneuve et al., 2015 and 6.7 µg/m³ Weichenthal et al., 2014. Weichenthal et al. 2014 found no effect. The Villeneuve et al. 2015 study provided no evidence of an effect of PM2.5 on all non-accidental mortality below 8 µg/m³. The study by Di et al. 2017a) has the next lowest 5th percentile (7.1 µg/m³) and the study by Hart et al. 2015 the next lowest (7.8 µg/m³). The average PM2.5 level across these five studies with the lowest exposure measurements in the systematic review is 4.2 µg/m³. A sensitivity analysis disregarding the Villeneuve et al.2015 and Weichenthal et al. 2014 studies produced a mean of 4.9 µg/m³ PM2.5. The sum of weights in the meta-analysis was > 25%, indicating that these studies were influential in the meta-analysis.

The recommendation is an annual $PM_{2.5}$ AQG level of 5 µg/m³. The GDG recommends maintaining the 2005 interim targets and introducing an interim target 4 at the level of the 2005 air quality guideline, as shown in Table 3.1.

Table 3.1. Recommended annual AQG level and interim targets for $PM_{2.5}$

Recommendation		$PM_{2.5}$ (µg/m³)
Interim target 1	124	35
Interim target 2	116	25
Interim target 3	108	15
Interim target 4	104	10
AQG level	100	**5**



Select, Select, Select !!!!

WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Page 76,78

WHO AQG ($PM_{2.5}$ Short Term, 24-h)

↑ 10 ug/m^3 → RR: 1.007   000070

Step 2. Determine the lowest level of exposure measured

As discussed in the protocol for deriving AQG levels in section 2.5, the lowest concentrations in time-series studies of the effects of daily variations in air pollution concentrations are often very low. Therefore, the 5th percentiles of these daily distributions cannot be used as starting points for AQG level development. In such cases, the protocol suggests identifying the 99th percentile of common distributions of daily air pollution concentrations corresponding to an average long-term concentration equivalent to the annual AQG level. Thus, it is expected that daily means will be higher than the short-term AQG level not more than three to four times per year once air quality complies with the proposed annual mean AQG level. The proposed annual mean AQG level is 5 μg/m³ for PM2.5. Common distributions observed in large numbers of cities around the world (data from Liu et al. 2019) suggest that the 99th percentiles of daily concentrations are about three times higher than the annual mean PM2.5 concentration.

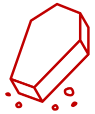
The recommendation is a short-term (24-hour) $PM_{2.5}$ AQG level of 15 μg/m³, defined as the 99th percentile (equivalent to 3–4 exceedance days per year) of the annual distribution of 24-hour average concentrations.

The GDG recommends maintaining the 2005 interim targets and introducing an interim target 4 at the level of the 2005 air quality guideline, as shown in Table 3.6.

Table 3.6. Recommended short-term (24-hour) AQG level and interim targets for $PM_{2.5}$[a]

Recommendation		$PM_{2.5}$ (μg/m³)
Interim target 1	104	75
Interim target 2	102	50
Interim target 3	101	37.5
Interim target 4	101	25
AQG level	100	**15**

[a] Defined as the 99th percentile of the annual distribution of 24-hour average concentrations (equivalent to 3–4 exceedance days per year).



Select, Select, Select !!!!

WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Page 86, 88

Long Term: ↑ 10 ug/m^3 → ↑ 7.3%

The NEW ENGLAND JOURNAL of MEDICINE

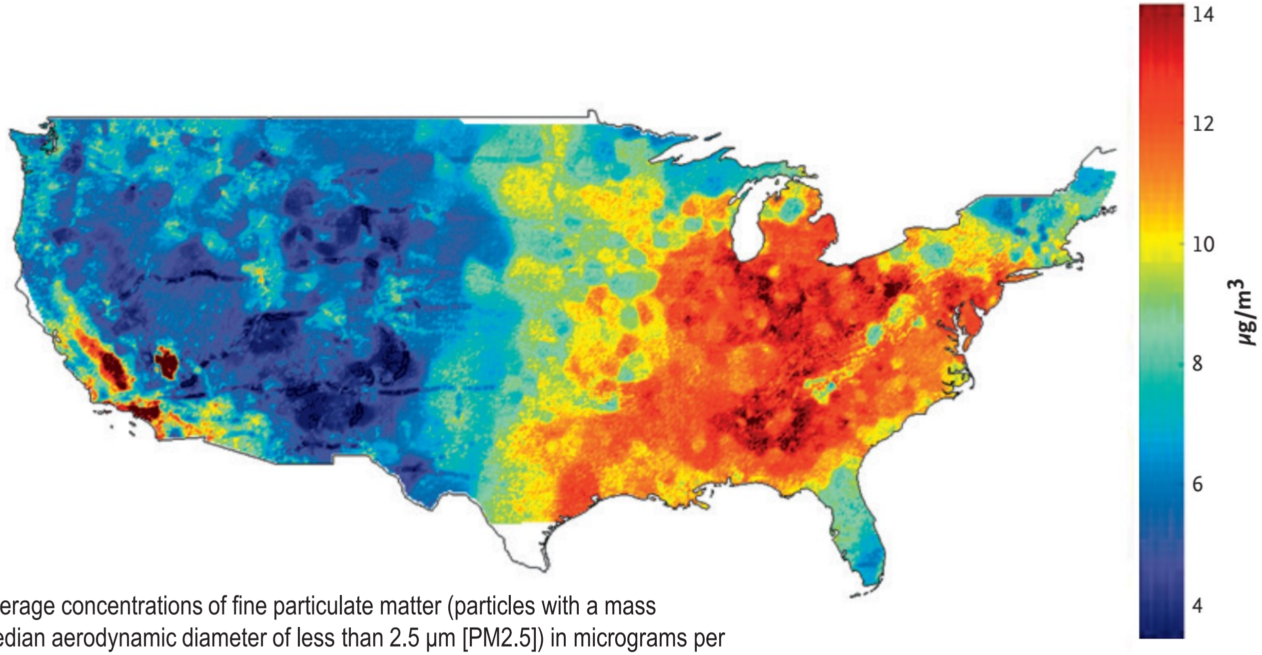
ESTABLISHED IN 1812 JUNE 29, 2017 VOL. 376 NO. 26

Air Pollution and Mortality in the Medicare Population

Qian Di, M.S., Yan Wang, M.S., Antonella Zanobetti, Ph.D., Yun Wang, Ph.D., Petros Koutrakis, Ph.D., Christine Choirat, Ph.D., Francesca Dominici, Ph.D., and Joel D. Schwartz, Ph.D.

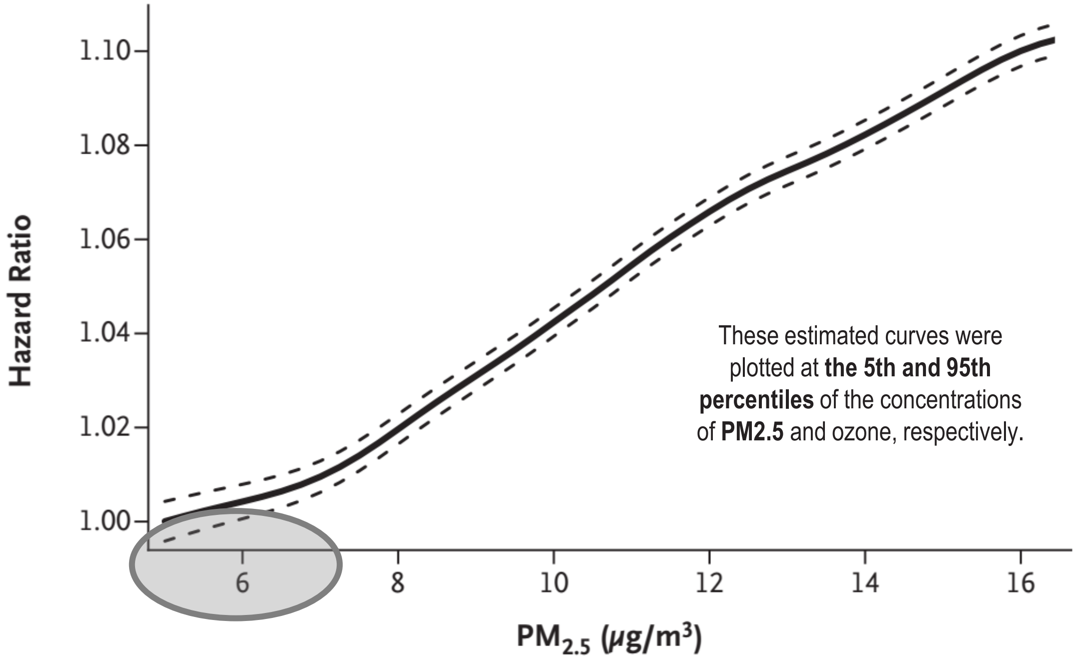
Increases of 10 μg per cubic meter in PM2.5 and of 10 ppb in ozone were associated with increases in all-cause mortality of **7.3%** (95% confidence interval [CI], 7.1 to 7.5) and 1.1% (95% CI, 1.0 to 1.2), respectively.

A Average Concentrations of $PM_{2.5}$



Average concentrations of fine particulate matter (particles with a mass median aerodynamic diameter of less than 2.5 μm [PM2.5]) in micrograms per cubic meter, as estimated on the basis of all daily predictions during the study period.

