SALUTE IN COMUNE

La città della salute: resilienza e sostenibilità. Gli obiettivi ONU per il 2030

Brescia, Palazzo Loggia, 25 febbraio 2019, ore 13,30 - 18,00

L'aria che respiriamo e la nostra salute

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Università degli Studi di Brescia

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2. Come leggere i dati: gli studi scientifici e le stime (impatto teorico)
3. Gli effetti acuti
4. Gli effetti cronici
5. L'impatto globale sulla salute
6. I benefici della riduzione degli inquinanti


World Health Organization
Media centre
WHO releases country estimates on air pollution exposure and health impact
New interactive maps highlight areas within countries that exceed WHO air quality limits
AIR POLLUTION AND CHILD HEALTH
Prescribing clean air
World Health Organization
REGIONAL OFFICE FOR Europe
Review of evidence on health aspects of air pollution – REVIHAAP Project
Technical Report
OECD
Economic cost of the health impact of air pollution in Europe
Clean air, health and wealth
PREVENTING DISEASE THROUGH HEALTHY ENVIRONMENTS
A global assessment of the burden of disease from environmental risks
Ambient air pollution:
A global assessment of
World Health Organization
Public health, environmental and social determinants of health (PHE)
CLEAN AIR FOR HEALTH: Geneva Action Agenda
First WHO Global Conference on Air Pollution and Health – summary report
1 November 2018
World Health Organization
Burden of disease from ambient air pollution for 2016
v2 April 2018

quotidianosanità.it

Martedì 30 OTTOBRE 2018

L'inquinamento uccide 600mila bambini l'anno. Il rapporto shock dell'Oms presentato a Ginevra

Il rapporto è stato presentato nel corso della prima Conferenza mondiale dell'Oms sull'inquinamento atmosferico e la salute aperta ieri a Ginevra: l'Oms stima che nel 2016, 600.000 bambini siano morti per infezioni acute delle basse vie respiratorie causate da aria inquinata e inoltre che i bambini esposti ad alti livelli di inquinamento atmosferico possono essere maggiormente a rischio nella loro vita di malattie croniche come le malattie cardiovascolari. IL RAPPORTO OMS.

Ogni giorno circa il 93% dei bambini di età inferiore ai 15 anni (1,8 miliardi) respira aria così inquinata che mette a serio rischio la salute e lo sviluppo. Molti di loro muoiono: l'Oms stima che nel 2016, 600.000 bambini siano morti per infezioni acute delle basse vie respiratorie causate da aria inquinata.

Un nuovo rapporto dell'Oms sull'inquinamento atmosferico e la salute dei bambini prescrivere l'aria pulita ed esamina il pesante bilancio dell'inquinamento atmosferico sia ambientale (esterno) che domestico sulla salute dei bambini nel mondo, in particolare nei paesi a basso e medio reddito. Il rapporto è stato lanciato alla prima Conferenza mondiale dell'Oms sull'inquinamento atmosferico e la salute aperta ieri a Ginevra.

Secondo il Rapporto quando le donne incinte sono esposte all'aria inquinata, hanno più probabilità di partorire prematuramente e hanno figli piccoli e di peso inferiore alla nascita. L'inquinamento atmosferico influisce anche sul neurosviluppo e sulle capacità cognitive e può scatenare l'asma e il cancro infantile.

I bambini che sono stati esposti ad alti livelli di inquinamento atmosferico possono essere maggiormente a rischio nella loro vita di malattie croniche come le malattie cardiovascolari.

"L'aria inquinata sta avvelenando milioni di bambini e rovina le loro vite", afferma **Tedros Adhanom Ghebreyesus**, direttore generale dell'Oms. "Questo è imperdonabile. Ogni bambino dovrebbe essere in grado di respirare aria pulita in modo che possa crescere e realizzare il suo pieno potenziale".

Corriere, 12/10/18

La Stampa, 19/12/18

A Brescia c'è l'aria più inquinata d'Italia, al secondo posto Torino

Il rapporto Ispra presentato al Senato mette però in evidenza una significativa tendenza alla riduzione delle emissioni di Pm10 primario. Viterbo città con meno smog

ANSA

Nel 2017 a Torino sono stati registrati 69 sforamenti dei livelli di polveri sottili

CONDIVIDI

SCOPRI TOP NEWS

Pubblicato il 19/12/2018
Ultima modifica il 19/12/2018 alle ore 12:36

C'è in Italia una significativa tendenza alla riduzione dei livelli di emissione di PM10 primario, quello che è direttamente emesso dal riscaldamento domestico e dai trasporti, ma anche dalle industrie e da alcuni fenomeni naturali, che si riduce del 19% in 10 anni (2005 al 2015). Ma al tempo stesso continuano i superamenti nelle città italiane: i dati preliminari, aggiornati al 10 dicembre, mostrano valori oltre la norma in 19 aree urbane con Brescia capofila dei superamenti (87) e Viterbo che invece, almeno finora, non ha mai oltrepassato il limite. Torino, con Lodi, è la seconda città d'Italia per numero di sforamenti. Lo

PRIMO PIANO

Non solo il latte. Dai trasporti all'energia fino al Fisco: le sfide della Sardegna al voto

NICOLA PINNA

REPORT DI LEGAMBIENTE

Inquinamento dell'aria: Brescia la peggiore in Lombardia

Agli 81 giorni di superi per il Pm10 nell'inverno 2017 si aggiungono i 101 giorni di superi per l'ozono nella calda estate 2018. Meggetto: «Si respira aria malata un giorno su due»

M.TR.

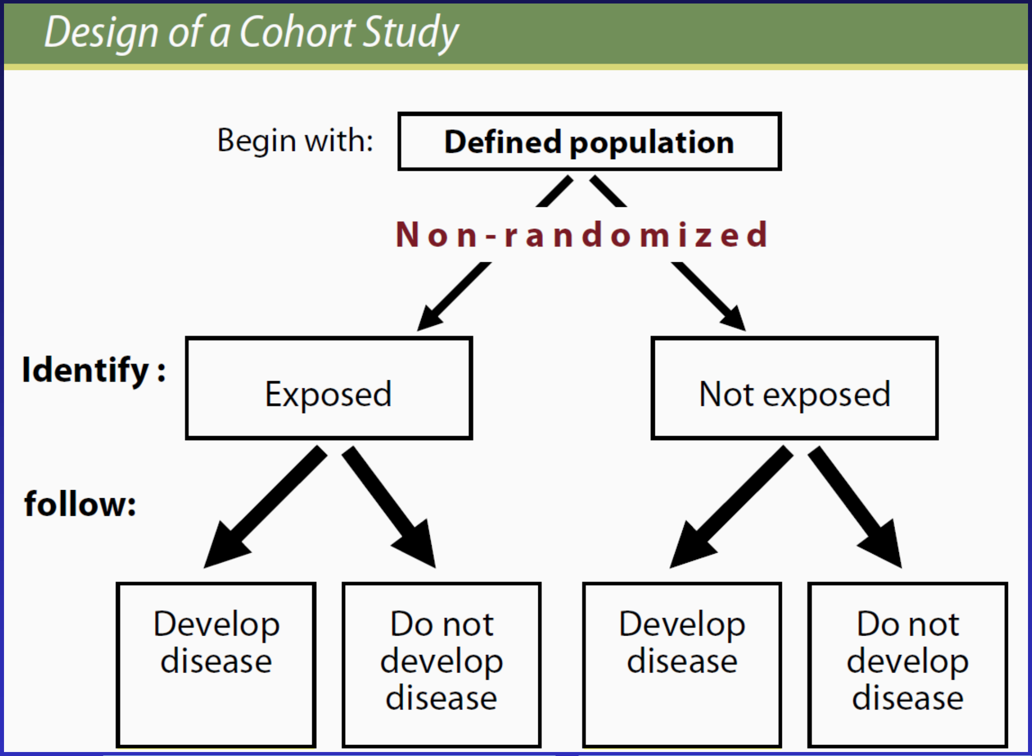
di M.Tr.

Non c'è solo il Pm 10 ad avvelenare i polmoni dei bresciani, visto che nell'inverno 2017 i giorni fuorilegge sono stati 81. Se si sommano i 101 giorni di superi per l'ozono registrati nell'estate appena conclusa Brescia guida la classifica lombarda dell'aria più inquinata, davanti a Monza, Cremona e Bergamo. Lo afferma il rapporto Captor 2018 di Legambiente. Mentre comincia la conta dei giorni fuorilegge per le polveri sottili - soglia che a Milano è stata superata tre volte dall' inizio di ottobre - fino a tutto il mese di settembre l'aria di Lombardia ha convissuto con quello che per Legambiente è «il più micidiale degli inquinanti estivi, l'ozono». «Si tende a considerare l'inquinamento estivo da ozono un problema minore rispetto a quello dello smog invernale - dichiara Barbara Meggetto, presidente lombarda di Legambiente -. Ma è sbagliato sia per gli impatti sulla salute, che sono amplificati dal maggior tempo passato all'aria aperta rispetto alle stagioni fredde, sia perché i due inquinamenti condividono la stessa origine: i micidiali NOx, le cui principali fonti emissive sono i motori dei veicoli, soprattutto quelli diesel». Per Damiano Di Simine, responsabile scientifico di Legambiente Lombardia «la pianura padana, oltre ad essere l'area europea più inquinata d'inverno, lo è anche d'estate, anche se a causa di fenomeni completamente diversi. Il problema è che gli inquinanti cambiano, ma i polmoni che li respirano sono sempre gli stessi!».

Come leggere i dati:

gli studi scientifici e le stime (impatto teorico)

Gli studi epidemiologici condotti per misurare gli effetti dell'inquinamento dell'aria



Incidenza negli esposti (I_1)

Incidenza nei NON esposti (I_0)

Rischio relativo = I_1 / I_0

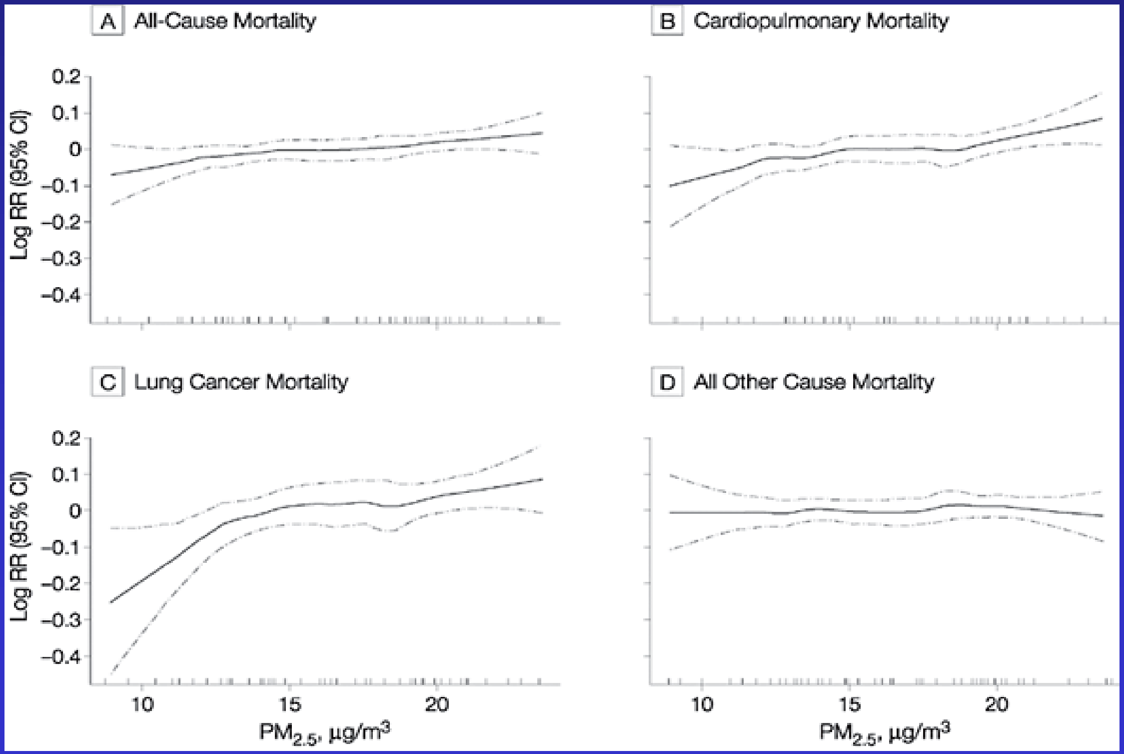
Indica quanto è maggiore l'incidenza (o rischio) negli esposti rispetto ai non esposti

Studio di Harvard delle 6 città: rapporto dei tassi di mortalità (rischio relativo) per i livelli di PM2,5 più alti rispetto ai più bassi (città a maggiore inquinamento vs città a minore inquinamento)

Cause di morte	**%**	**Rischio relativo (IC 95%)**	
Tutte	100	**1,26**	(1,08-1,47)
Cancro del polmone	8,4	**1,37**	(0,81-1,47)
Malattie cardio-vascolari	53,1	**1,37**	(1,11-1,68)
Tutte le altre	38,5	1,01	(0,79-1,30)

Inquinamento atmosferico e salute: i risultati del "Cancer Prevention Study II" (Pope et al, 2002)

- *Inclusi nello studio 1,2 milioni di adulti USA dal 1982 al 2000.*
- *Registrate le cause di morte in relazione alla qualità dell'aria in ciascuna città, tenuto conto degli altri fattori di rischio*



Inquinamento atmosferico e salute: i risultati del "Cancer Prevention Study II" (Pope et al, 2002)

Risultati dello studio:

- per ogni aumento di 10 µg/m^3 di PM2,5 si è visto un incremento della mortalità per:

- ***Tutte le cause: RR= 1,04; + 4 %***
- ***Malattie cardiovascolari: RR= 1,06; + 6 %***
- ***Cancro polmonare: RR= 1,08; + 8 %***

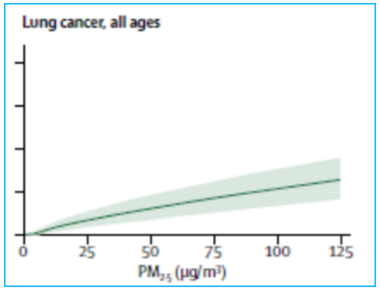
Results Fine particulate and sulfur oxide–related pollution were associated with all-cause, lung cancer, and cardiopulmonary mortality. Each 10-µg/m^3 elevation in fine particulate air pollution was associated with approximately a 4%, 6%, and 8% increased risk of all-cause, cardiopulmonary, and lung cancer mortality, respectively. Mea-

LE STIME DI IMPATTO SANITARIO

- **Numero o percentuale di casi o di morti:** causati da un certo fattore (aria inquinata) negli esposti o nella popolazione (rischio attribuibile).
- **Anni di vita perduta** (years of life lost = YLL) = differenza tra l'età al decesso e l'aspettativa di vita (mortalità prematura).
- **Anni di vita perduta, aggiustati per la disabilità** (disability-adjusted life years = DALYs) = anni di vita perduta + anni perduti per disabilità = totale anni di vita in buona salute persi

Come si calcolano le stime di impatto: il rischio attribuibile (RA)

$$RA = \frac{P * (RR-1)}{P * (RR-1) + 1} * 100 \quad \text{(formula di Levin)}$$



- P = proporzione di soggetti esposti
- RR = rischio relativo per un livello elevato vs basso di esposizione
- si assume che non vi siano altri fattori di rischio per la malattia

Es.: casi di cancro polmonare (~40.000 l'anno) in Italia:

1) da fumo di tabacco : RA = [0,25 (10-1)] / [0,25 (10-1) +1] *100 = 70% = 28.000 -> 12.000 in non fumatori

2) da PM2.5 medio annuo (20 vs 10 µg/m^3) = : RA = [0,5 (1,4-1)] / [0,5 (1,4-1) +1] *100 = 24% di 12.000 ~ 3.000 (7,5%)

Perché ci sono differenze tra le stime di impatto dell'inquinamento dell'aria sulla salute

1. Esposizione: parametri e livelli di riferimento:

WHO Air Quality Guidelines:

$PM_{2.5}$	PM_{10}
10 μg/m³ annual mean	20 μ/m³ annual mean
25 μg/m³ 24-hour mean	50 μg/m³ 24-hour mean

2. Rischio: relazione dose-effetto (rischio relativo, RR):

RR per morti totali per un incremento di 10 μg/m³ di PM2,5:

Cancer Prev. Study (USA): RR=1,06; ESCAPE (Europa): RR=1,14

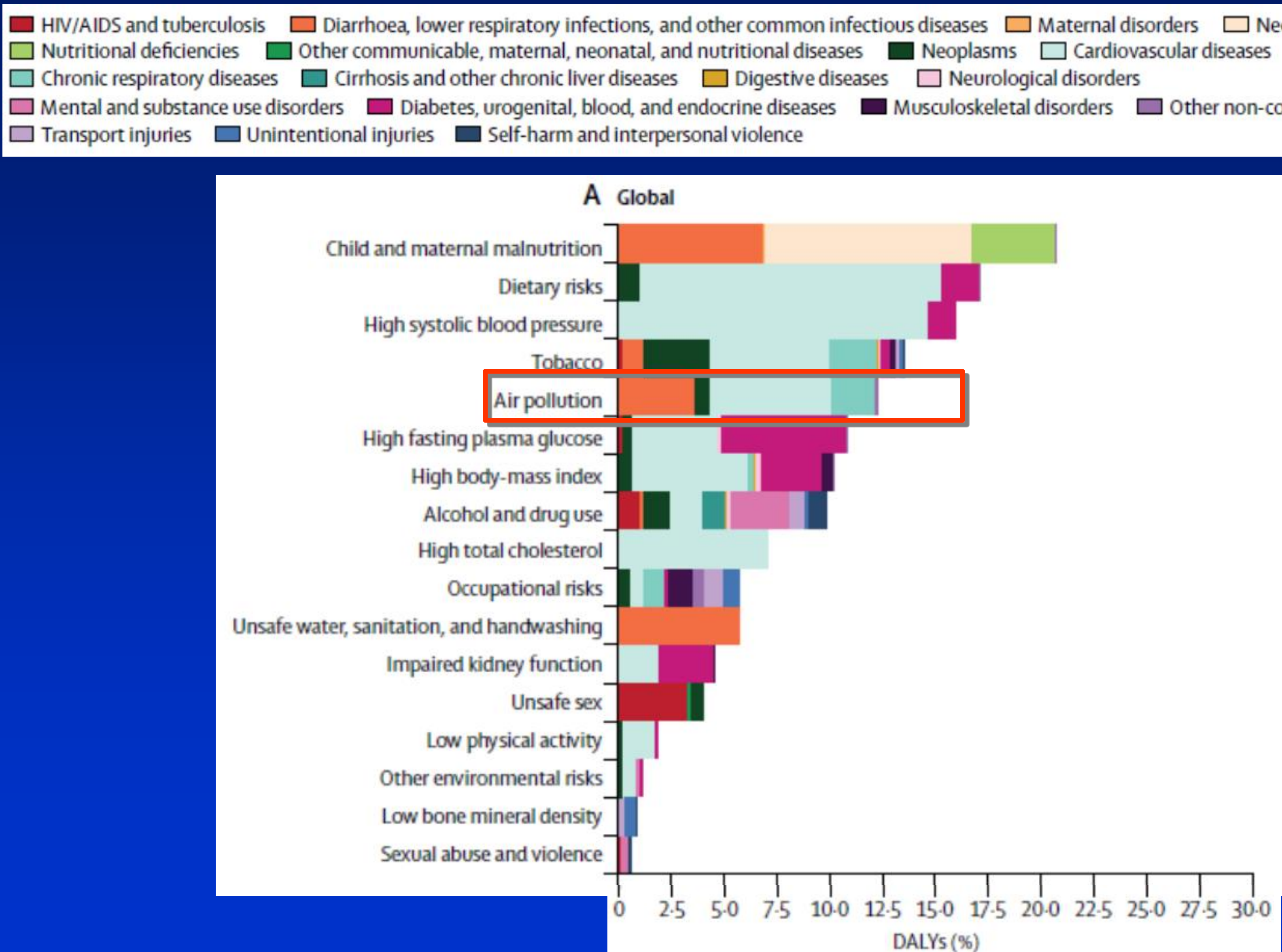
3. Popolazione: aree di esposizione a livelli diversi di inquinanti

		$PM_{2.5}$ [μg/m³], urban and rural areas			$PM_{2.5}$ [μg/m³], urban areas		
Region	Country	Median	Lower	Upper	Median	Lower	Upper
	Italy	17	12	25	18	13	26

Morti in Italia per anno (2016):
- European Environment Agency: 60.000
- WHO (Ambient Air Pollution Database): 30.000
- WHO (Global Burden Study): 20.000

Figure 2: DALYs attributable to all Level 2 risk factors

Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016

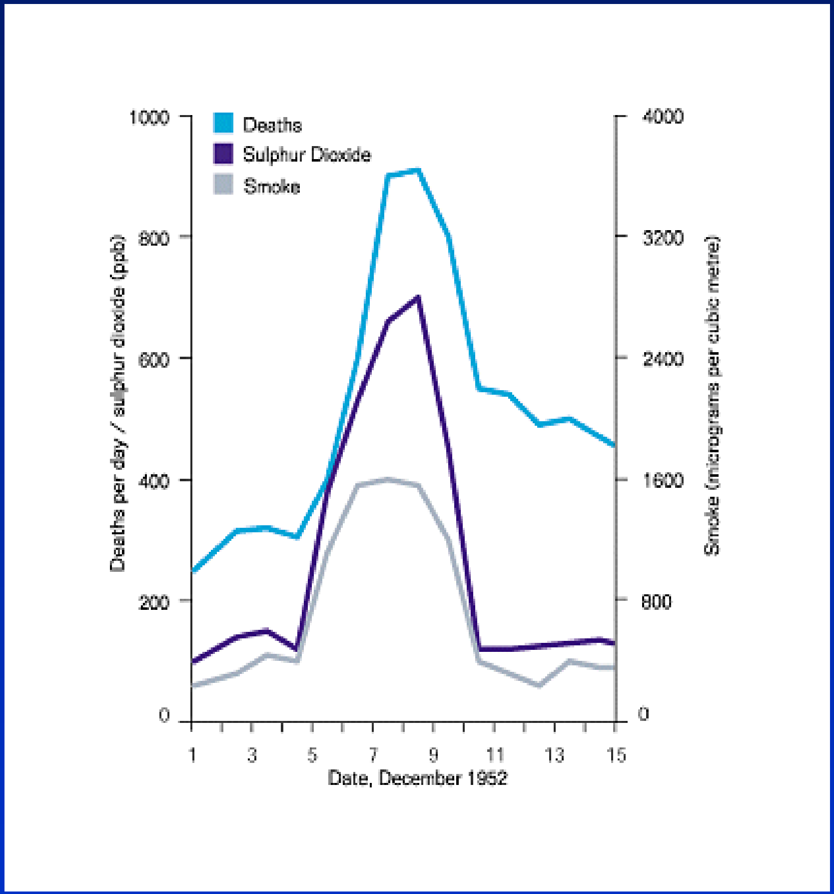


Gli effetti acuti

“The Killer Fog of 1952”

Londra, 4-12 dicembre 1952

Buio a mezzogiorno



- ***4 000 morti durante i «giorni dello smog» per malattie respiratorie e cardiocircolatorie***
- ***12 000 morti nelle settimane successive***

Logan WP. Lancet 1953;1:336-368
Bell ML e Davis DL. Environ Health Perspect 2001;109(S3):389-394

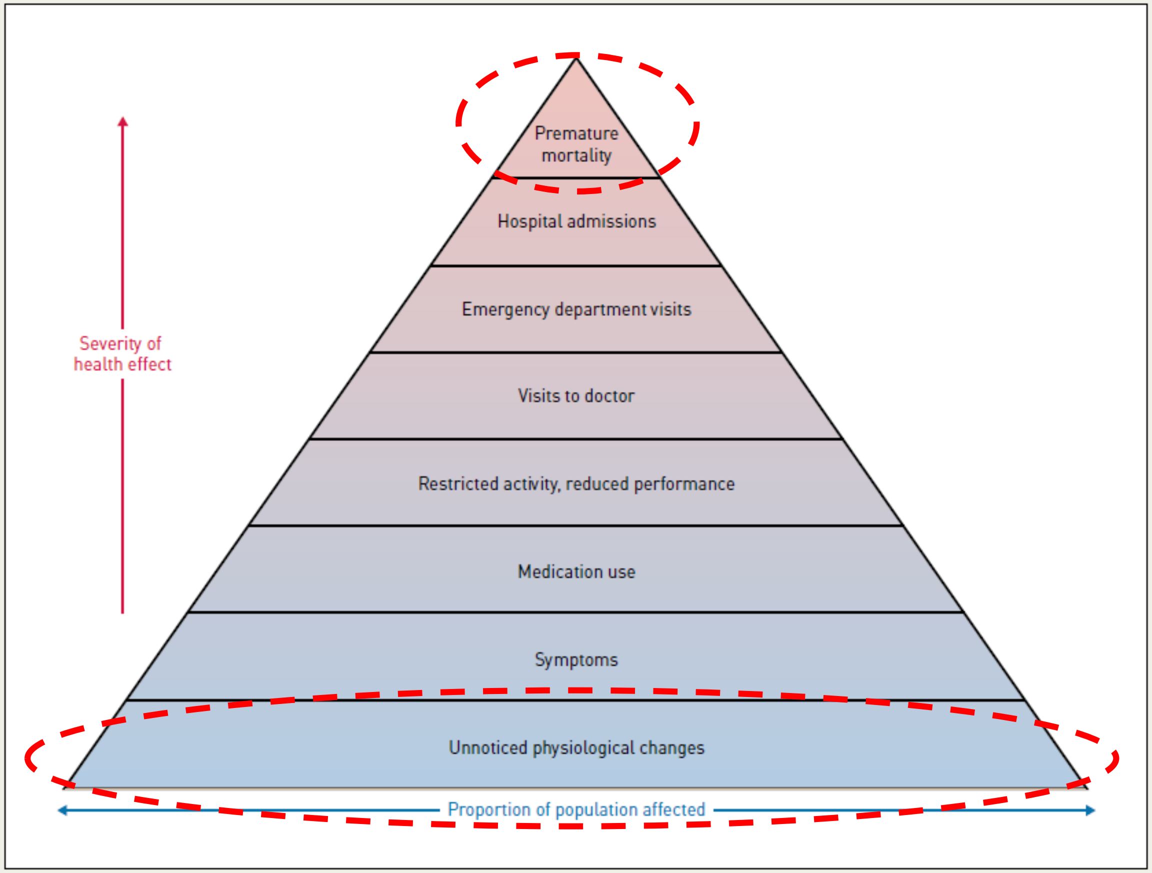
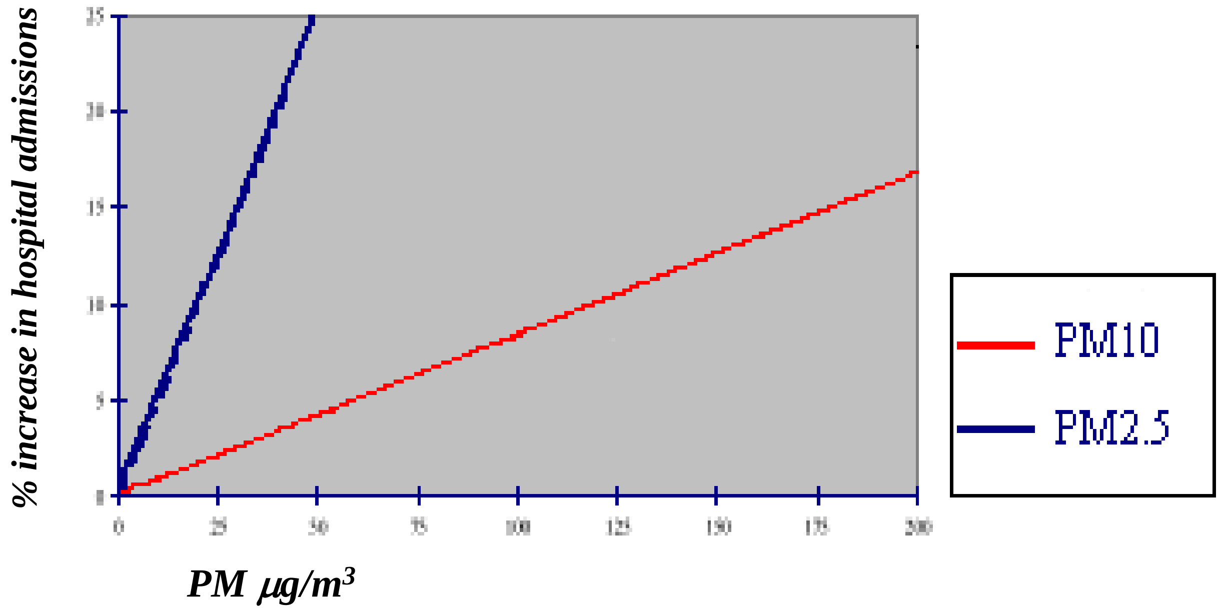


Figure 6a.1. Pyramid of health effects associated with air pollution [21].

Air Quality and Health, European Respiratory Society, 2010

Percentage increase in hospital admissions according to PM10 and PM2.5 air levels



Short-term Associations between Fine and Coarse Particulate Matter and Hospitalizations in Southern Europe: Results from the MED-PARTICLES Project
Massimo Stafoggia,[1] Evangelia Samoli,[2] Ester Alessandrini,[1] Ennio Cadum,[3] Bart Ostro,[4,5] Giovanna Berti,[3]

VOLUME 121 | NUMBER 9 | September 2013 • Environmental Health Perspectives

Relazione tra i ricoveri ospedalieri per malattie cardiocircolatorie e respiratorie (aumento %) e la concentrazione di PM2,5 e PM10

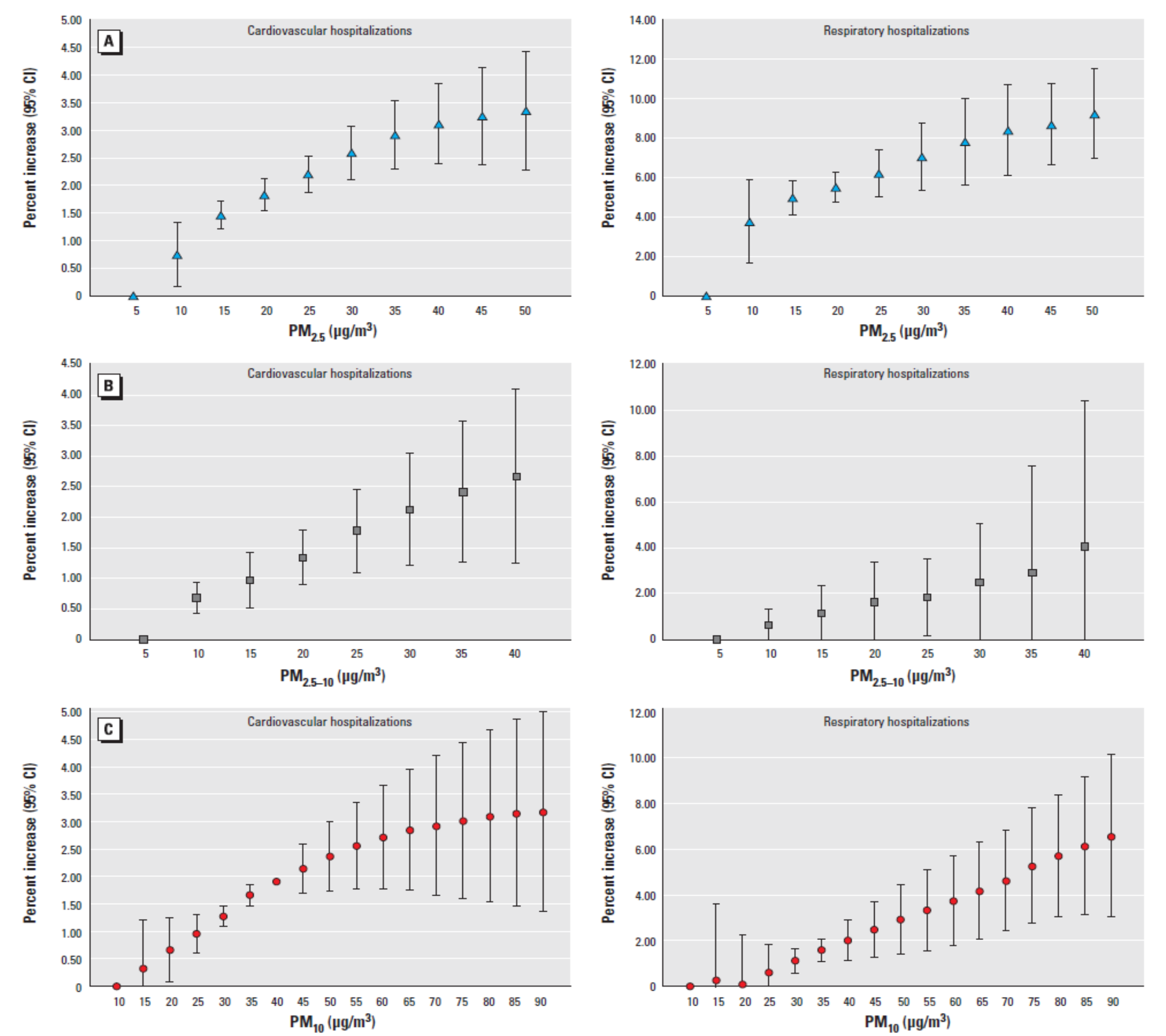


Figure 1. Concentration–response relationship between $PM_{2.5}$ (*A*), $PM_{2.5-10}$ (*B*), and PM_{10} (*C*) with cardiovascular hospitalizations, lag 0–1 (left), and respiratory hospitalizations, lag 0–5 (right). Values are percent increase (95% CI) of hospital admissions associated with increases of $PM_{2.5}$ and $PM_{2.5-10}$ levels relative to 5 µg/m^3, and of PM_{10} levels relative to 10 µg/m^3.