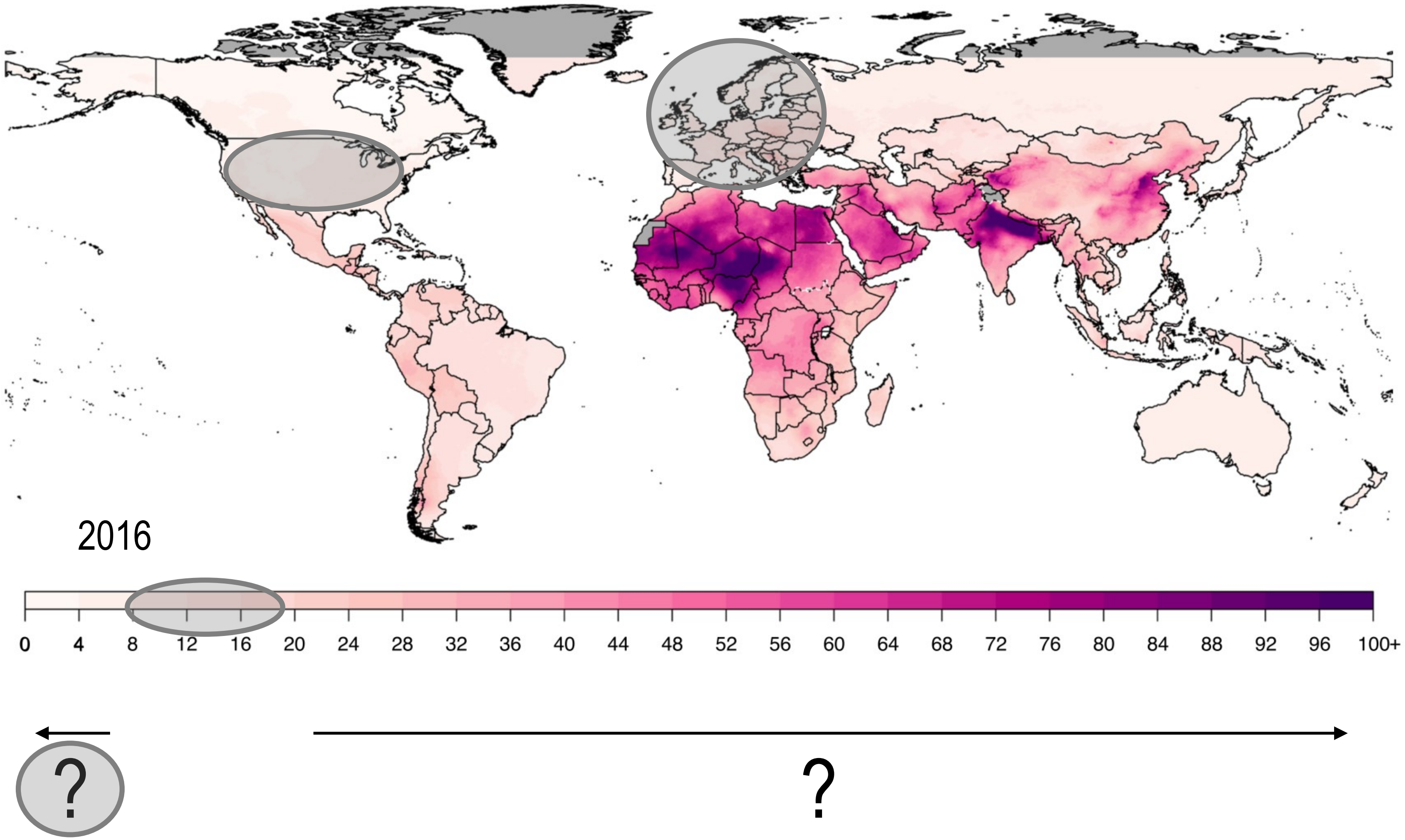
A Exposure to $PM_{2.5}$

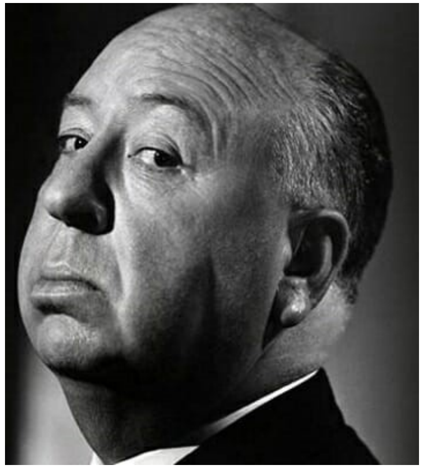


We constructed an open cohort of all Medicare beneficiaries **(60,925,443 persons**) in the continental United States from the years 2000 through 2012, with 460,310,521 person-years of follow-up. **Annual averages of fine particulate matter (particles with a mass median aerodynamic diameter of less than 2.5 μm [PM2.5])** and ozone were estimated according to the **ZIP Code of residence for each enrollee** with the use of previously validated prediction models. **We estimated the risk of death associated with exposure to increases of 10 μg per cubic meter for PM2.5** and 10 parts per billion (ppb) for ozone using a two-pollutant Cox proportional hazards model that controlled for demographic characteristics, Medicaid eligibility, and area-level covariates.

$PM_{2.5}$ levels worldwide

Annual concentrations (ug/m^3) of $PM_{2.5}$ for 2016





Suspenso

Shaddick et al. 2020

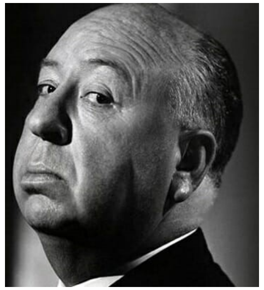
000071 VTA

SOCIAL SCIENCES

How low can you go? Air pollution affects mortality at very low levels

Scott Weichenthal[1,2]*†, Lauren Pinault[3]†, Tanya Christidis[3], Richard T. Burnett[4], Jeffrey R. Brook[5], Yen Chu[6], Dan L. Crouse[7], Anders C. Erickson[6], Perry Hystad[8], Chi Li[9], Randall V. Martin[9,10], Jun Meng[10,11], Amanda J. Pappin[2], Michael Tjepkema[3], Aaron van Donkelaar[9,10], Crystal L. Weagle[9], Michael Brauer[4,6]

The World Health Organization (WHO) recently released new guidelines for outdoor fine particulate air pollution (PM2.5) recommending an **annual average concentration of 5 ug/m3**. Yet, our understanding of the concentration response relationship between outdoor PM2.5 and mortality in this range of near-background concentrations **remains incomplete**. To address this uncertainty, we conducted a population-based cohort study of 7.1 million adults in one of the world's lowest exposure environments. **Our findings reveal a supralinear concentration response relationship between outdoor PM2.5 and mortality at very low (<5 ug/m3) concentrations**. Our updated global concentration-response function **incorporating this new information suggests an additional 1.5 million deaths globally attributable to outdoor PM2.5 annually compared to previous estimates**. **The global health benefits of meeting the new WHO guideline for outdoor PM2.5 are greater than previously assumed and indicate a need for continued reductions in outdoor air pollution around the world.**



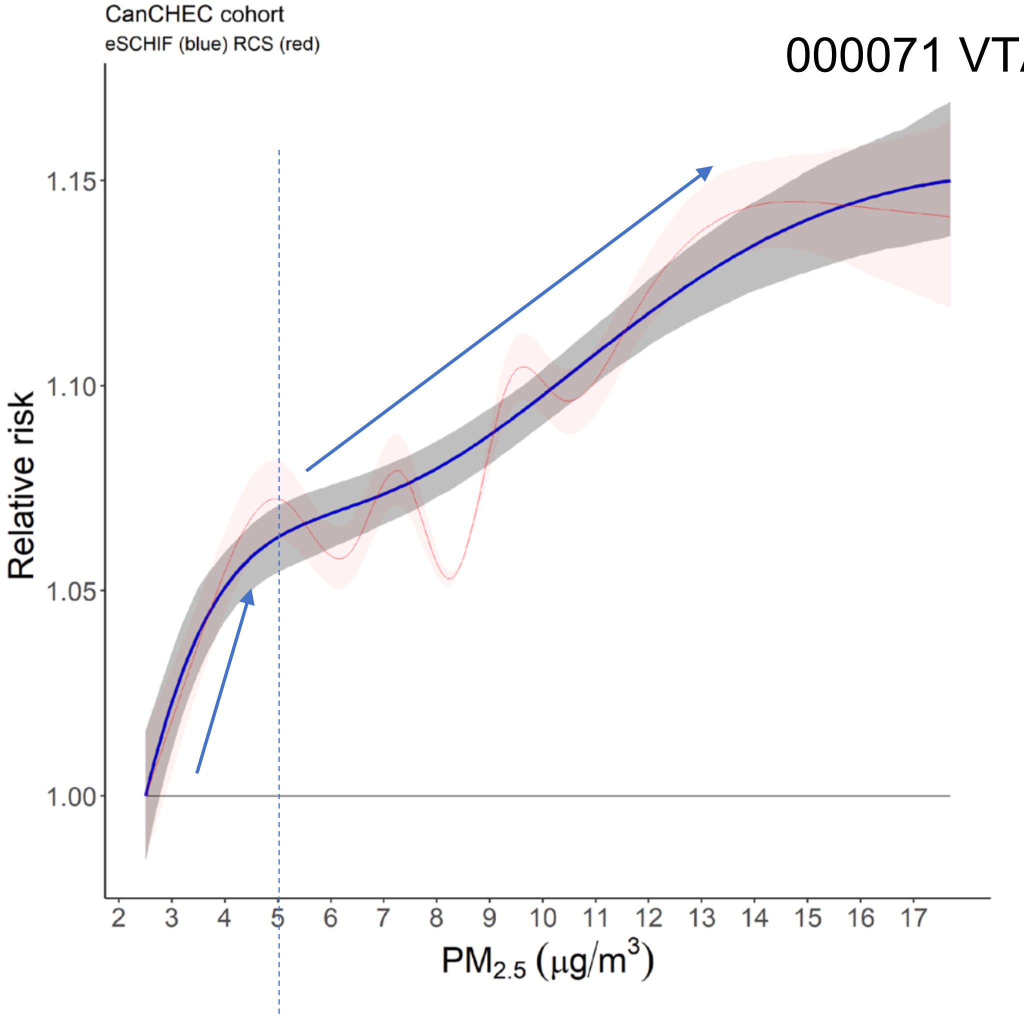


Fig. 1. Fully adjusted restricted cubic spline relative risk predictions for non-accidental mortality over the CanCHEC $PM_{2.5}$ concentration range (red dashed line, mean; red shaded area, 95% CIs) with associated eSCHIF predictions (blue solid line, mean; gray shaded area, 95% CIs). The green *x*-axis tick marks indicate the nine restricted cubic spline (RCS) knot locations that reflect percentiles of $PM_{2.5}$ (2, 14, 26, 50, 62, 74, 86, and 98%) for person-years of during follow-up (13.3% of person-years had PM2.5 values below 5 $\mu g/m^3$, which is indicated by the vertical dotted line).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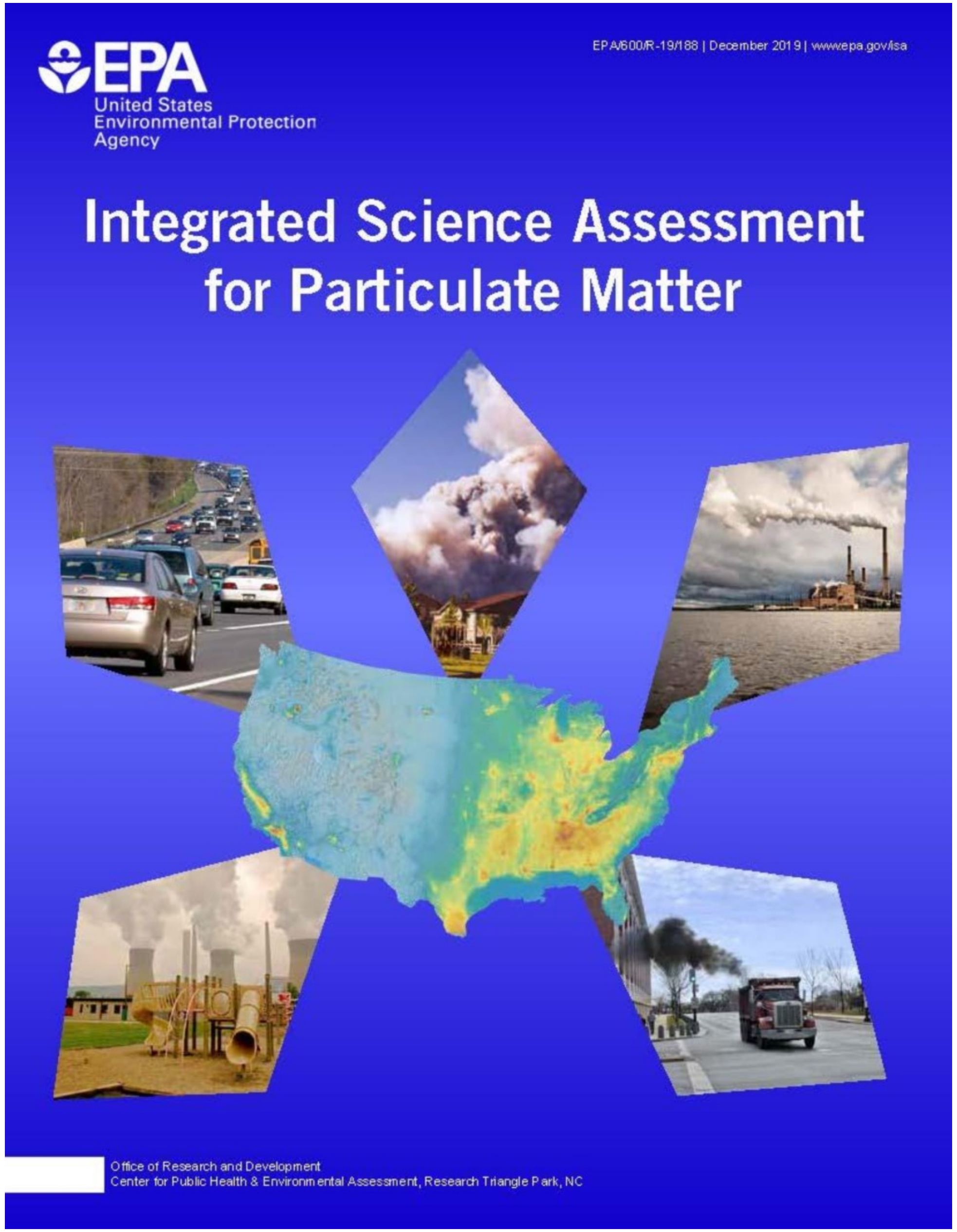


U.S. EPA. (2019). ***Integrated Science Assessment (ISA) for Particulate Matter (Final Report, Dec 2019)***. **Page P-9 https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=347534**

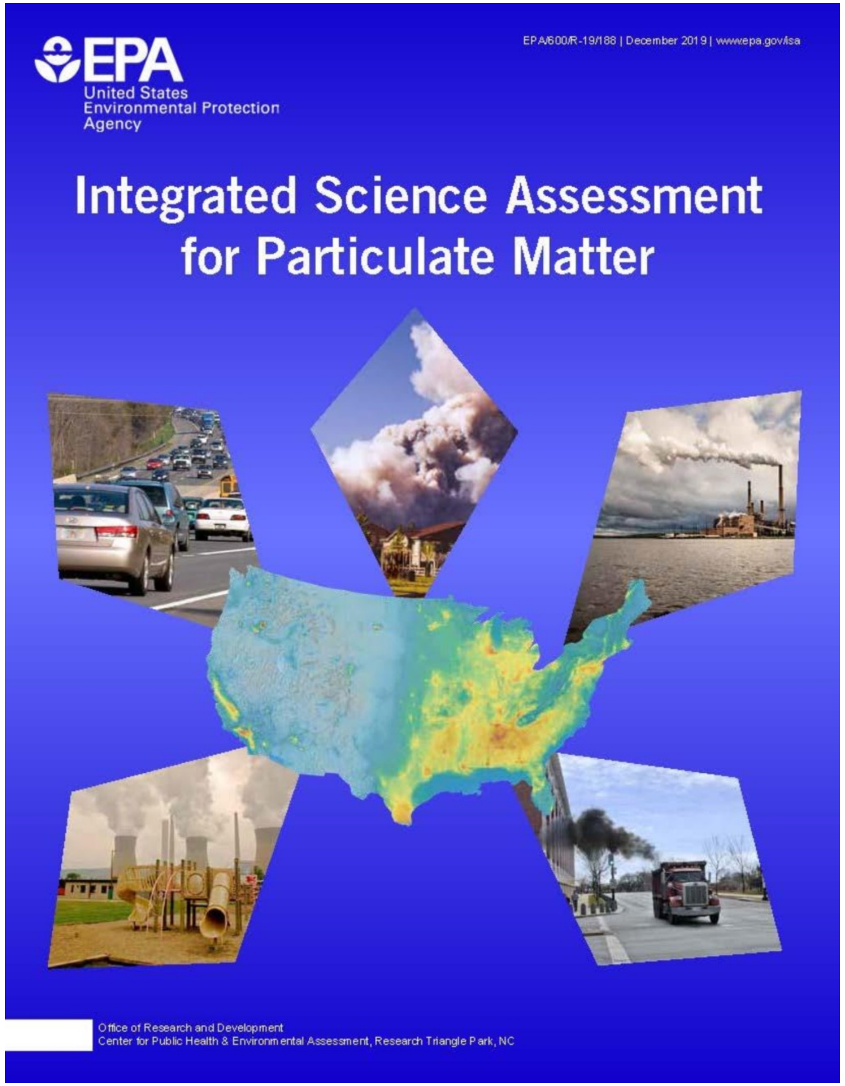
The Integrated Science Assessment (ISA) is a **comprehensive evaluation and synthesis of the policy-relevant science “useful in indicating the kind and extent of identifiable effects on public health or welfare which may be expected from the presence of [a] pollutant in ambient air,”** as described in Section 108 of the Clean Air Act (CAA, 1990a). This ISA communicates critical science judgments of the health and welfare criteria for particulate matter (PM), and serves as the scientific foundation for the review of the current primary (health-based) and secondary (welfare-based) National Ambient Air Quality Standards (NAAQS) for PM.