Mortalità per tutte le cause e per cause cardiorespiratorie e concentrazione di NO_2 in studi europei: rischio relativo per incrementi di 10 microgrammi/m^3

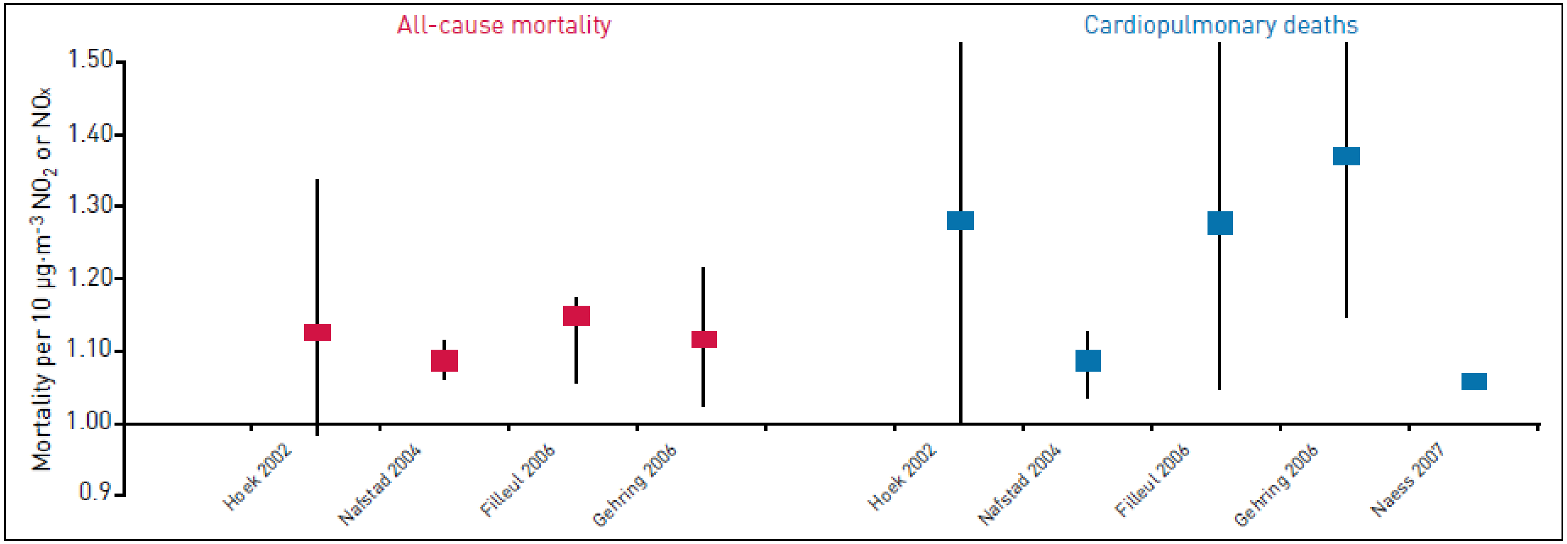


Figure 6.2. Relative risks with 95% confidence intervals from European cohort studies on air pollution and mortality, expressed per 10 $\mu g \cdot m^{-3}$ NO_2 or NOx [17].

Air Quality and Health, European Respiratory Society, 2010

Gli effetti cronici

BRITISH MEDICAL JOURNAL
LONDON SATURDAY DECEMBER 13 1952

A STUDY OF THE AETIOLOGY OF CARCINOMA OF THE LUNG

BY
RICHARD DOLL, M.D., M.R.C.P.
Member of the Statistical Research Unit of the Medical Research Council
AND
A. BRADFORD HILL, C.B.E., Ph.D., D.Sc.
Professor of Medical Statistics, London School of Hygiene and Tropical Medicine; Honorary Director of the Statistical Research Unit of the Medical Research Council

In a previous paper (Doll and Hill, 1950) we reported the first results of a large-scale investigation undertaken to determine whether patients with carcinoma of the lung differed materially from other persons, either in their smoking habits or in some way which might be related to the theory that atmospheric pollution is responsible for the development of the disease. We

Our first observations were, however, limited to patients drawn mainly from London and the adjacent counties. We have now extended the investigation to other parts of the country and have made more detailed inquiries into smoking habits. Many further patients

strated. In the present investigation some additional, but not very strong, evidence was obtained that lung carcinoma is commoner in urban than in rural areas, but otherwise we found no major or clear association apart from that with the consumption of tobacco.

The Harvard Six Cities Study

AN ASSOCIATION BETWEEN AIR POLLUTION AND MORTALITY IN SIX U.S. CITIES

DOUGLAS W. DOCKERY, SC.D., C. ARDEN POPE III, PH.D., XIPING XU, M.D., PH.D.,

(N Engl J Med 1993;329:1753-9.)

Methods. In this prospective cohort study, we estimated the effects of air pollution on mortality, while controlling for individual risk factors. Survival analysis, including Cox proportional-hazards regression modeling, was conducted with data from a 14-to-16-year mortality follow-up of 8111 adults in six U.S. cities.

Table 1. Characteristics of the Study Population and Mean Air-Pollution Levels in Six Cities.*

CHARACTERISTIC	PORTAGE, WIS.	TOPEKA, KANS.	WATERTOWN, MASS.	HARRIMAN, TENN.	ST. LOUIS	STEUBENVILLE, OHIO
No. of participants	1,631	1,239	1,336	1,258	1,296	1,351
Person-years of follow-up	21,618	16,111	19,882	17,836	17,715	17,914
No. of deaths	232	156	248	222	281	291
Deaths/1000 person-years	10.73	9.68	12.47	12.45	15.86	16.24
Female sex (%)	52	56	56	54	55	56
Smokers (%)	36	33	40	37	35	35
Former smokers (%)	24	25	25	21	24	23
Fine particles ($\mu g/m^3$)	11.0	12.5	14.9	20.8	19.0	29.6
Sulfate particles ($\mu g/m^3$)	5.3	4.8	6.5	8.1	8.1	12.8
Aerosol acidity ($nmol/m^3$)	10.5	11.6	20.3	36.1	10.3	25.2
Sulfur dioxide (ppb)	4.2	1.6	9.3	4.8	14.1	24.0
Nitrogen dioxide (ppb)	6.1	10.6	18.1	14.1	19.7	21.9
Ozone (ppb)	28.0	27.6	19.7	20.7	20.9	22.3

Tasso di mortalità per tutte le cause e livelli di alcuni inquinanti atmosferici nello studio delle 6 città.

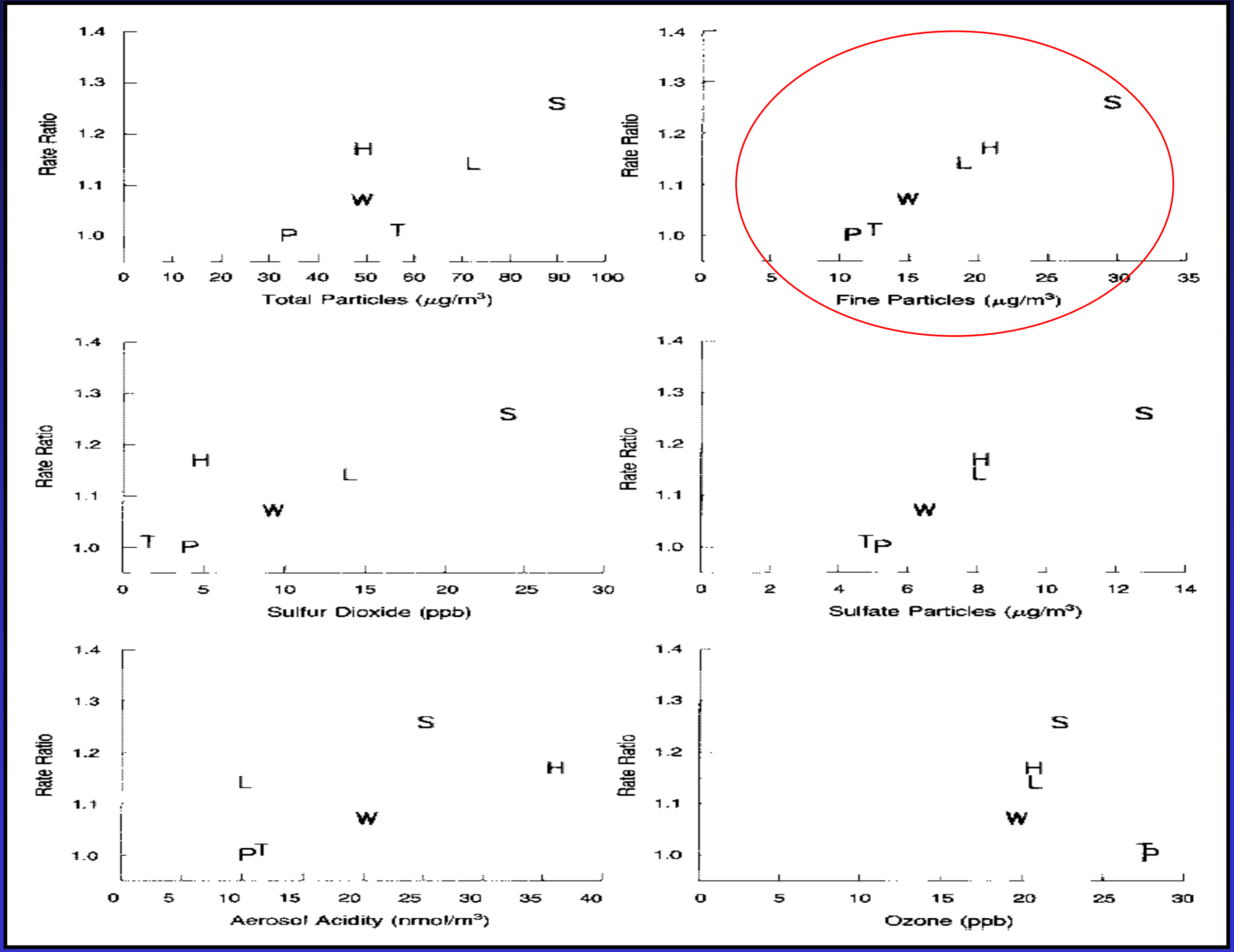
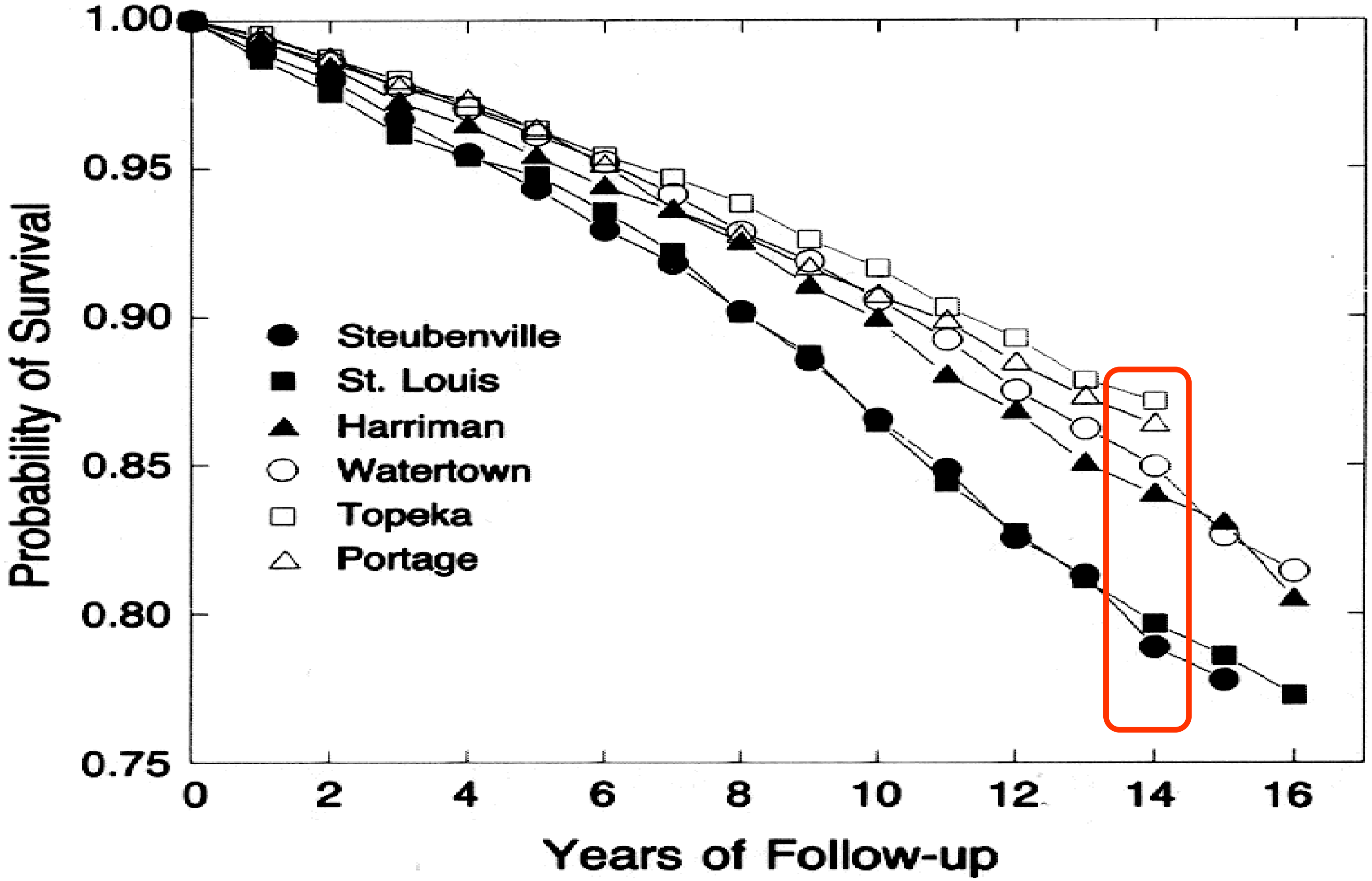


Figure 2. Crude Probability of Survival in the Six Cities, According to Years of Follow-up.



Studio delle 6 città: rapporto dei tassi di mortalità per l’esposizione ai livelli più alti di PM10 (città a maggiore inquinamento) rispetto ai più bassi (città a minore inquinamento

Cause di morte	**%**	**Livello di PM10 più alto vs meno alto:** Rischio relativo	(IC 95%)
Tutte	100	**1,26**	(1,08-1,47)
Cancro del polmone	8,4	**1,37**	(0,81-1,47)
Malattie cardio-vascolari	53,1	**1,37**	(1,11-1,68)
Tutte le altre	38,5	1,01	(0,79-1,30)

Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009

Johanna Lepeule,[1] Francine Laden,[1,2,3] Douglas Dockery,[1,2,3] and Joel Schwartz[1,2,3]

Environmental Health Perspectives • VOLUME 120 | NUMBER 7 | July 2012

Table 2. Adjusted[a] association between $PM_{2.5}$[b] and mortality, for the 8,096 participants and certain subpopulations of the Harvard Six Cities study, 1974–2009.

Cause of death/stratum-specific estimates according to characteristics at enrollment	*n* participants (*n* person-years)	RR (95% CI) for 10-µg/m³ increase in $PM_{2.5}$
All-cause	8,096 (212,067)	1.14 (1.07, 1.22)
Chronic conditions[c]		
Hypertension	1,439 (30,540)	1.17 (1.03, 1.32)
COPD	942 (17,723)	1.09 (0.95, 1.26)
Diabetes	563 (11,473)	1.04 (0.85, 1.27)
Smoking status (*p*-interaction = 0.58)		
Never smoker	3,265 (90,372)	1.09 (0.98, 1.21)
Former smoker	1,934 (48,049)	1.17 (1.04, 1.30)
Current smoker	2,897 (73,646)	1.17 (1.06, 1.28)
Follow-up period (*p*-interaction = 0.06)		
1974–1982	8,096 (58,798)	1.06 (0.96, 1.17)
1983–1991	7,478 (63,129)	1.32 (1.16, 1.50)
1992–2000	6,391 (51,800)	1.11 (0.98, 1.27)
2001–2009	4,910 (38,340)	1.19 (0.91, 1.55)
Cardiovascular	7,961 (195,941)	1.26 (1.14, 1.40)
Lung cancer	7,961 (195,941)	1.37 (1.07, 1.75)
COPD	7,805 (180,106)	1.17 (0.85, 1.62)

Aumento del rischio di morte per un incremento di 10 µg/m³ di PM2,5 (la relazione dose-effetto era lineare):

- **Tutte le cause: +14%**
- **Cardiovascolari: +26%**
- **Cancro polmonare: + 37%**
- **Broncopneumopatia cronica ostruttiva: +17%**

Inquinamento atmosferico e salute: i risultati del "Cancer Prevention Study II" (Pope et al, 2002)

- *Inclusi nello studio 1,2 milioni di adulti USA dal 1982 al 2000.*

- *Sono state registrate tutte le morti in relazione al livello medio di inquinamento atmosferico nell'area di residenza, tenuto conto di tutti gli altri fattori di rischio, dal 1982 al 1998*

- *Per un aumento di 10 µg/m^3 di PM2,5 si è visto un aumento di mortalità per:*
  - **Malattie cardiovascolari: + 6 %**
  - **Cancro polmonare: + 8 %**
  - **Tutte le cause: + 4 %**

Air pollution and lung cancer incidence in 17 European cohorts: prospective analyses from the European Study of Cohorts for Air Pollution Effects (ESCAPE)

Ole Raaschou-Nielsen, Zorana J Andersen, Rob Beelen, Evangelia Samoli, Massimo Stafoggia, Gudrun Weinmayr, Barbara Hoffmann, Paul Fisc Mark J Nieuwenhuijsen, Bert Brunekreef, Wei W Xun, Klea Katsouyanni, Konstantina Dimakopoulou, Johan Sommar, Bertil Forsberg, Lars Mod Anna Oudin, Bente Oftedal, Per E Schwarze, Per Nafstad, Ulf De Faire, Nancy L Pedersen, Claes-Göran Östenson, Laura Fratiglioni, Johanna Per Michal Korek, Göran Pershagen, Kirsten T Eriksen, Mette Sørensen, Anne Tjønneland, Thomas Ellermann, Marloes Eeftens, Petra H Peeters, Kees Meliefste, Meng Wang, Bas Bueno-de-Mesquita, Timothy J Key, Kees de Hoogh, Hans Concin, Gabriele Nagel, Alice Vilier, Sara Grioni, Vittorio Krogh, Ming-Yi Tsai, Fulvio Ricceri, Carlotta Sacerdote, Claudia Galassi, Enrica Migliore, Andrea Ranzi, Giulia Cesaroni, Chiara Badaloni Francesco Forastiere, Ibon Tamayo, Pilar Amiano, Miren Dorronsoro, Antonia Trichopoulou, Christina Bamia, Paolo Vineis, Gerard Hoek**

Figure 1: Areas where cohort members lived, measurements were taken, and land-use regression models for prediction of air pollution were developed
NO_2=nitrogen dioxide. NOx=nitrogen oxides (the sum of nitric oxide and nitrogen dioxide). PM=particulate matter.

Summary

Background Ambient air pollution is suspected to cause lung cancer. We aimed to assess the association between long-term exposure to ambient air pollution and lung cancer incidence in European populations.

Methods This prospective analysis of data obtained by the European Study of Cohorts for Air Pollution Effects used data from 17 cohort studies based in nine European countries. Baseline addresses were geocoded and we assessed air pollution by land-use regression models for particulate matter (PM) with diameter of less than 10 μm (PM_{10}), less than 2·5 μm ($PM_{2\cdot5}$), and between 2·5 and 10 μm (PM_{coarse}), soot ($PM_{2\cdot5absorbance}$), nitrogen oxides, and two traffic indicators. We used Cox regression models with adjustment for potential confounders for cohort-specific analyses and random effects models for meta-analyses.

Findings The 312 944 cohort members contributed 4 013 131 person-years at risk. During follow-up (mean 12·8 years), 2095 incident lung cancer cases were diagnosed. The meta-analyses showed a statistically significant association between risk for lung cancer and PM_{10} (hazard ratio [HR] 1·22 [95% CI 1·03–1·45] per 10 μg/m³). For $PM_{2\cdot5}$ the HR was 1·18 (0·96–1·46) per 5 μg/m³. The same increments of PM_{10} and $PM_{2\cdot5}$ were associated with HRs for adenocarcinomas of the lung of 1·51 (1·10–2·08) and 1·55 (1·05–2·29), respectively. An increase in road traffic of 4000 vehicle-km per day within 100 m of the residence was associated with an HR for lung cancer of 1·09 (0·99–1·21). The results showed no association between lung cancer and nitrogen oxides concentration (HR 1·01 [0·95–1·07] per 20 μg/m³) or traffic intensity on the nearest str

Interpretat

Funding European Community's Seventh Framework Programme.

Aumento del rischio di cancro polmonare per un incremento di 5 μg/m³ di PM2,5: +18%

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See Online/Comment
http://dx.doi.org/10.1016/S1470-2045(13)70302-4

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Danish Cancer Society Research Center, Copenhagen, Denmark (O Raaschou-Nielsen PhD, Z J Andersen PhD, K T Eriksen PhD, M Sørensen PhD, A Tjønneland DMSc); **Center for Epidemiology and Screening, Department of Public Health, University of Copenhagen, Copenhagen, Denmark** (Z J Andersen); **Institute for Risk Assessment Sciences, Utrecht University, Utrecht, Netherlands** (R Beelen PhD, Prof B Brunekreef PhD, M Eeftens MSc, K Meliefste BSc, M Wang MSc, G Hoek PhD);

Studio ESCAPE: effetti del PM10 e PM2,5 su mortalità e incidenza di eventi CV e tumori (rischio relativo corretto per fumo di tabacco e altri fattori)

	PM_{10} (10 µg/m³)	$PM_{2.5}$ (5 µg/m³)	
Mortalità per cause non accidentali	1.04 (1.00–1.09)	1.07 (1.02–1.13)	**+7%**
Mortalità CV	1.02 (0.92–1.14)	0,99 (0.91–1.08)	
Incidenza di eventi coronarici acuti	1.12 (1.04-1.28)	1.13 (0.98-1.30)	**+13%**
Incidenza di ictus	1.02 (0.90-1.16)	1.19 (0.88-1.62)	**+19%**
Incidenza di tumore del polmone	1.22 (1.03–1.45)	1.18 (0.96–1.46)	**+18%**

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ELSEVIER

Association between long-term exposure to outdoor air pollution and mortality in China: A cohort study

Jie Cao[a,1], Chunxue Yang[b,c,1], Jianxin Li[a], Renjie Chen[b,c], Bingheng Chen[b],

As the largest developing country in the world, China has achieved rapid development in the recent two decades. However, levels of outdoor air pollution in China are among the highest in the world [11]. The relationship between outdoor air pollution and

Our analysis is based on data collected by the China National Hypertension Follow-up Survey, a prospective study of 158,666 adults [20–22]. Briefly, in 1991, a multistage, random cluster-

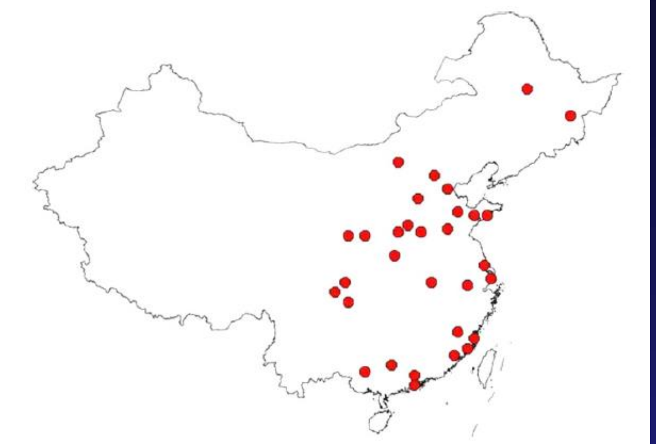


Fig. 1. Locations of selected cities in the China National Hypertension Follow-up Survey.

Table 3
Percent increase (and 95%CIs) of mortality associated with 10μg/m³ increase in air pollutants' concentrations.

Cause of mortality	TSP		SO_2		NO_x	
	Basic model[a]	Adjusted model[b]	Basic model[a]	Adjusted model[b]	Basic model[a]	Adjusted model[b]
All-cause	0.2 (−0.1, 0.5)	0.3 (−0.1, 0.6)	1.8 (1.4, 2.2)*	1.8 (1.3, 2.3)*	1.2 (0.2, 2.2)*	1.5 (0.4, 2.5)*
Cardiovascular	1.3 (0.7, 0.8)*	0.9 (0.3, 1.5)*	4.8 (4.0, 5.6)*	3.2 (2.3, 4.0)*	2.7 (1.0, 4.3)*	2.3 (0.6, 4.1)*
Respiratory	−0.1 (−1.1, 0.9)	0.3 (−0.6, 1.3)	1.5 (0.3, 2.8)*	3.2 (1.8, 4.7)*	1.7 (−1.3, 4.8)	2.6 (−0.2, 5.6)
Lung cancer	0.6 (−0.6, 1.7)	1.1 (−0.1, 2.3)	4.0 (2.4, 5.6)*	4.2 (2.3, 6.2)*	1.6 (−2.0, 5.3)	2.7 (−0.9, 6.5)

[a] Covariates included age and sex.
[b] Covariates included age, sex, BMI, physical activity, education, smoking status, age at starting to smoke, years smoked, cigarettes per day, alcohol intake, and hypertension.
* $p < 0.05$.

International Agency for Research on Cancer

World Health Organization

PRESS RELEASE
N° 221

17 October 2013

IARC: Outdoor air pollution a leading environmental cause of cancer deaths

Lyon/Geneva, 17 October 2013 – The specialized cancer agency of the World Health Organization, the International Agency for Research on Cancer (IARC), announced today that it has classified outdoor air pollution as *carcinogenic to humans* (Group 1). [1]

After thoroughly reviewing the latest available scientific literature, the world's leading experts convened by the IARC Monographs Programme concluded that there is *sufficient evidence* that exposure to outdoor air pollution causes lung cancer (Group 1). They also noted a positive association with an increased risk of bladder cancer.

Particulate matter, a major component of outdoor air pollution, was evaluated separately and was also classified as *carcinogenic to humans* (Group 1).

The IARC evaluation showed an increasing risk of lung cancer with increasing levels of exposure to particulate matter and air pollution. Although the composition of air pollution and levels of exposure can vary dramatically between locations, the conclusions of the Working Group apply to all regions of the world.

A major environmental health problem

Air pollution is already known to increase risks for a wide range of diseases, such as respiratory and heart diseases. Studies indicate that in recent years exposure levels have increased significantly in some parts of the world, particularly in rapidly industrializing countries with large populations. The most recent data indicate that in 2010, 223 000 deaths from lung cancer worldwide resulted from air pollution. [2]

Particulate Matter Air Pollution and Cardiovascular Disease
An Update to the Scientific Statement From the American Heart Association

Robert D. Brook, MD, Chair; Sanjay Rajagopalan, MD; C. Arden Pope III, PhD;

(*Circulation*. 2010;121:2331-2378.)

were reached, including the following: Exposure to PM <2.5 μm in diameter ($PM_{2.5}$) over a few hours to weeks can trigger cardiovascular disease–related mortality and nonfatal events; longer-term exposure (eg, a few years) increases the risk for cardiovascular mortality to an even greater extent than exposures over a few days and reduces life expectancy within more highly exposed segments of the population by several months to a few years; reductions in PM levels are associated with decreases in cardiovascular mortality within a time frame as short as a few years; and many credible pathological mechanisms have been elucidated that lend biological plausibility to these findings. It is the opinion of the

Table 6. Overall Summary of Epidemiological Evidence of the Cardiovascular Effects of $PM_{2.5}$, Traffic-Related, or Combustion-Related Air Pollution Exposure at Ambient Levels

Health Outcomes	Short-Term Exposure (Days)	Longer-Term Exposure (Months to Years)
Clinical cardiovascular end points from epidemiological studies at ambient pollution concentrations		
Cardiovascular mortality	↑↑↑	↑↑↑
Cardiovascular hospitalizations	↑↑↑	↑
Ischemic heart disease*	↑↑↑	↑↑↑
Heart failure*	↑↑	↑
Ischemic stroke*	↑↑	↑
Vascular diseases	↑	↑†
Cardiac arrhythmia/cardiac arrest	↑	↑

AHA Scientific Statement

Particulate Matter Air Pollution and Cardiovascular Disease

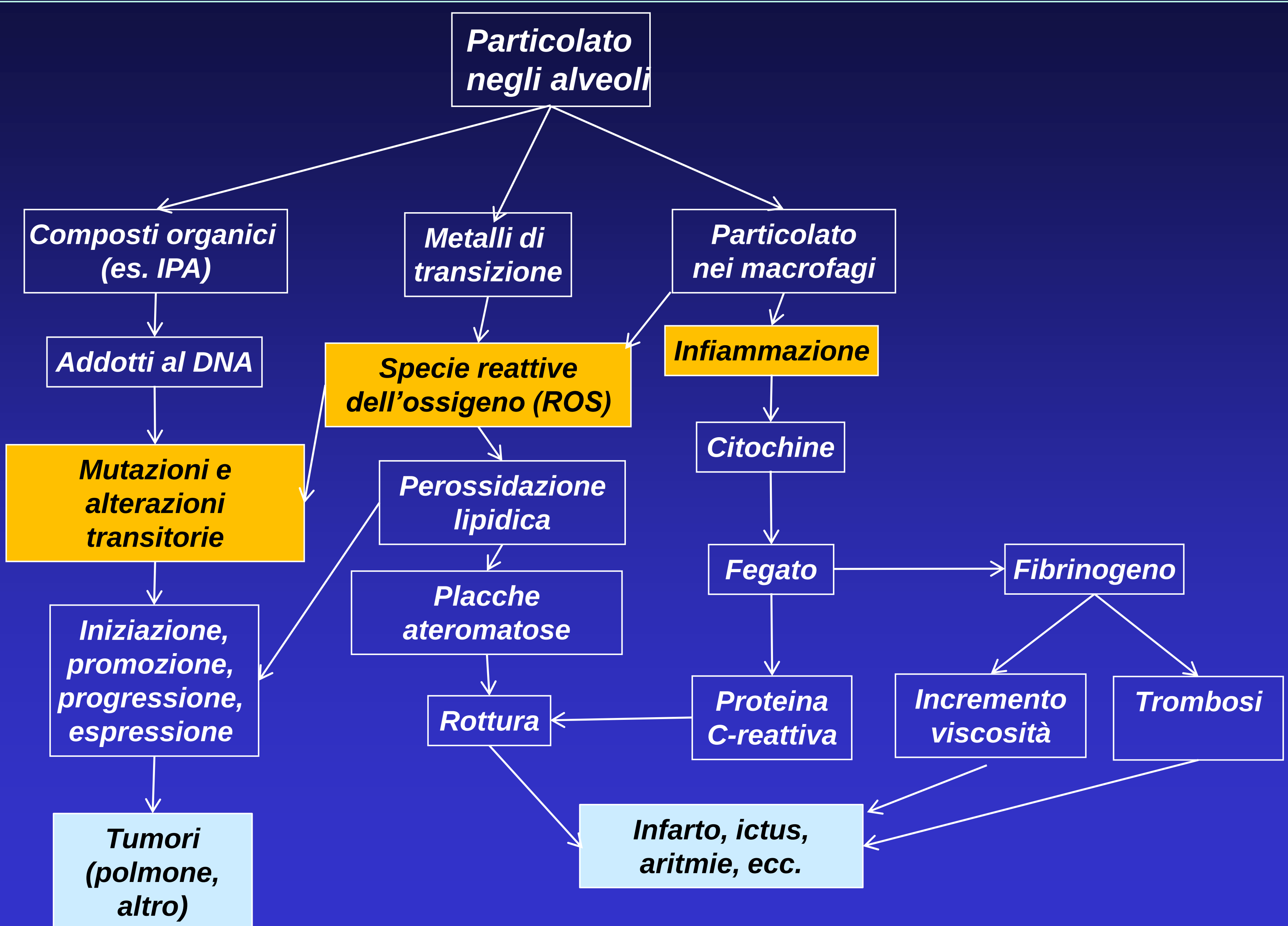
An Update to the Scientific Statement From the American Heart Association

Robert D. Brook, MD, Chair; Sanjay Rajagopalan, MD; C. Arden Pope III, PhD; Jeffrey R. Brook, PhD; Aruni Bhatnagar, PhD, FAHA; Ana V. Diez-Roux, MD, PhD, MPH; Fernando Holguin, MD; Yuling Hong, MD, PhD, FAHA; Russell V. Luepker, MD, MS, FAHA; Murray A. Mittleman, MD, DrPH, FAHA; Annette Peters, PhD; David Siscovick, MD, MPH, FAHA; Sidney C. Smith, Jr, MD, FAHA; Laurie Whitsel, PhD; Joel D. Kaufman, MD, MPH; on behalf of the American Heart Association Council on Epidemiology and Prevention, Council on the Kidney in Cardiovascular Disease, and Council on Nutrition, Physical Activity and Metabolism

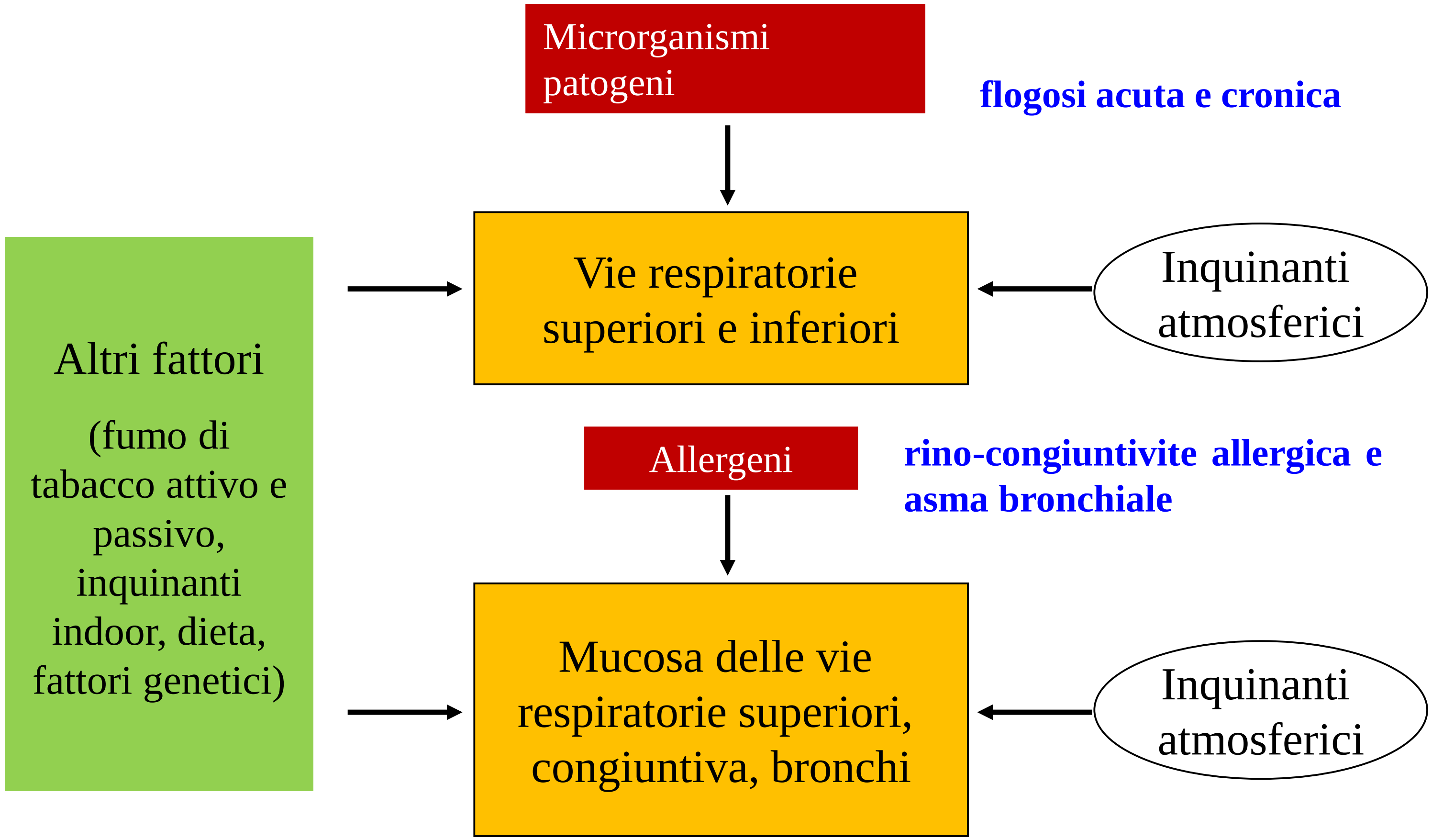
Abstract—In 2004, the first American Heart Association scientific statement on "Air Pollution and Cardiovascular Disease" concluded that exposure to particulate matter (PM) air pollution contributes to cardiovascular morbidity and mortality. In the interim, numerous studies have expanded our understanding of this association and further elucidated the physiological and molecular mechanisms involved. The main objective of this updated American Heart Association scientific statement is to provide a comprehensive review of the new evidence linking PM exposure with cardiovascular disease, with a specific focus on highlighting the clinical implications for researchers and healthcare providers. The writing group also sought to provide expert consensus opinions on many aspects of the current state of science and updated suggestions for areas of future research. On the basis of the findings of this review, several new conclusions were reached, including the following: Exposure to PM <2.5 μm in diameter ($PM_{2.5}$) over a few hours to weeks can trigger cardiovascular disease–related mortality and nonfatal events; longer-term exposure (eg, a few years) increases the risk for cardiovascular mortality to an even greater extent than exposures over a few days and reduces life expectancy within more highly exposed segments of the population by several months to a few years; reductions in PM levels are associated with decreases in cardiovascular mortality within a time frame as short as a few years; and many credible pathological mechanisms have been elucidated that lend biological plausibility to these findings. It is the opinion of the writing group that the overall evidence is consistent with a causal relationship between $PM_{2.5}$ exposure and cardiovascular morbidity and mortality. This body of evidence has grown and been strengthened substantially since the first American Heart Association scientific statement was published. Finally, $PM_{2.5}$ exposure is deemed a modifiable factor that contributes to cardiovascular morbidity and mortality. (*Circulation*. 2010;121:2331-2378.)