		Fracción	Determinaciones de Causalidad: PM ISA 2009	Determinaciones de Causalidad: PM ISA actual
efectos respiratorios	Exposición de corto plazo	$PM_{2.5}$	probablemente causal	probablemente causal
		$PM_{10-2.5}$	se sugiere,pero no es suficiente para inferirlo	se sugiere,pero no es suficiente para inferirlo
		UFP	se sugiere,pero no es suficiente para inferirlo	se sugiere,pero no es suficiente para inferirlo
	Exposición de largo plazo	$PM_{2.5}$	probablemente causal	probablemente causal
		$PM_{10-2.5}$	inadecuada	inadecuada
		UFP	inadecuada	inadecuada
efectos cardiovasculares	Exposición de corto plazo	$PM_{2.5}$	Causal	Causal
		$PM_{10-2.5}$	se sugiere,pero no es suficiente para inferirlo	se sugiere,pero no es suficiente para inferirlo
		UFP	se sugiere,pero no es suficiente para inferirlo	se sugiere,pero no es suficiente para inferirlo
	Exposición de largo plazo	$PM_{2.5}$	Causal	Causal
		$PM_{10-2.5}$	inadecuada	se sugiere,pero no es suficiente para inferirlo
		UFP	inadecuada	inadecuada
efectos metabólicos	Exposición de corto plazo	$PM_{2.5}$	-	se sugiere,pero no es suficiente para inferirlo
		$PM_{10-2.5}$	-	inadecuada
		UFP	-	inadecuada
	Exposición de largo plazo	$PM_{2.5}$	-	se sugiere,pero no es suficiente para inferirlo
		$PM_{10-2.5}$	-	se sugiere,pero no es suficiente para inferirlo
		UFP	-	inadecuada
efectos al sistema nervioso central	Exposición de corto plazo	$PM_{2.5}$	inadecuada	se sugiere,pero no es suficiente para inferirlo
		$PM_{10-2.5}$	inadecuada	inadecuada
		UFP	inadecuada	se sugiere,pero no es suficiente para inferirlo
	Exposición de largo plazo	$PM_{2.5}$	-	probablemente causal
		$PM_{10-2.5}$	-	se sugiere,pero no es suficiente para inferirlo
		UFP	-	se sugiere,pero no es suficiente para inferirlo
efectos reproductivos y del desarrollo	reproduccion masculina/emenina y fertilidad	$PM_{2.5}$	se sugiere,pero no es suficiente para inferirlo	se sugiere,pero no es suficiente para inferirlo
		$PM_{10-2.5}$	inadecuada	inadecuada
		UFP	inadecuada	inadecuada
	consecuencias en el embarazo y el nacimiento	$PM_{2.5}$	se sugiere,pero no es suficiente para inferirlo	se sugiere,pero no es suficiente para inferirlo
		$PM_{10-2.5}$	inadecuada	inadecuada
		UFP	inadecuada	inadecuada
cancer		$PM_{2.5}$	se sugiere,pero no es suficiente para inferirlo	probablemente causal
		$PM_{10-2.5}$	inadecuada	se sugiere,pero no es suficiente para inferirlo
		UFP	inadecuada	inadecuada
mortalidad	Exposición de corto plazo	$PM_{2.5}$	Causal	Causal
		$PM_{10-2.5}$	se sugiere,pero no es suficiente para inferirlo	se sugiere,pero no es suficiente para inferirlo
		UFP	inadecuada	inadecuada
	Exposición de largo plazo	$PM_{2.5}$	Causal	Causal
		$PM_{10-2.5}$	inadecuada	se sugiere,pero no es suficiente para inferirlo
		UFP	inadecuada	inadecuada

- Causal
- probablemente causal
- se sugiere,pero no es suficiente para inferirlo
- inadecuada

Determinaciones de causalidad para diversos efectos de distintas fracciones de material particulado. Tabla adaptada y traducida desde (U.S. EPA., 2019).

Grupos de riesgo



Clasificación	Efectos en la salud
Evidencia adecuada	Existe una evidencia **substancial y consistente** dentro de una disciplina para concluir que el factor resulta en que una población o estado de vida presente un aumento de riesgo a los efectos del contaminante cuando es comparada con alguna población o estado de vida de referencia. Cuando sea aplicable, esta evidencia incluye coherencia con otras disciplinas. La evidencia incluye múltiples estudios de alta calidad
Evidencia sugestiva	La evidencia colectiva **sugiere** que un factor resulta en el aumento de riesgo a los efectos del contaminante en una población o estado de vida relativo a una población/ estado de vida de referencia. La evidencia es limitada debido a algunas inconsistencias dentro de una disciplina o a la falta de coherencia entre disciplinas.
Evidencia inadecuada	La evidencia colectiva es **inadecuada** para sugerir que un factor resulta en el aumento de riesgo a los efectos del contaminante en una población o estado de vida relativo a una población / estado de vida de referencia. Los estudios disponibles son insuficientes en cantidad, calidad o consistencia y / o el poder estadistico es insuficiente para establecer alguna conclusión.
Evidencia de ausencia de efecto	Existe una evidencia **substancial y consistente** dentro de una disciplina para concluir que el factor no resulta en que una población o estado de vida presente un aumento de riesgo a los efectos del contaminante cuando es comparada con alguna población o estado de vida de referencia. Cuando sea aplicable, esta evidencia incluye coherencia con otras disciplinas. La evidencia incluye múltiples estudios de alta calidad

Condiciones / Enfermedades preexistentes	Enfermedades cardiovasculares	Evidencia sugestiva
	Diabetes y síndrome metabólico	Evidencia inadecuada
	Obesidad	Evidencia sugestiva
	Colesterol elevado	Evidencia inadecuada
	Enfermedades respiratorias preexistentes	Evidencia sugestiva
	Factores genéticos	Evidencia sugestiva
Factores sociodemográficos	**Etapa de vida (niños)**	**Evidencia adecuada**
	Etapa de vida (Adultos mayores)	Evidencia inadecuada
	Sexo	Evidencia inadecuada
	Estatus socioeconómico (ESE)	Evidencia sugestiva
	Raza/etnia	**Evidencia adecuada**
	Lugar de residencia	Evidencia inadecuada
Factores conductuales y otros	Tabaquismo (Fumar)	Evidencia sugestiva
	Dieta	Evidencia inadecuada

Caracterización de la evidencia para factores que potencialmente aumentan el riesgo de los efectos en la salud del material particulado. Tabla adaptada y traducida desde (U.S. EPA., 2019).

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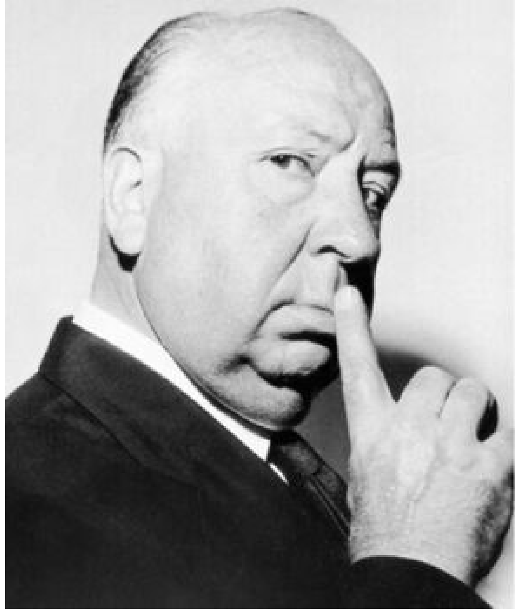


Gracias

Air Pollution and Mortality

Results from Santiago, Chile

Bart Ostro
Jose Miguel Sanchez
Carlos Aranda
Gunnar S. Eskeland

The relationship between particulate air pollution and premature death in Santiago, Chile is found to bc very similar to results from industrial countries.

1995

A change equal to 10-microgram-per-cubic-meter in daily PM10 (about 9 percent) averaged over three days was associated with a **1.1 percent increase in mortality** (95 percent confidence interval: 0.6 to 1.5 percent).

TECHNICAL PAPER

ISSN 1047-3289 *J. Air & Waste Manage. Assoc.* **50**:1287-1298

Effect of the Fine Fraction of Particulate Matter versus the Coarse Mass and Other Pollutants on Daily Mortality in Santiago, Chile

Luis A. Cifuentes, Jeanette Vega, and Katherine Köpfer
Pontificia Universidad Católica de Chile, Santiago, Chile

Lester B. Lave
Carnegie Mellon University, Pittsburgh, Pennsylvania

2000

A previous study conducted in Santiago by Ostro et al.19 found a **10% increase in total mortality associated with the average levels of PM10 (115 µg/m3 for 1989–1991**). This is **more than double our estimate of a 4.2% increase for average levels of PM2.5**. However, when seasonal effects were controlled in Ostro's work, including variables for months or trigonometric terms, the increase in mortality dropped to 4%, which is consistent with our estimates. While the studies conducted in the United States have found increases in mortality of around 0.7% per 10 µg/m3 of average 24-hr PM 10 concentrations,37 for European cities the increase is around **0.4–0.5%**.38 **Our risk estimates are closer to the risks found in European cities than those in U.S. cities.**

000075 VTA

RESEARCH Open Access

Elemental concentrations of ambient particles and cause specific mortality in Santiago, Chile: a time series study

Ana Valdés[1,2*], Antonella Zanobetti[3], Jaana I Halonen[3,5], Luis Cifuentes[4], Diego Morata[6] and Joel Schwartz[3]

2012

Results: We found significant effects of PM2.5 on all the causes analyzed, with a **1.33%** increase (95% CI: 0.87-1.78) **in cardiovascular mortality per 10µg/m3 increase in the two days average of PM2.5**. We found that zinc was associated with higher cardiovascular mortality. Particles with high content of chromium, copper and sulfur showed stronger associations with respiratory and COPD mortality, while high zinc and sodium content of PM2.5 amplified the association with cerebrovascular disease.