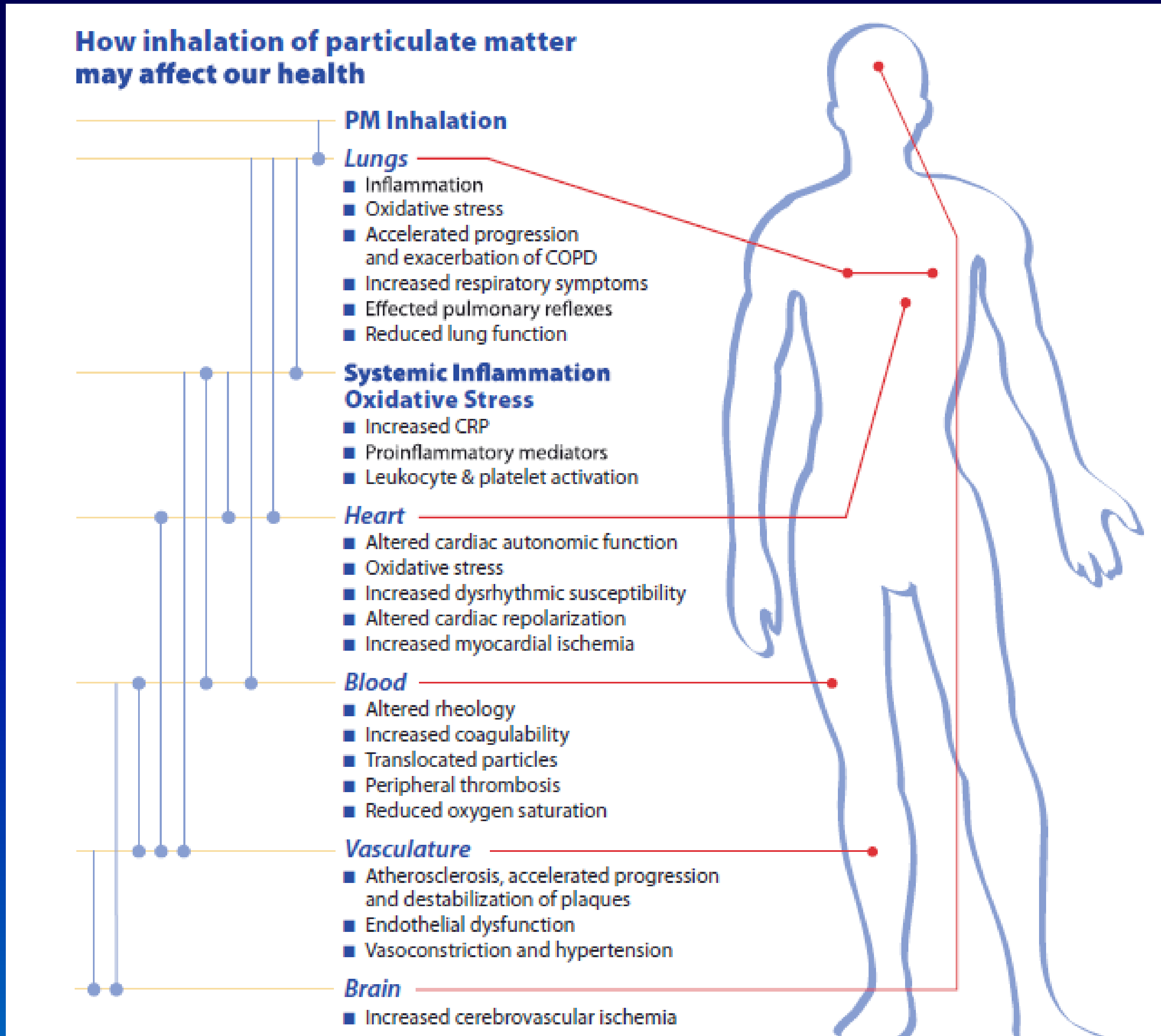
Key Words: AHA Scientific Statements ■ atherosclerosis ■ epidemiology ■ prevention ■ air pollution ■ public policy

Meccanismi d’azione con cui il particolato fine può determinare tumori e patologie cardiovascolari



Interazione tra inquinanti atmosferici e altri fattori sull'apparato respiratorio:





Based on Pope and Dockery (J Air & Waste Management Association, 2006). Illustration: ©2009 fischerdesign.com

A joint ERS/ATS policy statement: what constitutes an adverse health effect of air pollution? An analytical framework

George D. Thurston[1], Howard Kipen[2], Isabella Annesi-Maesano[3],

Eur Respir J 2017;

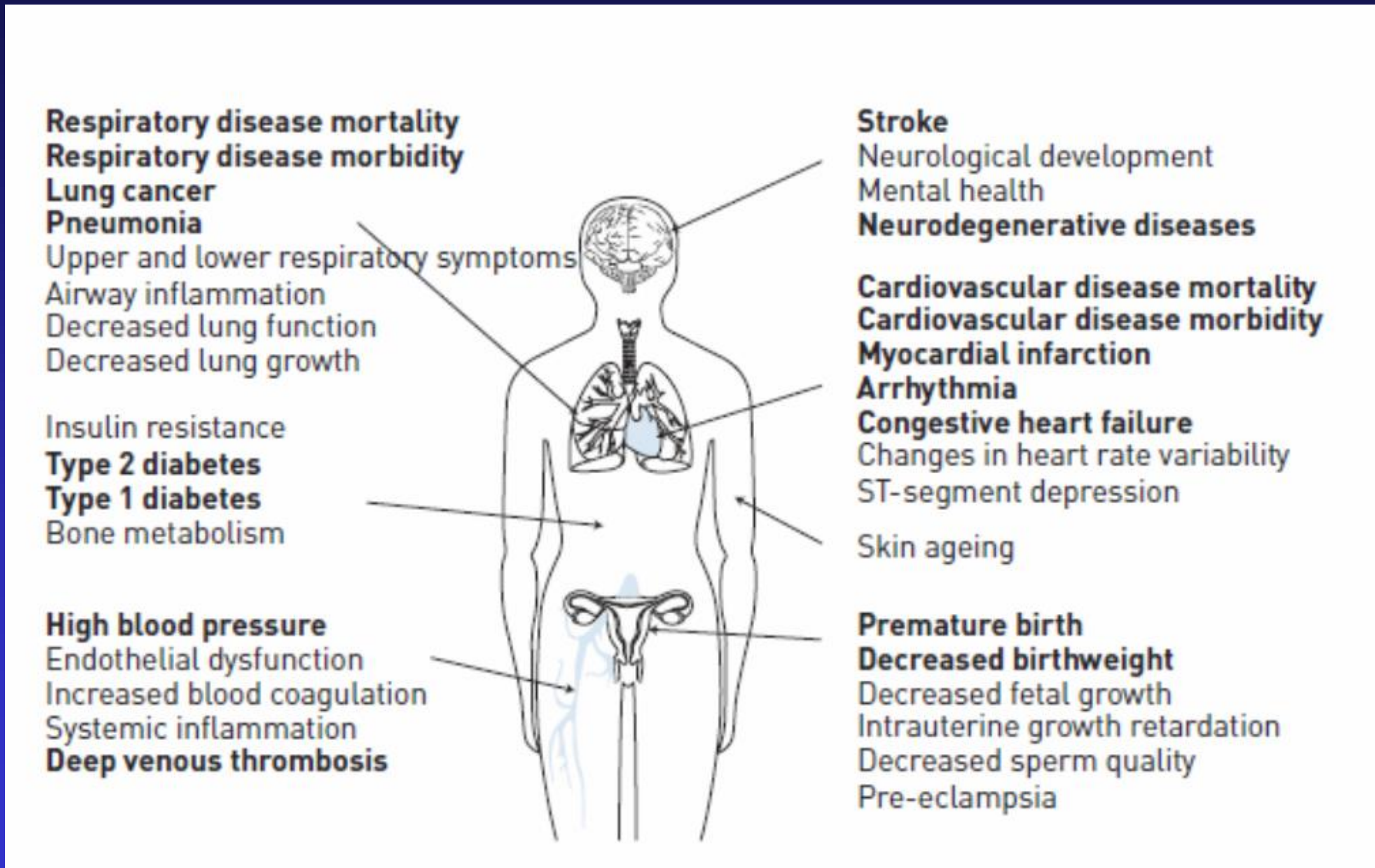


TABLE 3 Examples of respiratory clinical effects associated with air pollution

Increased respiratory mortality
Increased incidence of malignancies of the respiratory tract
Increased incidence, prevalence or frequency of exacerbations in chronic pulmonary disease: asthma, COPD and cystic fibrosis
Increased incidence or severity of upper and lower respiratory tract infections
Increased respiratory symptoms that affect quality of life: cough, phlegm, wheezing, dyspnoea and nasal drainage
Increased incidence of preterm birth, low birthweight or growth restriction leading to adverse respiratory outcomes
Reduced growth of lung function in children
Transient (hours) reductions in lung function associated with symptoms in healthy individuals
Transient (hours) reductions in lung function without symptoms in especially susceptible individuals (*e.g.* children with severe asthma)
Persistent or chronic (weeks, months or years) reductions in lung function

COPD: chronic obstructive pulmonary disease.

TABLE 4 Examples of biomarkers of potentially adverse respiratory health effects

Increased levels of markers of airway inflammation (*e.g.* PMNs or inflammatory cytokines in BAL or sputum)
Increased levels of markers of airway injury or inflammation in exhaled breath (*e.g.* increased acidity of exhaled breath condensate or increased F_{eNO} in asthmatics)
Increased levels of blood markers of lung injury (*e.g.* 8-isoprostanes, club cell secretory protein)
Imaging evidence for lung injury or reduced lung volume
Reduced pulmonary gas exchange (*e.g.* D_{LCO}, D_{LNO}, P_{aO_2}, pulse oximetry)
Increased airways responsiveness to nonspecific challenge
Increased airways hyperresponsiveness in asthmatic patients

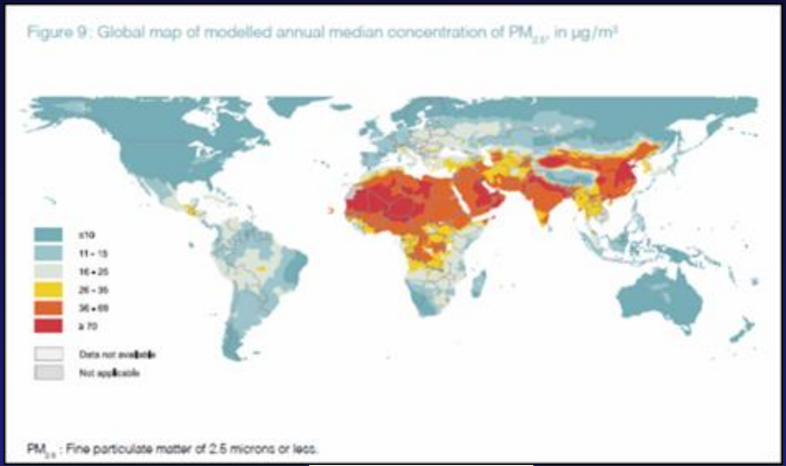
PMN: polymorphonuclear leukocyte; BAL: bronchoalveolar lavage; F_{eNO}: exhaled nitric oxide fraction; D_{LCO}: diffusing capacity of the lung for carbon monoxide; D_{LNO}: diffusing capacity of the lung for nitric oxide; P_{aO_2}: arterial oxygen tension.

L’impatto globale sulla salute

Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015

Aaron J Cohen*, Michael Brauer*, Richard Burnett, H Ross Anderson, Joseph Frostad, Kara Estep, Kalpana Balakrishnan, Bert Brunekreef, Lalit Dandona, Rakhi Dandona, Valery Feigin, Greg Freedman, Bryan Hubbell, Amelia Jobling, Haidong Kan, Luke Knibbs, Yang Liu, Randall Martin, Lidia Morawska, C Arden Pope III, Hwashin Shin, Kurt Straif, Gavin Shaddick, Matthew Thomas, Rita van Dingenen, Aaron van Donkelaar, Theo Vos, Christopher J L Murray, Mohammad H Forouzanfar†

Lancet 2017; 389: 1907–18



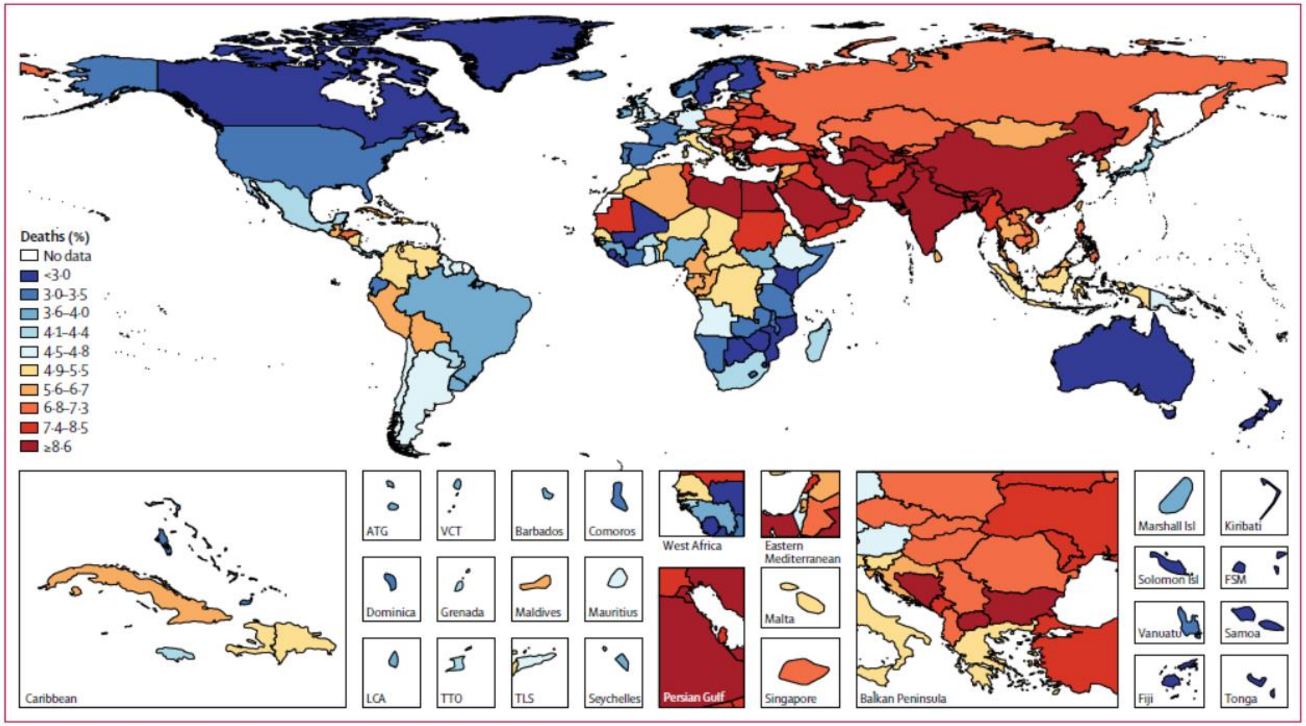


Figure 5: Deaths attributable to ambient particulate matter pollution in 2015
ATG=Antigua and Barbuda. FSM=Federated States of Micronesia. Isl=Island. LCA=Saint Lucia. TLS=Timor-Leste. TTO=Trinidad and Tobago. VCT=Saint Vincent and the Grenadines.

World Health Organization

Ambient (outdoor) air quality and health

2 May 2018

- Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma.
- The lower the levels of air pollution, the better the cardiovascular and respiratory health of the population will be, both long- and short-term.
- The WHO Air Quality Guidelines: Global Update 2005 provide an assessment of health effects of air pollution and thresholds for health-harmful pollution levels.
- In 2016, 91% of the world population was living in places where the WHO air quality guidelines levels were not met.
- Ambient (outdoor air pollution) in both cities and rural areas was estimated to cause 4.2 million premature deaths worldwide in 2016.
- Some 91% of those premature deaths occurred in low- and middle-income countries, and the greatest number in the WHO South-East Asia and Western Pacific regions.
- Policies and investments supporting cleaner transport, energy-efficient homes, power generation, industry and better municipal waste management would reduce key sources of outdoor air pollution.
- In addition to outdoor air pollution, indoor smoke is a serious health risk for some 3 billion people who cook and heat their homes with biomass, kerosene fuels and coal.

Worldwide ambient air pollution accounts for:

- 29% of all deaths and disease from lung cancer
- 17% of all deaths and disease from acute lower respiratory infection
- 24% of all deaths from stroke
- 25% of all deaths and disease from ischaemic heart disease
- 43% of all deaths and disease from chronic obstructive pulmonary disease

Table 10.1 Premature deaths attributable to $PM_{2.5}$, NO_2 and O_3 exposure in 41 European countries and the EU-28, 2015

		$PM_{2.5}$		NO_2		O_3	
Country	Population (1 000)	Annual mean (a)	Premature deaths (b)	Annual mean (a)	Premature deaths (b)	SOMO35 (a)	Premature deaths (b)
Austria	8 576	13.3	5 900	19.8	1 200	6 170	380
Belgium	11 237	13.0	7 400	20.9	1 500	2 790	220
Bulgaria	7 202	24.1	14 200	16.1	640	4 180	350
Croatia	4 225	17.4	4 500	17.3	430	6 240	230
Cyprus	1 173	16.9	750	14.1	30	6 390	40
Czechia	10 538	17.0	10 100	16.6	490	5 560	460
Denmark	5 660	9.7	2 800	10.5	80	2 200	90
Estonia	1 315	6.7	560	8.2	< 5	1 780	20
Finland	5 472	5.3	1 500	8.8	40	1 360	50
France	66 488	11.9	35 800	17.9	9 700	4 250	1 800
Germany	81 198	12.3	62 300	20.0	13 100	4 300	3 000
Greece	10 858	19.1	12 000	18.1	2 300	6 910	610
Hungary	9 856	18.9	12 800	18.0	1 300	5 550	530
Ireland	4 629	6.5	1 100	7.6	30	860	20
Italy	60 796	18.5	60 600	24.9	20 500	6 860	3 200
Poland	38 006	21.6	44 500	15.6	1 700	4 530	1 300
Portugal	9 870	9.8	5 500	15.7	890	3 990	300
Romania	19 871	18.1	25 400	14.9	1 300	2 950	580
Slovakia	5 421	19.1	5 200	16.9	240	5 460	210
Slovenia	2 063	17.4	1 800	16.7	160	6 650	100
Spain	44 154	12.7	27 900	21.2	8 900	5 820	1 800
Sweden	9 747	5.9	3 000	10.8	110	2 080	140
United Kingdom	64 875	9.4	31 300	19.7	9 600	1 290	590
EU-28	**506 030**	**13.9**	**391 000**	**18.9**	**76 000**	**4 250**	**16 400**
Total	**538 278**	**14.1**	**422 000**	**18.8**	**79 000**	**4 310**	**17 700**

Notes: (a) The annual mean (in μg/m³) and the SOMO35 (in μg/m³.days), expressed as population-weighted concentration, is obtained according to the methodology described by ETC/ACM (2017a) and not only from monitoring stations; (b) Total and EU-28 premature deaths are rounded to the nearest thousand (except for O_3, nearest hundred). The national totals are rounded to the nearest hundred or ten.

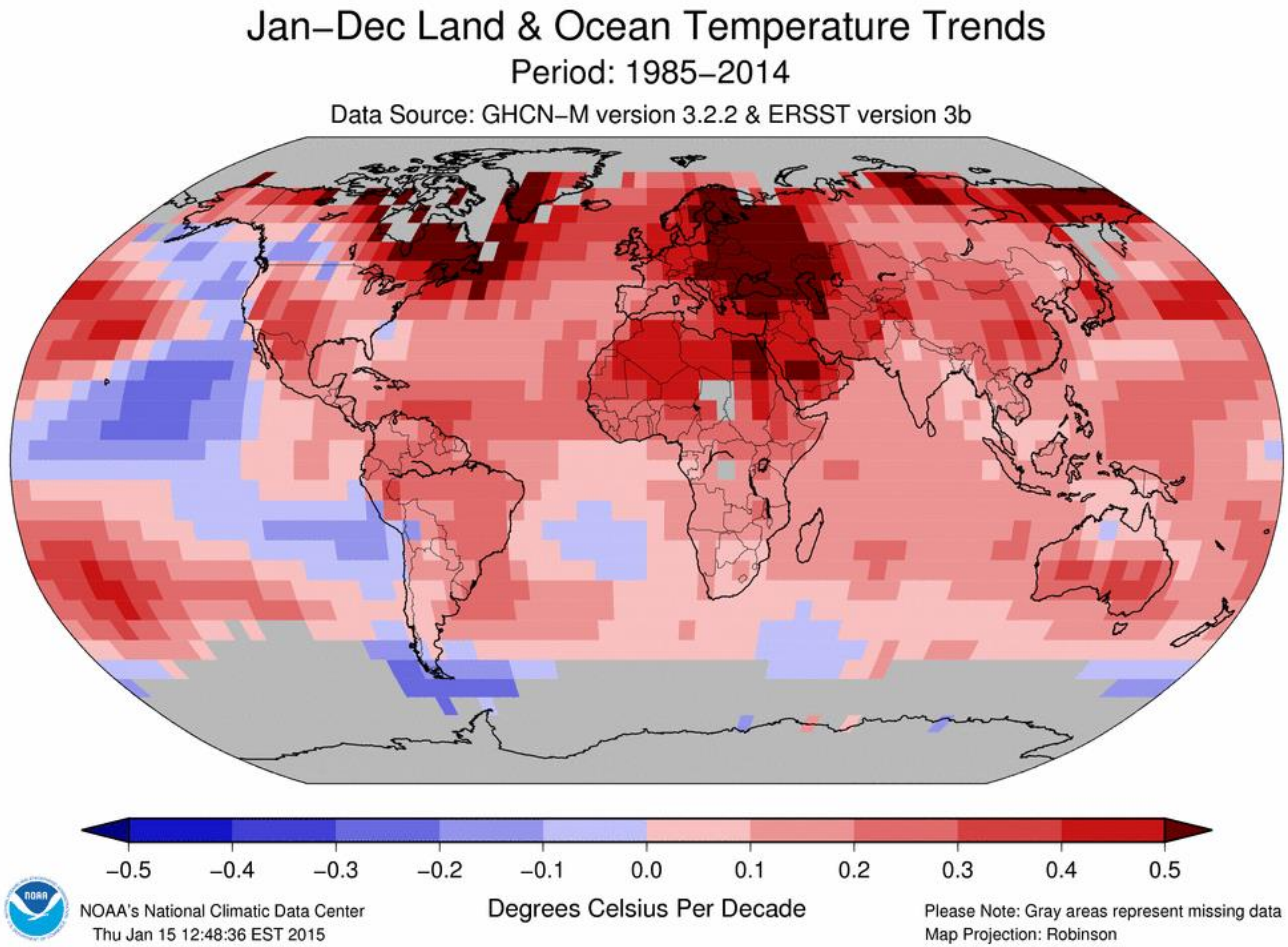
Table 10.2 **Years of life lost (YLL) attributable to $PM_{2.5}$, NO_2 and O_3 exposure in 41 European countries and the EU-28, 2015**

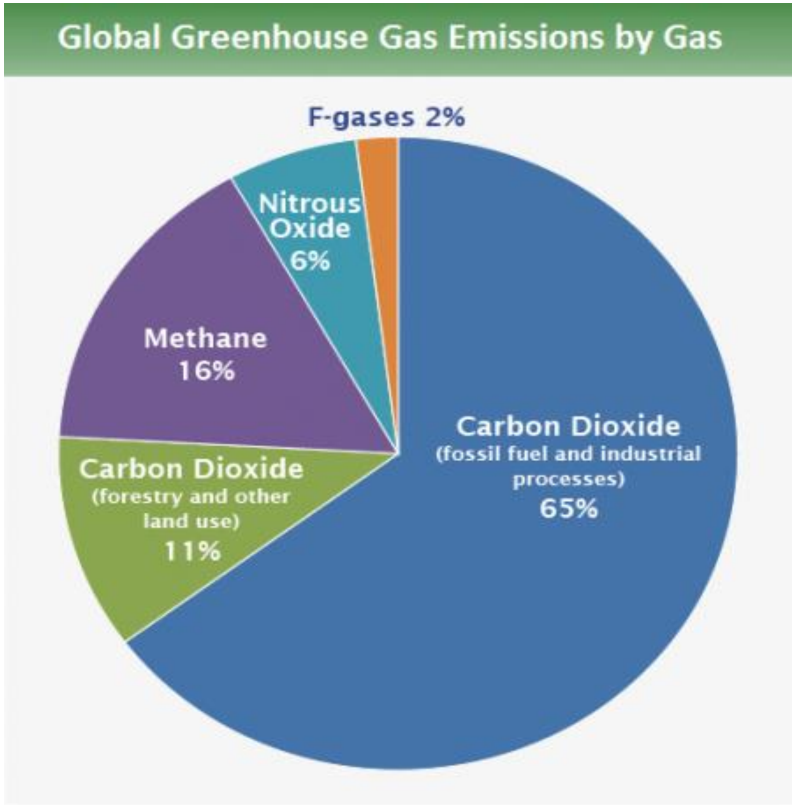
	$PM_{2.5}$		NO_2		O_3	
Country	**YLL**	**YLL/10^5 inhabitants**	**YLL**	**YLL/10^5 inhabitants**	**YLL**	**YLL/10^5 inhabitants**
Austria	60 200	702	12 200	142	4 000	47
Belgium	77 600	691	16 200	144	2 400	21
Bulgaria	142 000	1 972	6 400	89	3 700	52
Croatia	46 900	1 110	4 500	105	2 500	58
Cyprus	7 400	631	300	26	410	35
Czechia	105 500	1 001	5 100	49	5 000	47
Denmark	30 100	532	860	15	980	17
Estonia	6 300	479	40	3	230	18
Finland	16 000	292	470	9	570	10
France	414 700	624	112 400	169	21 600	32
Germany	638 500	786	134 200	165	31 800	39
Greece	120 700	1 112	23 100	213	6 400	59
Hungary	139 300	1 413	14 300	145	6 000	60
Ireland	12 000	259	310	7	230	5
Italy	593 700	977	200 700	330	32 100	53
Poland	533 300	1 403	20 400	54	16 600	44
Portugal	56 300	570	9 100	92	3 200	33
Romania	271 600	1 367	14 100	71	6 600	33
Slovakia	59 900	1 105	2 700	51	2 600	47
Slovenia	20 000	970	1 800	88	1 100	53
Spain	290 500	658	92 400	209	19 100	43
Sweden	28 300	290	1 000	10	1 400	14
United Kingdom	324 900	501	99 700	154	6 400	10
EU-28	**4 150 000**	**820**	**795 000**	**157**	**180 000**	**36**
Total	**4 466 000**	**830**	**821 000**	**153**	**193 800**	**36**

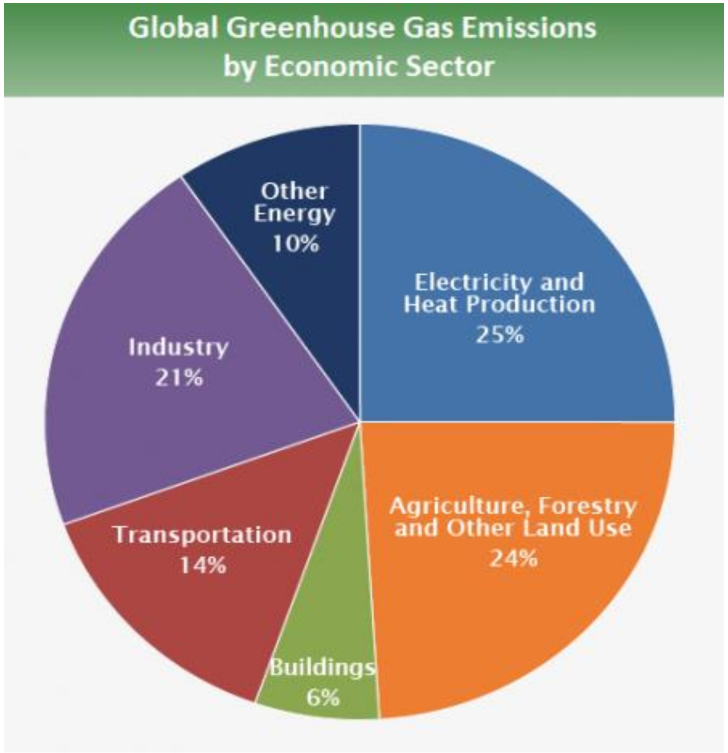
Note: Total and EU-28 YLL figures are rounded to the nearest thousand or hundred. National data are rounded to the nearest hundred or ten.

WHO: Ambient air pollution - a major threat to health and climate

Il riscaldamento globale (global warming)







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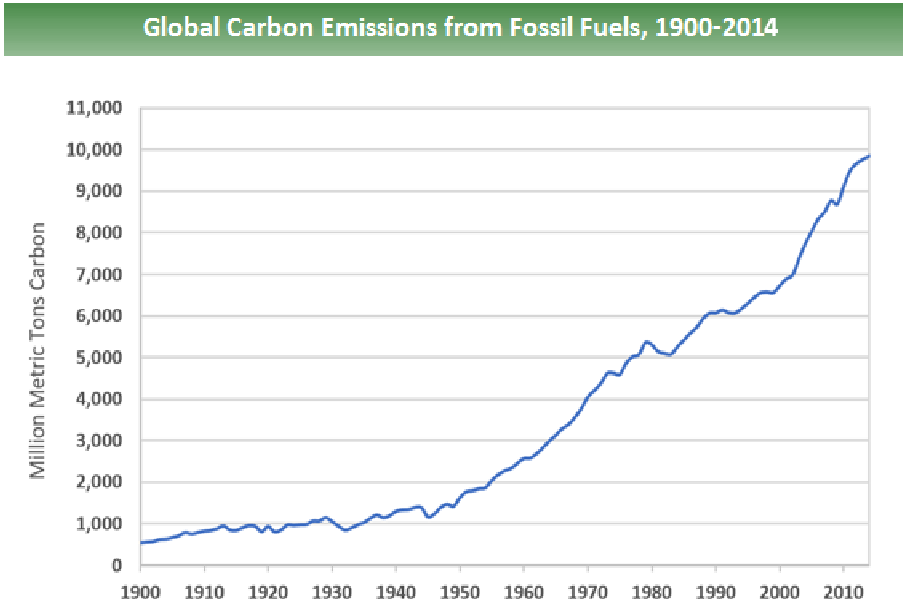
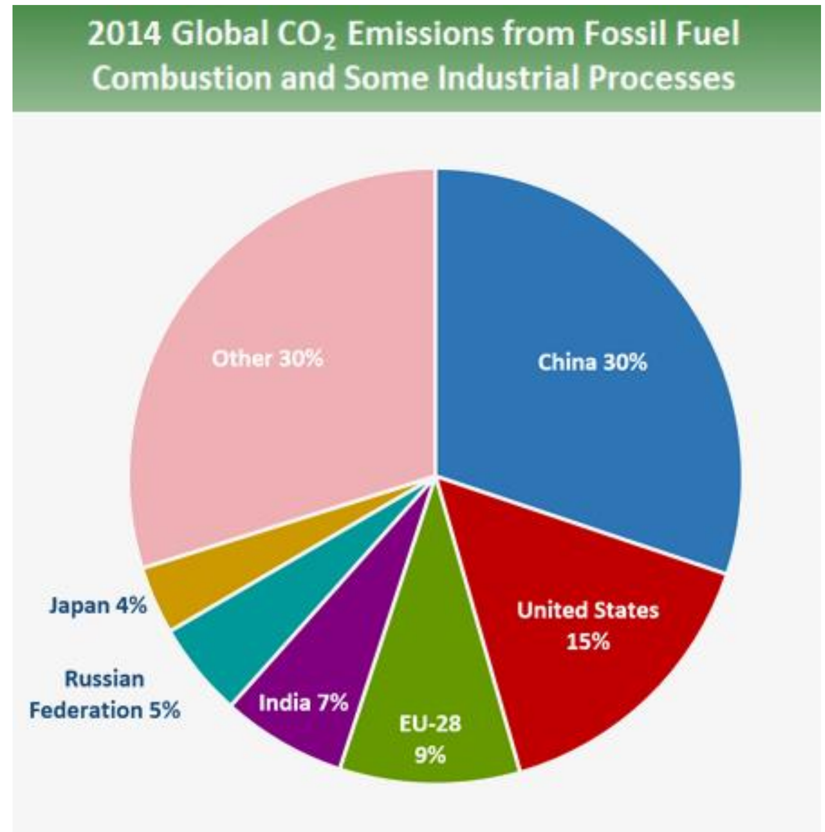




https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data

Il riscaldamento del pianeta: effetti sulla salute

- Ondate di calore ⇨ maggiori rischi per anziani e per soggetti con patologie a carico dell'apparato respiratorio e cardiovascolare, effetti di tipo psichico
- Eventi estremi ⇨ aumento mortalità e morbosità, problematiche psicologiche
- Desertificazione ⇨ carestie, perdite economiche, migrazioni
- Tropicalizzazione del clima, cambiamento dell'habitat di specie vegetali e animali ⇨ malattie infettive e parassitarie
- Riduzione ozonosfera ⇨ aumento di rischio di tumori epidermici e danni alla retina
- Eutrofizzazione delle acque ⇨ alghe tossiche
- Acidificazione delle acque ⇨ liberazione dai sedimenti di sostanze tossiche (metalli pesanti, NH_3, H_2S, CH_4)
- Salute degli animali e sicurezza alimentare

The Imperative for Climate Action to Protect Health

Andy Haines, M.D., and Kristie Ebi, M.P.H., Ph.D.