Executive summary

The global burden of disease associated with air pollution exposure exacts a massive toll on human health worldwide: exposure to air pollution is estimated to cause millions of deaths and lost years of healthy life annually. The burden of disease attributable to air pollution is now estimated to be on a par with other major global health risks such as unhealthy diet and tobacco smoking, and air pollution is now recognized as the single biggest environmental threat to human health.

Despite some notable improvements in air quality, the global toll in deaths and lost years of healthy life has barely declined since the 1990s. **While air quality has markedly improved in high-income countries over this period, it has generally deteriorated in most low- and middle-income countries, in step with large-scale urbanization and economic development.** In addition, the global prevalence of noncommunicable diseases (NCDs) as a result of population ageing and lifestyle changes has grown rapidly, and NCDs are now the leading causes of death and disability worldwide. NCDs comprise a broad range of diseases affecting the cardiovascular, neurological, respiratory and other organ systems. **Air pollution increases morbidity and mortality from cardiovascular and respiratory disease and from lung cancer, with increasing evidence of effects on other organ systems**. The burden of disease resulting from air pollution also imposes a significant economic burden. As a result, governments worldwide are seeking to improve air quality and reduce the public health burden and costs associated with air pollution

Short Term: ↑ 10 ug/m^3 → ↑ 0.68%

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 AUGUST 22, 2019 VOL. 381 NO. 8

Ambient Particulate Air Pollution and Daily Mortality in 652 Cities

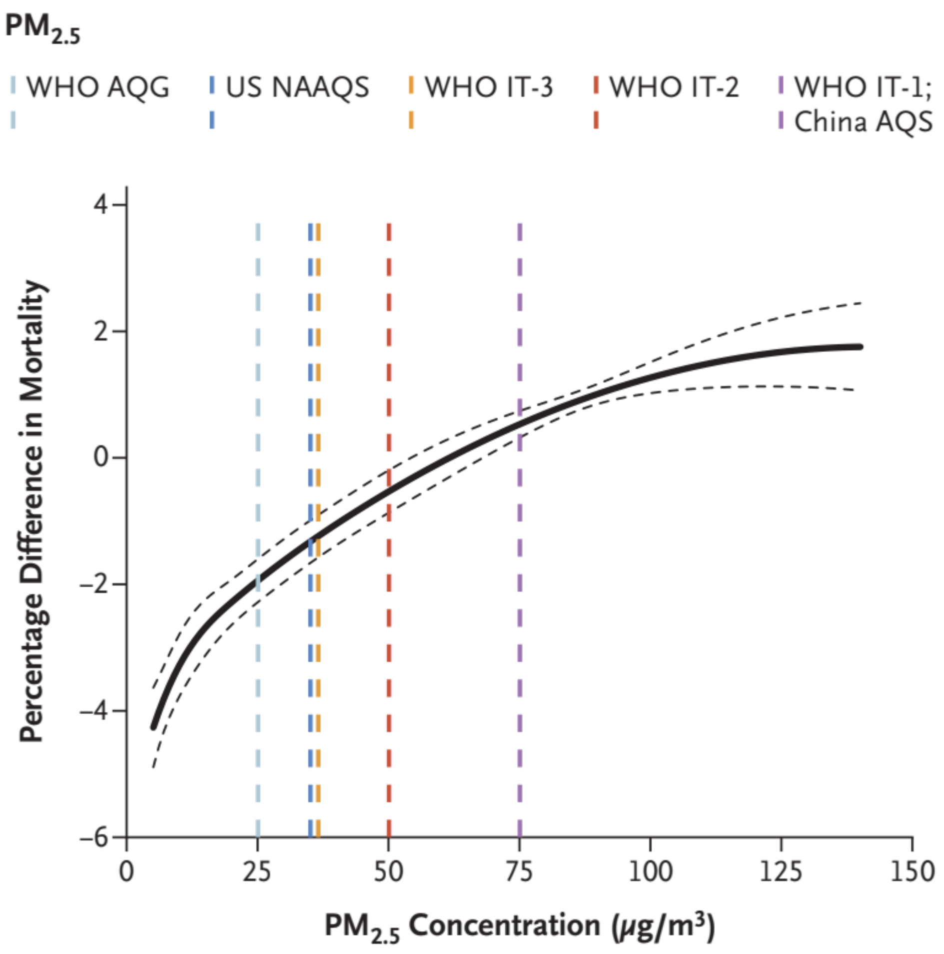
C. Liu, R. Chen, F. Sera, A.M. Vicedo-Cabrera, Y. Guo, S. Tong, M.S.Z.S. Coelho, P.H.N. Saldiva, E. Lavigne, P. Matus, N. Valdes Ortega, S. Osorio Garcia, M. Pascal, M. Stafoggia, M. Scortichini, M. Hashizume, Y. Honda, M. Hurtado-Díaz, J. Cruz, B. Nunes, J.P. Teixeira, H. Kim, A. Tobias, C. Íñiguez, B. Forsberg, C. Åström, M.S. Ragettli, Y.-L. Guo, B.-Y. Chen, M.L. Bell, C.Y. Wright, N. Scovronick, R.M. Garland, A. Milojevic, J. Kyselý, A. Urban, H. Orru, E. Indermitte, J.J.K. Jaakkola, N.R.I. Ryti, K. Katsouyanni, A. Analitis, A. Zanobetti, J. Schwartz, J. Chen, T. Wu, A. Cohen, A. Gasparrini, and H. Kan

METHODS

We evaluated the associations of inhalable particulate matter (PM) with an aerodynamic diameter of 10 µm or less (PM10) and fine PM with an aerodynamic diameter of 2.5 µm or less (PM 2.5) with **daily all-cause, cardiovascular, and respiratory mortality across multiple countries or regions**. Daily data on mortality and air pollution were collected from 652 cities in 24 countries or regions. We used overdispersed generalized additive models with random-effects meta-analysis to investigate the associations. Two-pollutant models were fitted to test the robustness of the associations. Concentration–response curves from each city were pooled to allow global estimates to be derived.

RESULTS

On average, **an increase of 10 µg per cubic meter in the 2-day moving average** of PM10 concentration, which represents the average over the current and previous day, was associated with increases of 0.44% (95% confidence interval [CI], 0.39 to 0.50) in daily all-cause mortality, 0.36% (95% CI, 0.30 to 0.43) in daily cardiovascular mortality, and 0.47% (95% CI, 0.35 to 0.58) in daily respiratory mortality. The corresponding increases in daily mortality for the same change in **PM2.5 concentration were 0.68%** (95% CI, 0.59 to 0.77), 0.55% (95% CI, 0.45 to 0.66), and 0.74% (95% CI, 0.53 to 0.95). These associations remained significant after adjustment for gaseous pollutants. Associations were stronger in locations with lower annual mean PM concentrations and higher annual mean temperatures. The pooled concentration–response curves showed a consistent increase in daily mortality with increasing PM concentration, with steeper slopes at lower PM concentrations.



The y axis represents the percentage difference from the pooled mean effect (as derived from the entire range of PM concentrations at each location) on mortality. Zero on the y axis represents the pooled mean effect, and the portion of the curve below zero denotes a smaller estimate than the mean effect.

Table 1. Percentage Change in All-Cause Mortality per 10-μg-per-Cubic-Meter Increase in 2-Day Moving Average Concentrations of Inhalable Particulate Matter (PM_{10}) and Fine Particulate Matter ($PM_{2.5}$).*