N Engl J Med 2019;380:263-73.

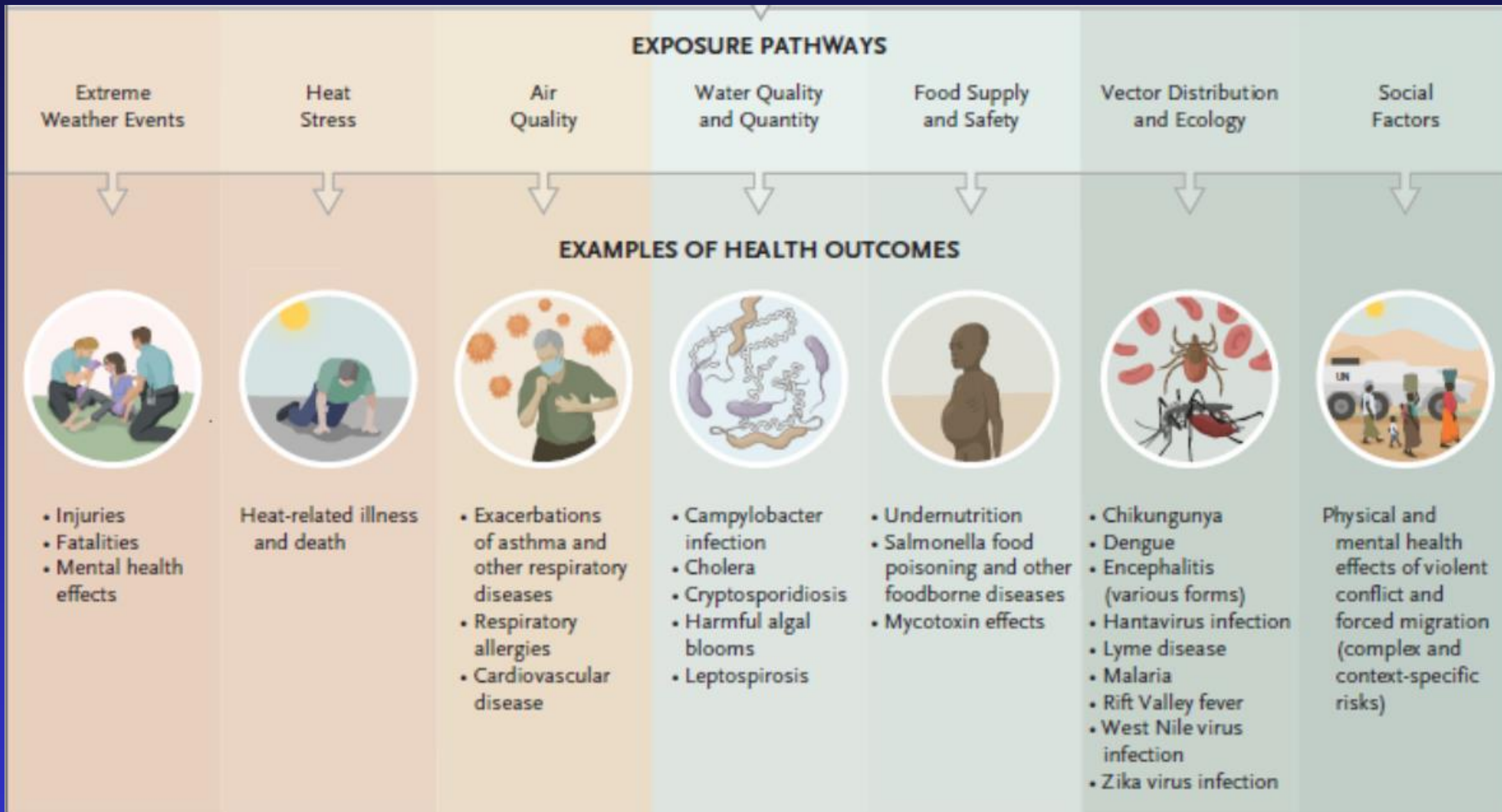


Figure 3. Major Health Risks Associated with Climate Change.

Examples of potential health outcomes and exposure pathways linking climate change with human health are shown, together with factors that can influence the magnitude and pattern of risks. The figure is based on several sources (e.g., Ebi et al.,[3] Smith et al.,[4] the World Health Organization,[16] Hallegatte et al.,[17] and Missirian and Schlenker[18]) and is not intended to be comprehensive.

I benefici della riduzione degli inquinanti

Gli studi quasi-sperimentali. L'acciaieria della Valle dello Utah

Respiratory Disease Associated with Community Air Pollution and a Steel Mill, Utah Valley

C. Arden Pope III, PhD

Abstract: This study assessed the association between hospital admissions and fine particulate pollution (PM_{10}) in Utah Valley during the period April 1985–February 1988. This time period included the closure and reopening of the local steel mill, the primary source of PM_{10}. An association between elevated PM_{10} levels and hospital admissions for pneumonia, pleurisy, bronchitis, and asthma was observed. During months when 24-hour PM_{10} levels exceeded 150 $\mu g/m^3$, average admissions for children nearly tripled; in adults, the increase in admissions was 44 per cent. During months with mean PM_{10} levels greater than or equal to 50 $\mu g/m^3$ average admissions for children and adults increased by 89 and 47 per cent, respectively. During the winter months when the steel mill was open, PM_{10} levels were nearly double the levels experienced during the winter months when the mill was closed. This occurred even though relatively stagnant air was experienced during the winter the mill was closed. Children's admissions were two to three times higher during the winters when the mill was open compared to when it was closed. Regression analysis also revealed that PM_{10} levels were strongly correlated with hospital admissions. They were more strongly correlated with children's admissions than with adult admissions and were more strongly correlated with admissions for bronchitis and asthma than with admissions for pneumonia and pleurisy. (*Am J Public Health* 1989; 79:623–628.)

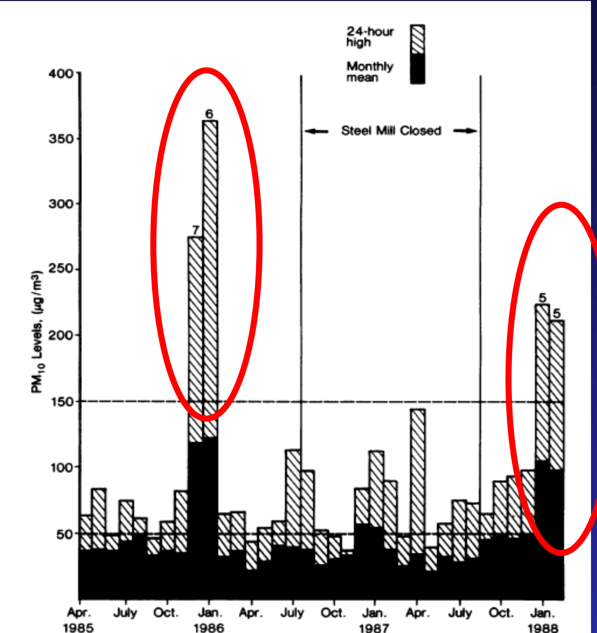


FIGURE 2—Monthly Mean and 24-Hour High PM_{10} (fine particulate pollution) Levels, Utah Valley, April 1985–January 1988

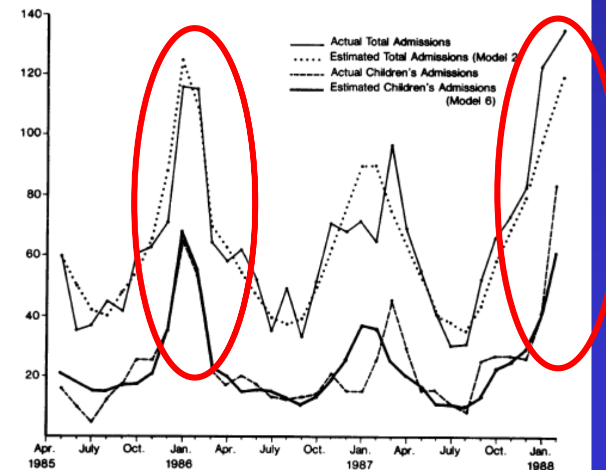


FIGURE 3—Actual and Estimated Hospital Admissions, April 1985 through January 1988, Utah Valley

Riduzione dell'inquinamento atmosferico e benefici per la salute

<u>DUBLINO – 1990</u>

divieto di utilizzo del carbone
per gli impianti di riscaldamento

- 35%
concentrazione media
di *black smoke*

- 15,5% mortalità per cause respiratorie
- 10,3% mortalità per cause cardiache

Riduzione dell'inquinamento atmosferico e benefici per la salute

OLIMPIADI di ATLANTA – 1996

- sostegno al trasporto pubblico
- sostegno al telelavoro
- area urbana chiusa ai veicoli privati

DIMINUZIONE DEI LIVELLI DI OZONO

- 42%

EPISODI ACUTI DI ASMA

Una nota di speranza…

Figure 3: Leading 30 Level 3 risk factors by attributable DALYs at the global level, 1990, 2006, and 2016, for males (A) and females (B)

Risks are connected by lines between time periods. Behavioural risk factors are shown in red, environmental risks in blue, and metabolic risks in green. For the time period of 1990 to 2006 and for 2006–16, three measures of change are shown: percent change in the number of DALYs, percent change in the all-age DALY rate, and percent change in the age-standardised DALY rate. Statistically significant increases or decreases are shown in bold (p<0·05). DALYs=disability-adjusted life-years.

Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016

A

Leading risks 1990
1 Child growth failure
2 Low birthweight and short gestation
3 Smoking
4 High blood pressure
5 Household air pollution
6 Ambient particulate matter
7 Unsafe water
8 Alcohol use
9 Unsafe sanitation
10 High fasting plasma glucose

Leading risks 2006	Mean % change in number of DALYs 1990–2006	Mean % change in all-age DALY rate 1990–2006	Mean % change in age-standardised DALY rate 1990–2006
1 Smoking	18·5	–5·3	–20·1
2 Low birthweight and short gestation	–24·4	–39·6	–24·8
3 High blood pressure	32·3	5·8	–12·4
4 Child growth failure	–45·9	–56·8	–46·7
5 Alcohol use	35·4	8·2	–5·4
6 High fasting plasma glucose	59·7	27·6	7·2
7 Ambient particulate matter	–2·6	–22·2	–22·5
8 Household air pollution	–24·7	–39·8	–37·8
9 High body-mass index	63·3	30·5	10·0
10 High total cholesterol	31·1	4·8	–13·4

Leading risks 2016	Mean % change in number of DALYs 2006–16	Mean % change in all-age DALY rate 2006–16	Mean % change in age-standardised DALY rate 2006–16
1 Smoking	2·1	–9·3	–20·4
2 High blood pressure	16·2	3·2	–10·5
3 Low birthweight and short gestation	–28·3	–36·3	–27·8
4 Alcohol use	2·6	–8·8	–15·5
5 High fasting plasma glucose	19·5	6·2	–7·2
6 High body-mass index	31·0	16·4	2·8
7 Ambient particulate matter	4·2	–7·4	–14·2
8 High total cholesterol	13·3	[illegible]	–11·0
9 Child growth failure	–42·3	–48·8	–43·8
10 Household air pollution	–27·4	–35·5	–38·3

B

Leading risks 1990
1 Child growth failure
2 Low birthweight and short gestation
3 Household air pollution
4 High blood pressure
5 Unsafe water
6 Unsafe sanitation
7 Ambient particulate matter
8 No access to handwashing facility
9 High fasting plasma glucose
10 High body-mass index

Leading risks 2006	Mean % change in number of DALYs 1990–2006	Mean % change in all-age DALY rate 1990–2006	Mean % change in age-standardised DALY rate 1990–2006
1 Low birthweight and short gestation	–25·0	–39·8	–24·9
2 High blood pressure	17·7	–5·6	–19·0
3 Child growth failure	–48·9	–59·0	–49·0
4 High fasting plasma glucose	53·3	23·0	7·0
5 High body-mass index	52·4	22·3	5·9
6 Household air pollution	–29·1	–43·2	–39·8
7 Unsafe sex	340·3	253·2	204·0
8 Ambient particulate matter	–14·9	–31·7	–29·0
9 Unsafe water	–36·9	–49·4	–41·0
10 Unsafe sanitation	–39·7	–51·7	–43·7

Leading risks 2016	Mean % change in number of DALYs 2006–16	Mean % change in all-age DALY rate 2006–16	Mean % change in age-standardised DALY rate 2006–16
1 High blood pressure	7·7	–4·1	–16·8
2 High body-mass index	26·1	12·3	–1·0
3 High fasting plasma glucose	14·2	1·6	–10·9
4 Low birthweight and short gestation	–28·8	–36·6	–28·7
5 Child growth failure	–47·1	–52·9	–48·7
6 Ambient particulate matter	–5·8	–16·2	–21·3
7 High total cholesterol	9·6	–2·5	–15·5
8 Household air pollution	–30·9	–38·5	–41·1
9 Smoking	–2·5	–13·2	–23·9
10 Unsafe sex	–38·7	–45·4	–46·7

Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009

Johanna Lepeule,[1] Francine Laden,[1,2,3] Douglas Dockery,[1,2,3] and Joel Schwartz[1,2,3]

Environmental Health Perspectives • VOLUME 120 | NUMBER 7 | July 2012

BACKGROUND: Epidemiologic studies have reported associations between fine particles (aerodynamic diameter ≤ 2.5 µm; $PM_{2.5}$) and mortality. However, concerns have been raised regarding the sensitivity of the results to model specifications, lower exposures, and averaging time.

OBJECTIVE: We addressed these issues using 11 additional years of follow-up of the Harvard Six Cities study, incorporating recent lower exposures.

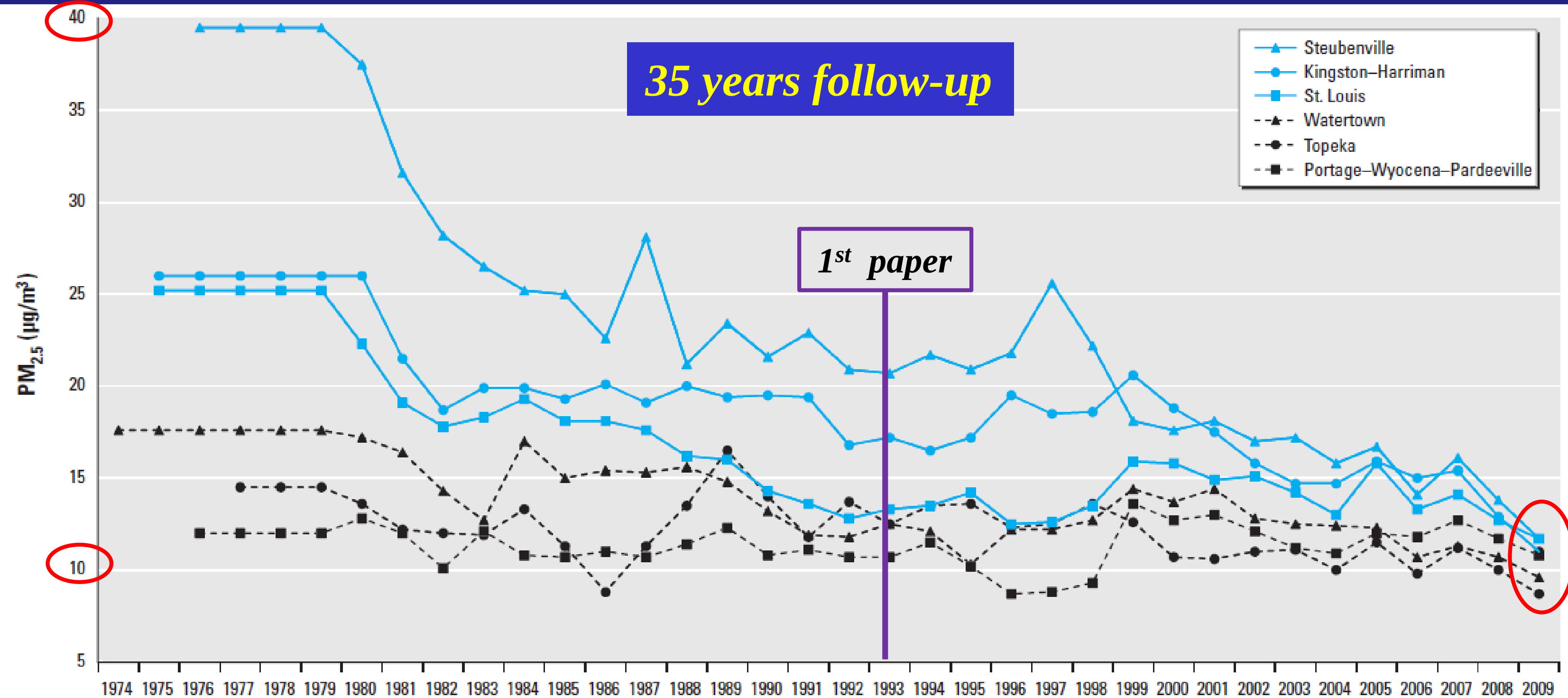


Figure 1. Annual mean $PM_{2.5}$ levels during 1974–2009 in the Harvard Six Cities study.

Fine-Particulate Air Pollution and Life Expectancy in the United States

C. Arden Pope III, Ph.D., Majid Ezzati, Ph.D., and Douglas W. Dockery, Sc.D.

N Engl J Med 2009;360:376-86.

We compiled data on life expectancy, socioeconomic status, and demographic characteristics for 211 county units in the 51 U.S. metropolitan areas with matching data on fine-particulate air pollution for the late 1970s and early 1980s and the late 1990s and early 2000s. Regression models were used to estimate the association

A decrease of 10 μg per cubic meter in the concentration of fine particulate matter was associated with an estimated increase in mean (±SE) life expectancy of 0.61±0.20 year (P=0.004). The estimated effect of reduced exposure to pollution on life expectancy was not highly sensitive to adjustment for changes in socioeconomic, demographic, or proxy variables for the prevalence of smoking or to the restriction of observations to relatively large counties. Reductions in air pollution accounted for as much as 15% of the overall increase in life expectancy in the study areas.

1979-83

Mean life expectancy: 74 yrs

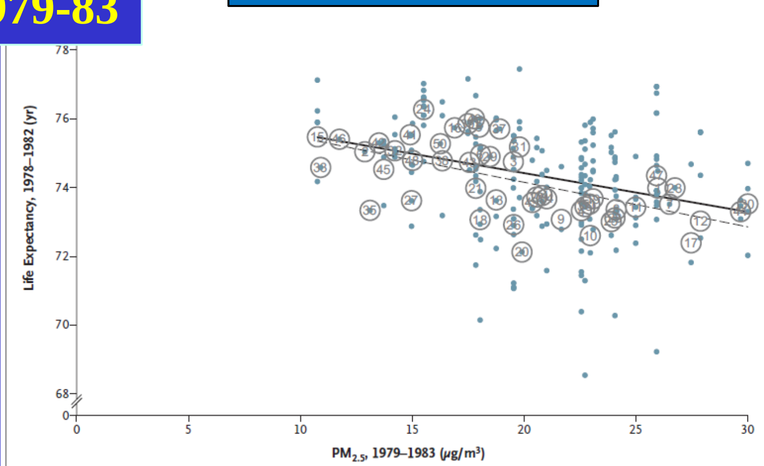


Figure 2. Cross-Sectional Life Expectancies for 1978–1982, Plotted against $PM_{2.5}$ Concentrations for 1979–1983.

+ 2.7 years

Mean life expectancy: 77 yrs

1999-2000

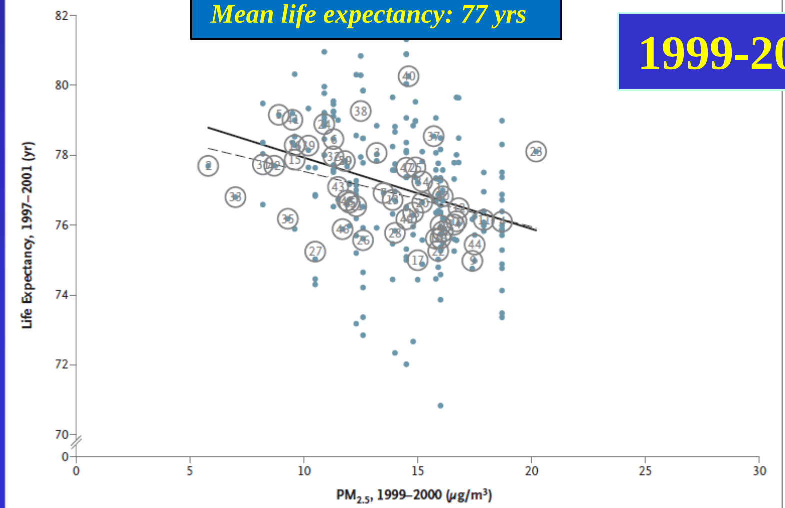
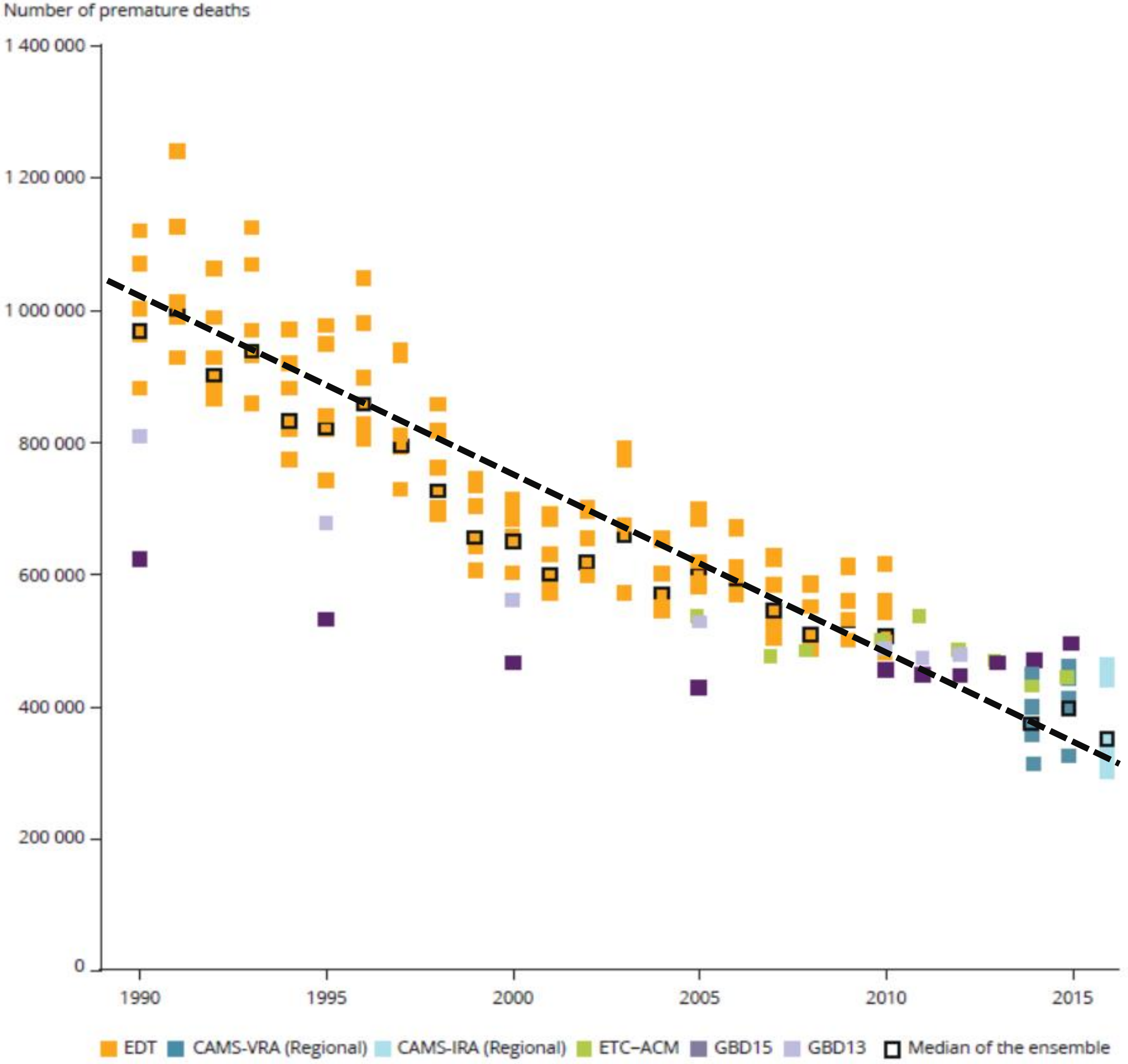


Figure 3. Cross-Sectional Life Expectancies for 1997–2001, Plotted against $PM_{2.5}$ Concentrations for 1999–2000.

Figure 10.1 Premature deaths due to exposure to $PM_{2.5}$ (all-cause (natural) mortality) in Europe over the period 1990-2016 for various data sets of $PM_{2.5}$ concentration



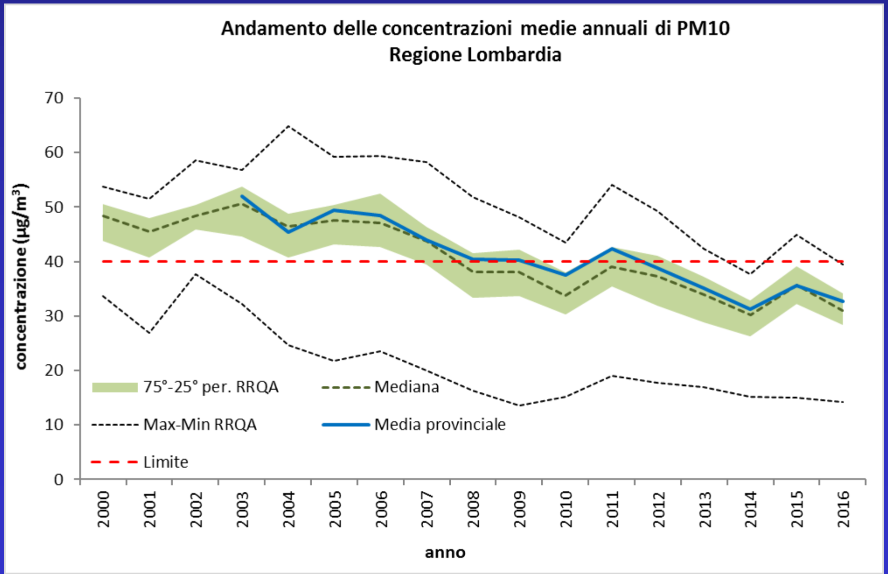
Note: The different datasets are: Eurodelta-Trends (EDT), Copernicus Atmospheric Monitoring Service (CAMS), European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM), and Global Burden of Diseases (GBD, versions 2013 and 2015). For CAMS and EDT, individual participating models are displayed, as well as the ensemble median (black frame).

Source: ETC/ACM, 2018c.

Although the health impact of air pollution remained high across Europe in 2015, the median estimate for all datasets of 445 000 premature deaths per year ([45]) equates to about half a million premature deaths avoided when compared with the situation in 1990 (when the median value was 960 000 deaths per year). Since population has grown in the period 1990-2015, and only total numbers are provided but not death rates, it can be assumed with confidence that the risk associated to air pollution has, at least, halved.

The study also clearly identified a larger reduction in exposure to $PM_{2.5}$ levels, and subsequent health impacts, throughout the 1990s than after the year 2000 and in more recent years, as Figure 10.1 shows.


ARPA LOMBARDIA
Agenzia Regionale per la Protezione dell'Ambiente
Settore Monitoraggi Ambientali
Centro Regionale Monitoraggio Qualità dell'Aria
Rapporto sulla qualità dell'aria della provincia di Brescia
ANNO 2016


Andamento delle concentrazioni medie annuali di PM10
Regione Lombardia
concentrazione (µg/m³)
anno
75°-25° per. RRQA
Mediana
Max-Min RRQA
Media provinciale
Limite

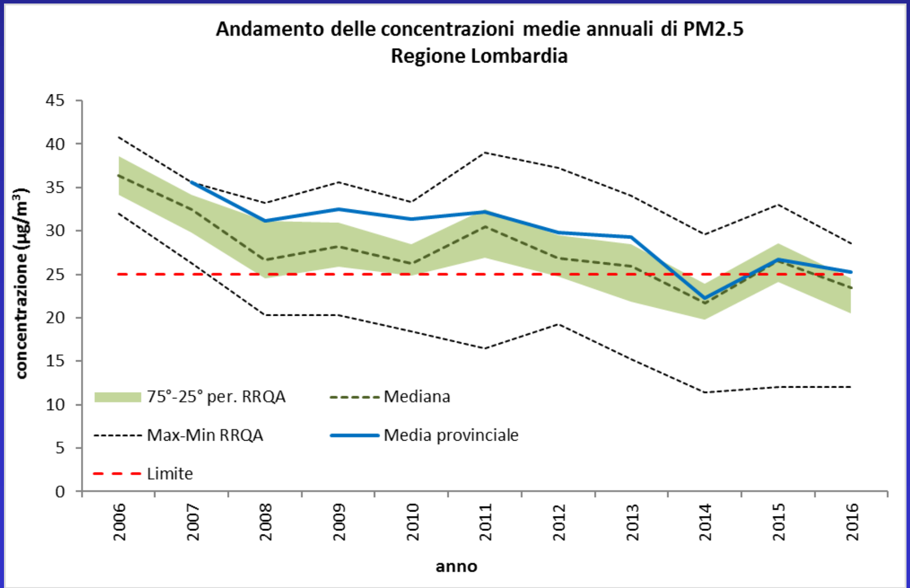

Andamento delle concentrazioni medie annuali di PM2.5
Regione Lombardia
concentrazione (µg/m³)
anno
75°-25° per. RRQA
Mediana
Max-Min RRQA
Media provinciale
Limite

Figura 5-1 concentrazioni medie annue di PM10 [μg/m³] in Lombardia, trend 2002-2016

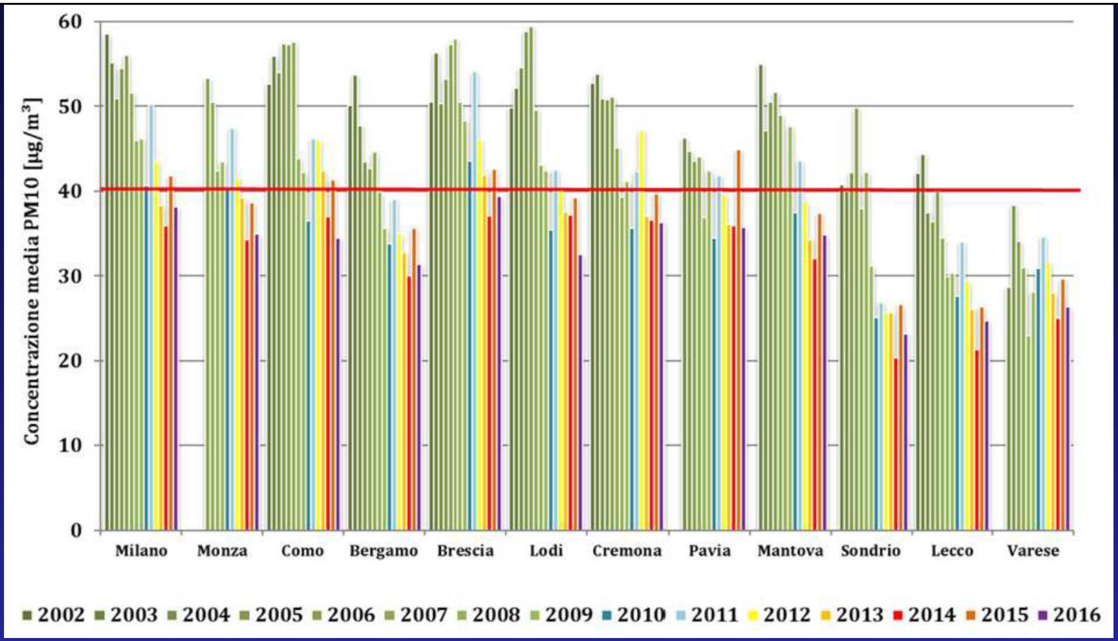
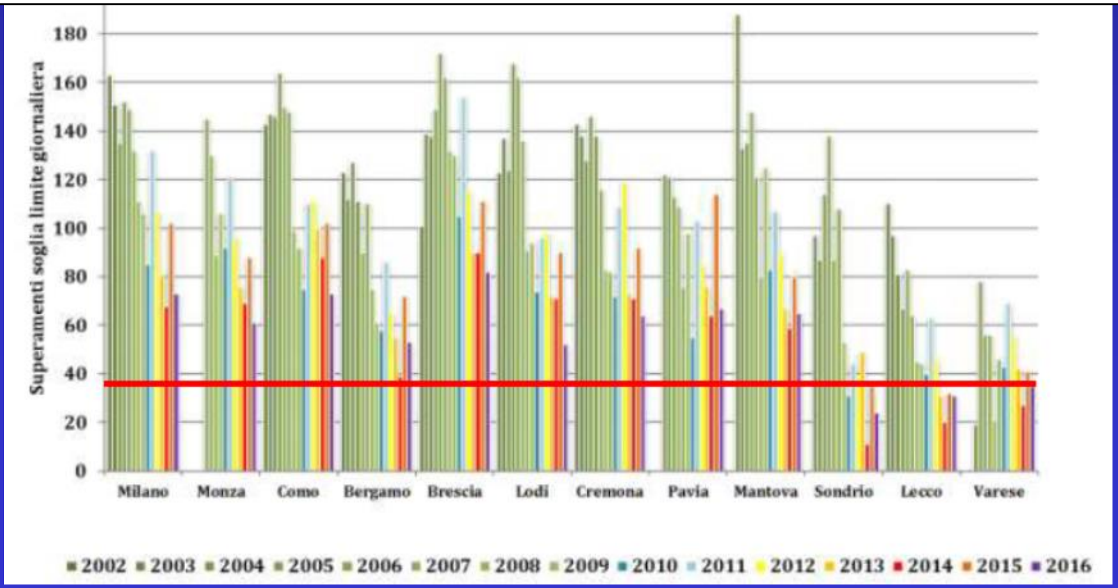


Figura 5-2 superamenti annui del valore limite giornaliero (50 μg/m³) di PM10 nei capoluoghi lombardi, trend 2002-2016



…Grazie per l’attenzione