Country or Region	PM_{10}		$PM_{2.5}$	
	Cities with Available Data	Pooled Estimate	Cities with Available Data	Pooled Estimate
	no.	*% (95% CI)*	*no.*	*% (95% CI)*
Australia	3	1.32 (0.22 to 2.44)	3	1.42 (−0.12 to 2.99)
Brazil	1	1.22 (0.97 to 1.47)	0	NA
Canada	13	0.76 (0.25 to 1.27)	25	1.70 (1.17 to 2.23)
Chile	4	0.33 (0.14 to 0.53)	4	0.27 (−0.68 to 1.23)
China	272	0.28 (0.22 to 0.34)	272	0.41 (0.32 to 0.50)
Colombia	1	0.03 (−0.34 to 0.39)	0	NA
Czech Republic	1	0.40 (−0.02 to 0.82)	0	NA
Estonia	4	0.46 (−0.69 to 1.63)	3	0.23 (−4.24 to 4.90)
Finland	1	0.07 (−0.51 to 0.65)	1	0.14 (−0.55 to 0.83)
France	18	0.46 (−0.15 to 1.07)	0	NA
Greece	1	0.53 (0.17 to 0.90)	1	2.54 (1.28 to 3.83)
Italy	18	0.65 (0.26 to 1.04)	0	NA
Japan	47	1.05 (0.78 to 1.31)	47	1.42 (1.05 to 1.81)
Mexico	8	0.67 (0.48 to 0.86)	3	1.29 (0.21 to 2.39)
Portugal	2	0.11 (−0.27 to 0.49)	1	0.03 (−1.14 to 1.21)
South Africa	6	0.41 (0.14 to 0.68)	5	0.80 (0.16 to 1.44)
South Korea	7	0.42 (0.27 to 0.58)	0	NA
Spain	45	0.87 (0.60 to 1.15)	19	1.96 (1.18 to 2.75)
Sweden	1	0.20 (−1.03 to 1.44)	1	0.08 (−1.44 to 1.62)
Switzerland	8	0.47 (−0.36 to 1.31)	4	0.79 (−0.96 to 2.58)
Taiwan	3	0.25 (−0.03 to 0.53)	3	0.62 (−0.39 to 1.64)
Thailand	19	0.61 (0.24 to 0.99)	0	NA
United Kingdom	15	0.06 (−0.36 to 0.48)	0	NA
United States	100	0.79 (0.60 to 0.98)	107	1.58 (1.28 to 1.88)
Total	598	0.44 (0.39 to 0.50)	499	0.68 (0.59 to 0.77)

* Pooled estimates represent the percentage changes in daily all-cause mortality per 10-μg-per-cubic-meter increase in concentrations of particulate matter (PM) with an aerodynamic diameter of 10 μm or less (PM_{10}) and PM with an aerodynamic diameter of 2.5 μm or less ($PM_{2.5}$), as determined with the use of trimmed exposure data in which the highest 5% and lowest 5% of PM_{10} and $PM_{2.5}$ measurements were excluded. NA denotes not available.

000077 VTA

A) Station

The area for which the health risk assessment will be calculated consists of four grids (1x1 km^2 each) and one monitoring station (S), which registered in year Y an annual mean $PM_{2.5}$ concentration of 17 µg/m^3

B) Concentration map

The concentration map from that monitoring station (S) and the supplementary data provides the result shown in B.

C) Population/exposure

The populations in the grids are shown in C. In grid 1, the 10 000 inhabitants are exposed to 15 µg/m^3; in grid 2, the 5 000 inhabitants are exposed to 10 µg/m^3; in grid 3, the 2 000 inhabitants are exposed to 10 µg/m^3; and in grid 4, the 1 000 inhabitants are exposed to 5 µg/m^3.

D) Relative risk

In the case of $PM_{2.5}$, the concentration-response function used for total (all cause) mortality in people above 30 years of age implies a relative risk of 1.062 per 10 µg/m^3. This means that, assuming linearity, an increase of 10 µg/m^3 of $PM_{2.5}$ is associated with a 6.2 % increase in total mortality in the total population considered.

E) Counterfactual concentration

The counterfactual concentration for $PM_{2.5}$ is 0 µg/m^3, meaning that, for instance, for grid 1 the effect of the whole range of 15 µg/m^3 will be estimated.

F) Mortality

The total mortality (incidence baseline) in the country for year Y and for the population over 30 years of age is 10 deaths per 1 000 inhabitants, so the number of deaths per grid are as shown in F.

G) Premature deaths

The number of deaths attributed to exposure to $PM_{2.5}$ in each grid (assuming, according to the concentration-response function, an increment of 6.2 % in total mortality per 10 µg/m^3) are as shown in G.

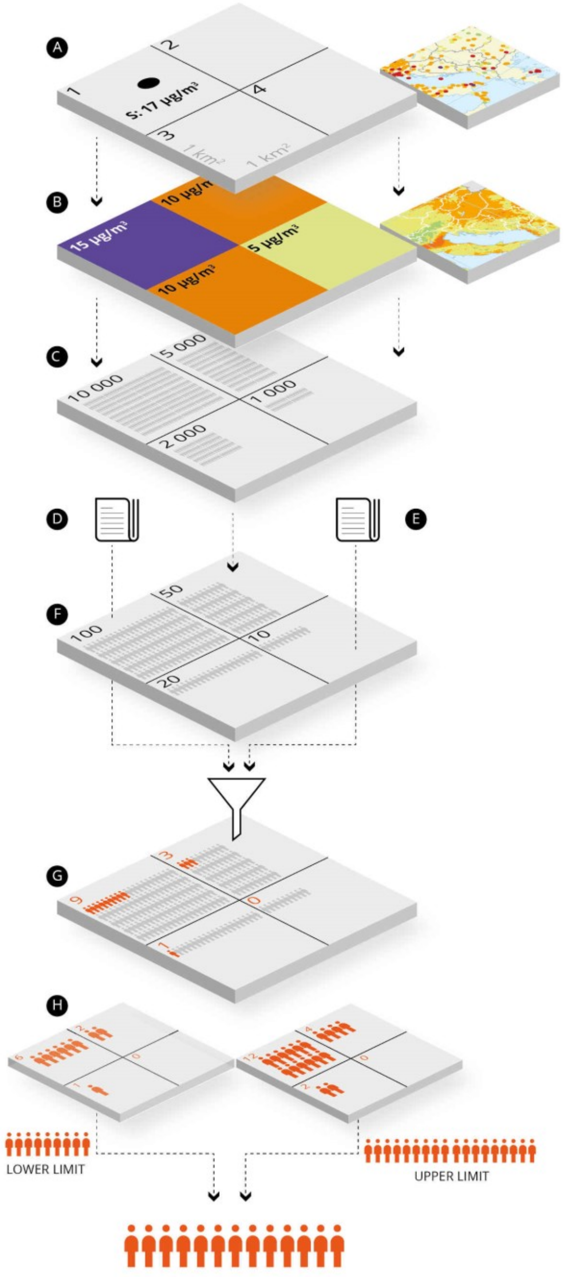
This is obtained from:
Relative risk (RR) = exp (**β** * concentration) = exp (0.0062 * concentration). For grid 1: 1.097462
The attributable fraction (AF) = (RR-1)/RR.
For grid 1: 0.0888065
Premature deaths (PD) = AF *mortality * pop.
For grid 1: 8.88 ≅ 9.

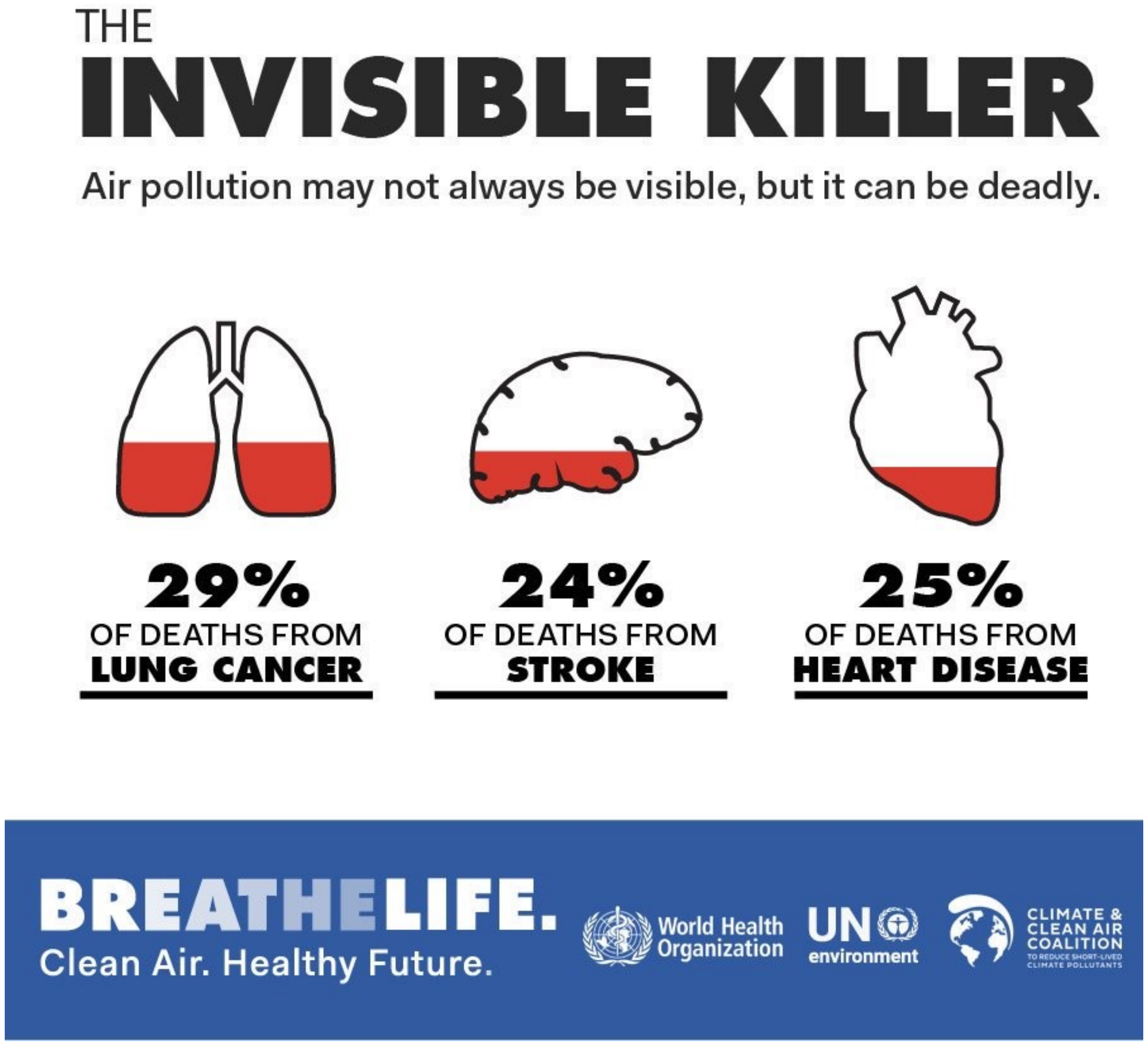
And the total number of deaths attributed to $PM_{2.5}$ in the whole area in year Y: 9+3+1+0=13.

H) Uncertainty range

The uncertainty range is calculated using the lower and upper limits of 1.040 and 1.083, instead of the relative risk of 1.062.

The total mortality is then expressed as 13 premature deaths with a 95 % confidence interval between the values of 9 and 18.

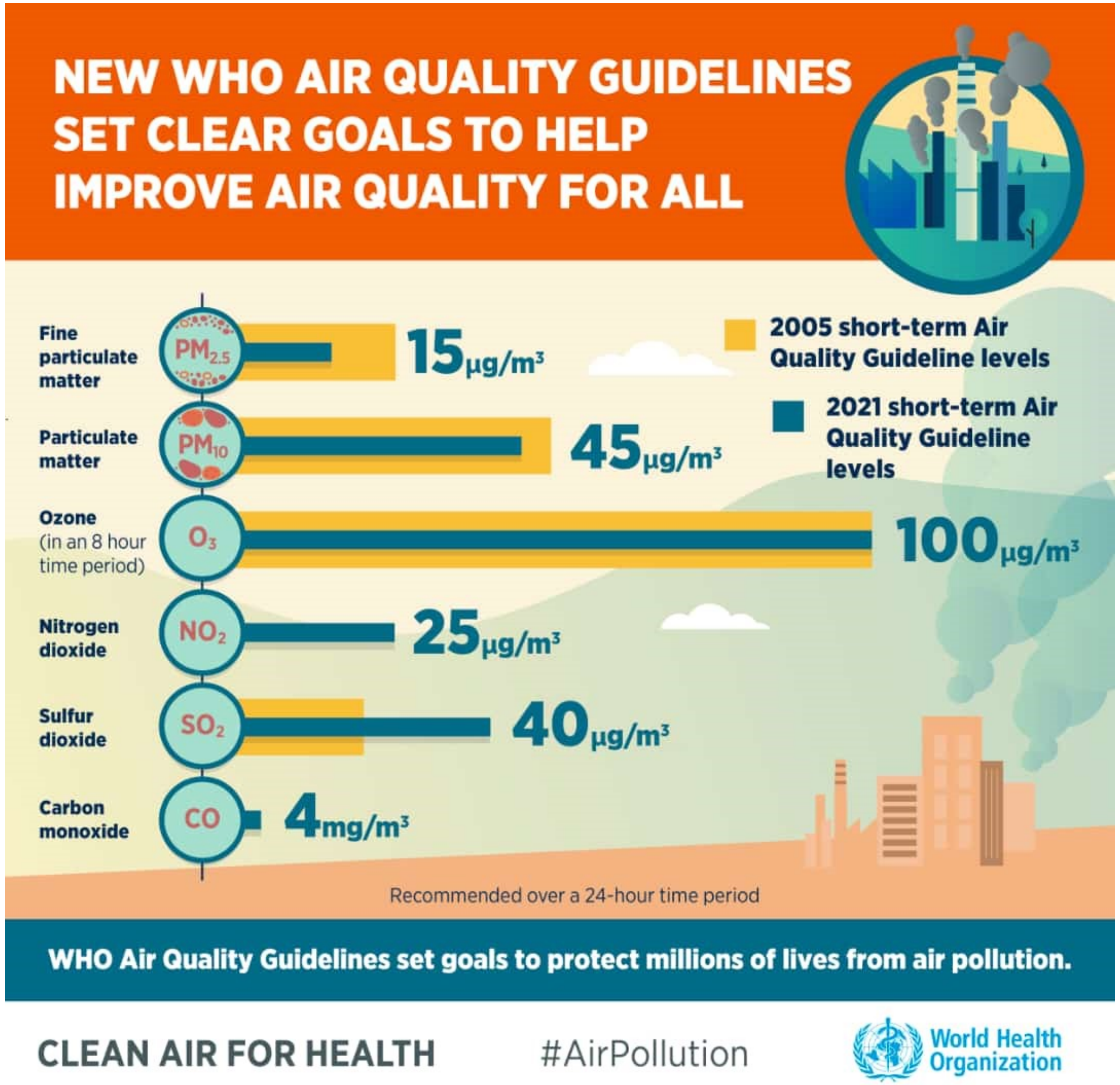



THE
INVISIBLE KILLER
Air pollution may not always be visible, but it can be deadly.
29% OF DEATHS FROM LUNG CANCER
24% OF DEATHS FROM STROKE
25% OF DEATHS FROM HEART DISEASE
BREATHELIFE.
Clean Air. Healthy Future.
World Health Organization
UN environment
CLIMATE & CLEAN AIR COALITION


AIR POLLUTION – THE SILENT KILLER
Every year, around 7 MILLION DEATHS are due to exposure from both outdoor and household air pollution.
Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce:
Stroke
Heart disease
Lung cancer, and both chronic and acute respiratory diseases, including asthma
REGIONAL ESTIMATES ACCORDING TO WHO REGIONAL GROUPINGS:
Over 2 million in South-East Asia Region
Over 2 million in Western Pacific Region
Nearly 1 million in Africa Region
About 500 000 deaths in Eastern Mediterranean Region
About 500 000 deaths in European Region
More than 300 000 in the Region of the Americas
CLEAN AIR FOR HEALTH
#AirPollution
World Health Organization

000078 VTA


WHO AIR QUALITY GUIDELINE LEVELS ARE LOWER THAN 15 YEARS AGO
Fine particulate matter
$PM_{2.5}$
5 µg/m³
Particulate matter
PM_{10}
15 µg/m³
Ozone (in peak season)
O_3
60 µg/m³
Nitrogen dioxide
NO_2
10 µg/m³
2005 long-term Air Quality Guideline levels
2021 long-term Air Quality Guideline levels
Recommended annually
WHO Air Quality Guidelines set goals to protect millions of lives from air pollution.
CLEAN AIR FOR HEALTH
#AirPollution
World Health Organization


NEW WHO AIR QUALITY GUIDELINES SET CLEAR GOALS TO HELP IMPROVE AIR QUALITY FOR ALL
Fine particulate matter
$PM_{2.5}$
15 µg/m³
Particulate matter
PM_{10}
45 µg/m³
Ozone (in an 8 hour time period)
O_3
100 µg/m³
Nitrogen dioxide
NO_2
25 µg/m³
Sulfur dioxide
SO_2
40 µg/m³
Carbon monoxide
CO
4 mg/m³
2005 short-term Air Quality Guideline levels
2021 short-term Air Quality Guideline levels
Recommended over a 24-hour time period
WHO Air Quality Guidelines set goals to protect millions of lives from air pollution.
CLEAN AIR FOR HEALTH
#AirPollution
World Health Organization


THE WHO AIR QUALITY GUIDELINES (AQGs) SET GOALS TO REDUCE AIR POLLUTION
They set out to achieve this by:
1
INTERIM TARGETS HELP COUNTRIES TO CONTINUOUSLY IMPROVE AIR QUALITY
2
RECOMMENDING AQG LEVELS TO PROTECT PEOPLE FROM AIR POLLUTION
CURRENT LEVELS
INTERIM TARGETS
RECOMMENDED AQG LEVELS
CLEAN AIR FOR HEALTH
#AirPollution
World Health Organization


THE WHO AIR QUALITY GUIDELINES PROVIDE VARIOUS GOOD PRACTICE STATEMENTS FOR:
Sand and dust storms
Black/ elemental carbon
Ultrafine particles
CLEAN AIR FOR HEALTH
#AirPollution
World Health Organization


SOLUTIONS
INVEST IN ENERGY-EFFICIENT POWER GENERATION.
IMPROVE DOMESTIC, INDUSTRY AND MUNICIPAL WASTE MANAGEMENT.
REDUCE AGRICULTURAL WASTE INCINERATION, FOREST FIRES AND CERTAIN AGRO-FORESTRY ACTIVITIES.
MAKE GREENER AND MORE COMPACT CITIES WITH ENERGY-EFFICIENT BUILDINGS.
PROVIDE UNIVERSAL ACCESS TO CLEAN, AFFORDABLE FUELS AND TECHNOLOGIES FOR COOKING, HEATING AND LIGHTING.
BUILD SAFE AND AFFORDABLE PUBLIC TRANSPORT SYSTEMS AND PEDESTRIAN- AND CYCLE-FRIENDLY NETWORKS.
WHO Air Quality Guidelines set goals to protect millions of lives from air pollution.
CLEAN AIR FOR HEALTH
#AirPollution
World Health Organization


SOURCES OF AIR POLLUTION ARE A GLOBAL CHALLENGE WE MUST TACKLE TOGETHER
INDUSTRY & ENERGY SUPPLY
DUST
AGRICULTURAL PRACTICES
TRANSPORT
HOUSEHOLD ENERGY
WASTE MANAGEMENT
WHO Air Quality Guidelines set goals to protect millions of lives from air pollution.
CLEAN AIR FOR HEALTH
#AirPollution
World Health Organization


REDUCING AIR POLLUTION AND MITIGATING CLIMATE CHANGE, TOGETHER HELP TO PROTECT OUR HEALTH
REDUCE CLIMATE CHANGE
Mitigating emissions
REDUCE AIR POLLUTION
PROTECT HEALTH
WHO Air Quality Guidelines set goals to protect millions of lives from air pollution.
CLEAN AIR FOR HEALTH
#AirPollution
World Health Organization

Efecto	Exposición	Fracción	Determinaciones de Causalidad: PM ISA 2009	Determinaciones de Causalidad: PM ISA actual
efectos respiratorios	Exposición de corto plazo	$PM_{2.5}$	probablemente causal	probablemente causal
		$PM_{10-2.5}$	se sugiere	se sugiere
		UFP	se sugiere	se sugiere
	Exposición de largo plazo	$PM_{2.5}$	probablemente causal	probablemente causal
		$PM_{10-2.5}$	inadecuada	inadecuada
		UFP	inadecuada	inadecuada
efectos cardiovasculares	Exposición de corto plazo	$PM_{2.5}$	Causal	Causal
		$PM_{10-2.5}$	se sugiere	se sugiere
		UFP	se sugiere	se sugiere
	Exposición de largo plazo	$PM_{2.5}$	Causal	Causal
		$PM_{10-2.5}$	inadecuada	se sugiere
		UFP	inadecuada	inadecuada
efectos metabólicos	Exposición de corto plazo	$PM_{2.5}$	-	se sugiere
		$PM_{10-2.5}$	-	inadecuada
		UFP	-	inadecuada
	Exposición de largo plazo	$PM_{2.5}$	-	se sugiere
		$PM_{10-2.5}$	-	se sugiere
		UFP	-	inadecuada
efectos al sistema nervioso central	Exposición de corto plazo	$PM_{2.5}$	inadecuada	se sugiere
		$PM_{10-2.5}$	inadecuada	inadecuada
		UFP	inadecuada	se sugiere
	Exposición de largo plazo	$PM_{2.5}$	-	probablemente causal
		$PM_{10-2.5}$	-	se sugiere
		UFP	-	se sugiere
efectos reproductivos y del desarrollo	reproduccion masculina/emenina y fertilidad	$PM_{2.5}$	se sugiere	se sugiere
		$PM_{10-2.5}$	inadecuada	inadecuada
		UFP	inadecuada	inadecuada
	consecuencias en el embarazo y el nacimiento	$PM_{2.5}$	se sugiere	se sugiere
		$PM_{10-2.5}$	inadecuada	inadecuada
		UFP	inadecuada	inadecuada
cancer		$PM_{2.5}$	se sugiere	probablemente causal
		$PM_{10-2.5}$	inadecuada	se sugiere
		UFP	inadecuada	inadecuada
mortalidad	Exposición de corto plazo	$PM_{2.5}$	Causal	Causal
		$PM_{10-2.5}$	se sugiere	se sugiere
		UFP	inadecuada	inadecuada
	Exposición de largo plazo	$PM_{2.5}$	Causal	Causal
		$PM_{10-2.5}$	inadecuada	se sugiere
		UFP	inadecuada	inadecuada

- Causal
- probablemente causal
- se sugiere,pero no es suficiente para inferirlo
- inadecuada

Determinaciones de causalidad para diversos efectos de distintas fracciones de material particulado. Tabla adaptada y traducida desde (U.S. EPA., 2019).

Conformación Comité Operativo Ampliado
Proceso de revisión de la norma primaria de calidad ambiental para MP2.5

Presentación Comité Operativo | SESIÓN N°2/2023
Miércoles 15 de marzo de 2023

Gabriel Mendoza Miranda
División de Educación Ambiental y Participación Ciudadana
Ministerio del Medio Ambiente

Comité Operativo Ampliado: Consideraciones para su creación

1
- Es facultativa

2
- Se materializa mediante resolución exenta del MMA

3
- Lo componen los miembros del comité operativo y personas naturales o jurídicas ajenas a la administración del Estado

4
- Sus integrantes deberán ser propuestos por el comité operativo

5
- Con la propuesta, el Ministro oficiará a los nominados solicitando su participación

6
- Para las personas jurídicas se solicitará la designación de un representante y un suplente

7
- Con la aceptación del cargo, se procederá a dictar la resolución de constitución del comité ampliado

Rol y funciones del Comités Operativo Ampliado

Una **instancia colaborativa** que tiene por objetivo conocer los avances en la elaboración del anteproyecto; transparentar los intereses de los sectores involucrados, y recabar antecedentes técnicos, científicos, sociales y/o económicos, a ser considerados en el proceso.

FUNCIONES

- Apoyar al Comité Operativo en materias específicas
- Aportar antecedentes técnicos
- Opinar sobre materias de la norma y su revisión, en relación al sector que se representa y su ámbito de acción
- Generar recomendaciones y sugerencias a la norma

Creación del Comité Operativo Ampliado

Acuerdo:

1. Envío propuesta de actores relevantes a ser considerados para conformar el Comité Operativo Ampliado, conforme criterios.

   Plazo de envío: lunes 13 de marzo, 2023

   Vía correo electrónico: jmunoz@mma.gob.cl

Creación del Comité Operativo Ampliado

Tabla 1: Representantes del Comité Operativo.

Organismo
Superintendencia del Medio Ambiente
Ministerio de Salud
Ministerio de Economía, Fomento y Turismo
Ministerio de Energía 😇
Ministerio de Obras Públicas
Ministerio de Transporte y Telecomunicaciones 😇
Ministerio de Minería
Ministerio de Ciencia Tecnología, Conocimiento e Innovación

Ministerio de Energía:

- Gremio de Generadoras de Chile.
- Asociación Chilena de Biomasa

Ministerio de Transporte y Telecomunicaciones:

- Asociación Nacional Automotriz de Chile (ANAC A.G)
- Asociación Nacional de Importadores de Motocicletas (ANIM A.G)

Creación del Comité Operativo Ampliado: Criterios para focalización de actores

Redes de Monitoreo (36 ciudades)	Declaraciones de Zonas Saturadas	Planes de Prevención y Descontaminación
Arica	Arica	Arica
Iquique	Iquique	Iquique
Antofagasta	Antofagasta	Antofagasta
Tocopilla	Tocopilla	Tocopilla
Mejillones	Mejillones	Mejillones
Calama	Calama	Calama
Copiapó	Copiapó	Copiapó
Huasco	Huasco	Huasco
La Serena	La Serena	La Serena
Coquimbo	Coquimbo	Coquimbo
Andacollo	Andacollo	Andacollo
Concón	Concón ✓	Concón ✓
Quintero	Quintero ✓	Quintero ✓
Puchuncaví	Puchuncaví ✓	Puchuncaví ✓
Viña del Mar	Viña del Mar	Viña del Mar
Valparaíso	Valparaíso	Valparaíso
R. Metropolitana	R. Metropolitana ✓	R. Metropolitana ✓
Rancagua	Rancagua ✓	Rancagua (en Contraloría)
Rengo	Rengo ✓	Rengo (en Contraloría)
San Fernando	San Fernando ✓	S. Fernando (en Contraloría)
Curicó	Curicó ✓	Curicó ✓
Talca-Maule	Talca-Maule ✓	Talca-Maule (en proceso)
Linares	Linares ✓	Linares (en proceso)
Chillán-Chillán Viejo	Chillán-Chillán Viejo ✓	Chillán-Chillán Viejo ✓
C. Metropolitano	C. Metropolitano ✓	C. Metropolitano ✓
Curanilahue	Curanilahue	Curanilahue
Los Ángeles	Los Ángeles ✓	Los Ángeles ✓
Temuco-P. Las Casas	Temuco-P. Las Casas ✓	Temuco-P. Las Casas ✓
Valdivia	Valdivia ✓	Valdivia ✓
La Unión	La Unión	La Unión
Osorno	Osorno ✓	Osorno ✓
Puerto Varas	Puerto Varas ✓	Puerto Varas (en proceso)
Puerto Montt	Puerto Montt ✓	Puerto Montt (en proceso)
Puerto Aysén	Puerto Aysén ✓	Puerto Aysén (en proceso)
Coyhaique	Coyhaique ✓	Coyhaique ✓
Cochrane	Cochrane	Cochrane
Punta Arenas	Punta Arenas	Punta Arenas

Calidad Aire en Línea
www.sinca.mma.gob.cl

Tipologías de actores

- Org. Sector Privado / Regulados
- ONGs
Org. Territoriales
Org. Funcionales
Org. Indígenas
- Academia
- Consultoras

Criterios de relevancia

- Representatividad
Nivel de actuación
- Interés e influencia
- Territorial
- Vulnerabilidad socio ambiental

Creación del Comité Operativo Ampliado

En próxima sesión del Comité Operativo mes de abril se definirá la composición del COA

Nuevo plazo de envío de propuestas: martes 28 de marzo, 2023

Vía correo electrónico: jmunoz@mma.gob.cl

Ministerio del Medio Ambiente

Gobierno de Chile