

LA CONTAMINACIÓ I EL CANVI CLIMÀTIC. ¿ENS HEM DE “PRE-OCUPAR” ELS CARDIÒLEGS?

L'aire nostre de cada dia i el cor

Jordi Bañeras Rius
13 de gener 2020

2 ways to say:
"Merry Christmas...
pleasant smoking!"

Camel
Cigarettes

Prince Albert
Smoking Tobacco

32785

It's one of the best-kept secrets in town. While his patients say little of it, 2 in 4 he's actually got call 24 hours a day. The doctor is a doctor, a diplomat, and a healthy cigarette smoker. Being all in one, he never has long and hard to schedule.

According to a recent Nationwide survey:
**MORE DOCTORS SMOKE CAMELS
THAN ANY OTHER CIGARETTE**

Hollywood Chooses
LEKTROLITE

BETTE DAVIS
Warner Bros.

Happy Birthday Dad
We Know Your
ABC's

ALWAYS BUY CHESTERFIELD

20,679* Physicians
say "**LUCKIES** are
less irritating"

"It's toasted"
Your Throat Protection
against irritation against cough

LUCKY STRIKE
"IT'S TOASTED"
CIGARETTES

*The figures quoted have been checked and certified to by EVBRAND, ROSS BROS. AND MONTGOMERY, Accountants and Auditors.

According to repeated nationwide surveys,

**More Doctors
Smoke CAMELS
than any other
cigarette!**

Doctors in every branch of medicine were asked, "What cigarette do you smoke?" The brand named most was Camel!

You'll enjoy Camels for the same reason so many doctors stress them. Camels have rich, mild satisfaction, quick after-punch, and a flavor unobscured by any other cigarette. Make this wonderful one. Smoker only. Camels for Wednesdays and we will Camels please your taste, here with they will give them as your steady smoke. You'll see how enjoyable a cigarette can be!

THE DOCTORS' CHOICE IS AMERICA'S CHOICE!

Before you scold me, Mom...
maybe you'd better light up a

Marlboro

Gee, Mommy
you sure enjoy your
Marlboro

Yes, you need never feel over-smoked... that's the Miracle of Marlboro!

Yes, you need never feel over-smoked... that's the Miracle of Marlboro!

MARLBORO
CIGARETTES

700 x 750



Societat Catalana de **Cardiologia**

Relació entre factors climàtics i contaminació atmosfèrica amb la incidència i severitat de la síndrome coronària aguda amb aixecament del ST a Barcelona

Jordi Bañeras Rius
7 Abril del 2014



Contaminación atmosférica y síndrome coronario agudo

Jordi Bañeras Rius
5 de diciembre 2014

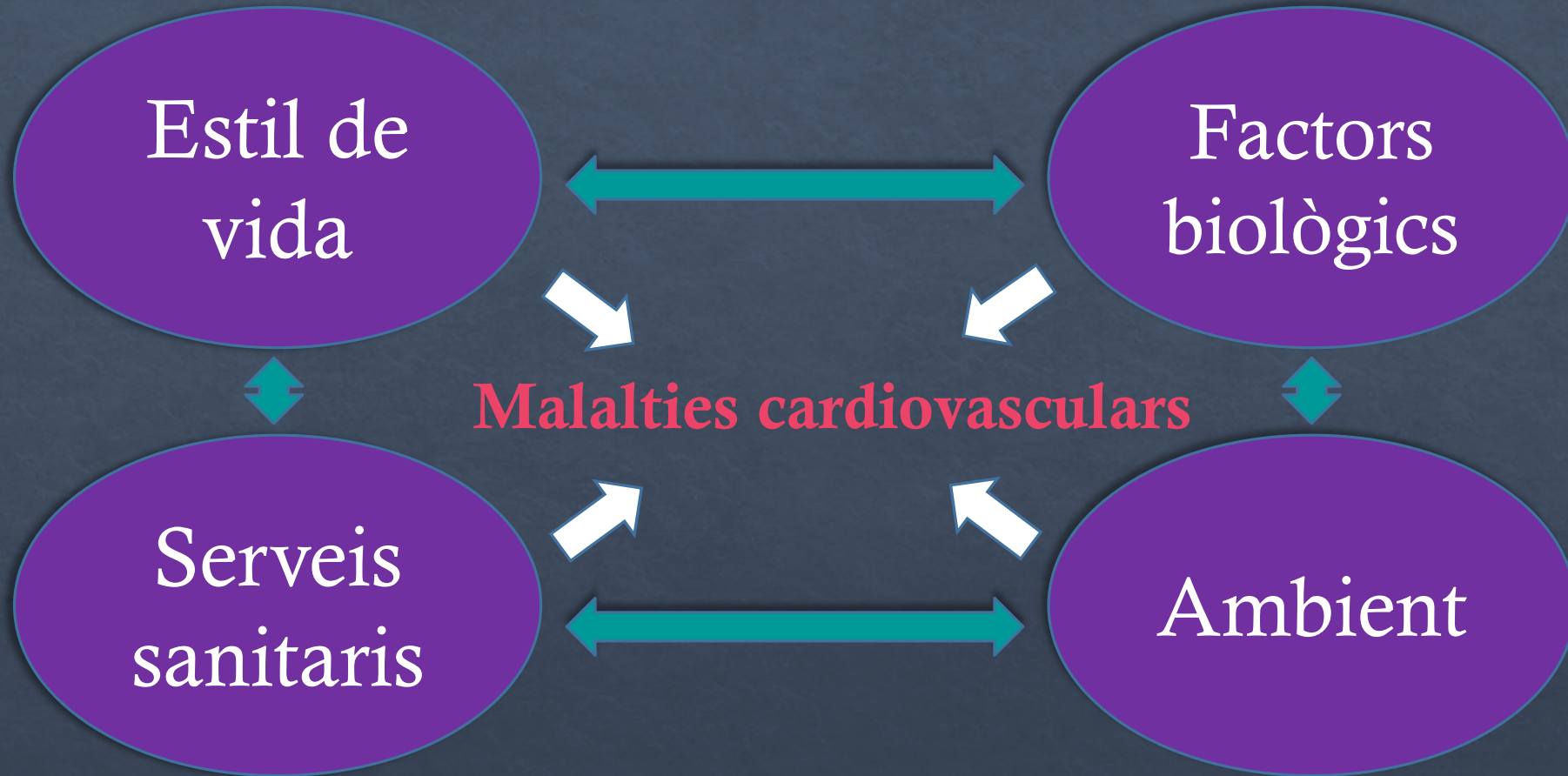
Índex

- ◆ 1. Magnitud del problema.
- ◆ 2. Contaminants implicats.
- ◆ 3. Mecanismes fisiopatològics.
- ◆ 4. Grau d'evidència.
- ◆ 5. Impacte econòmic i prevenció

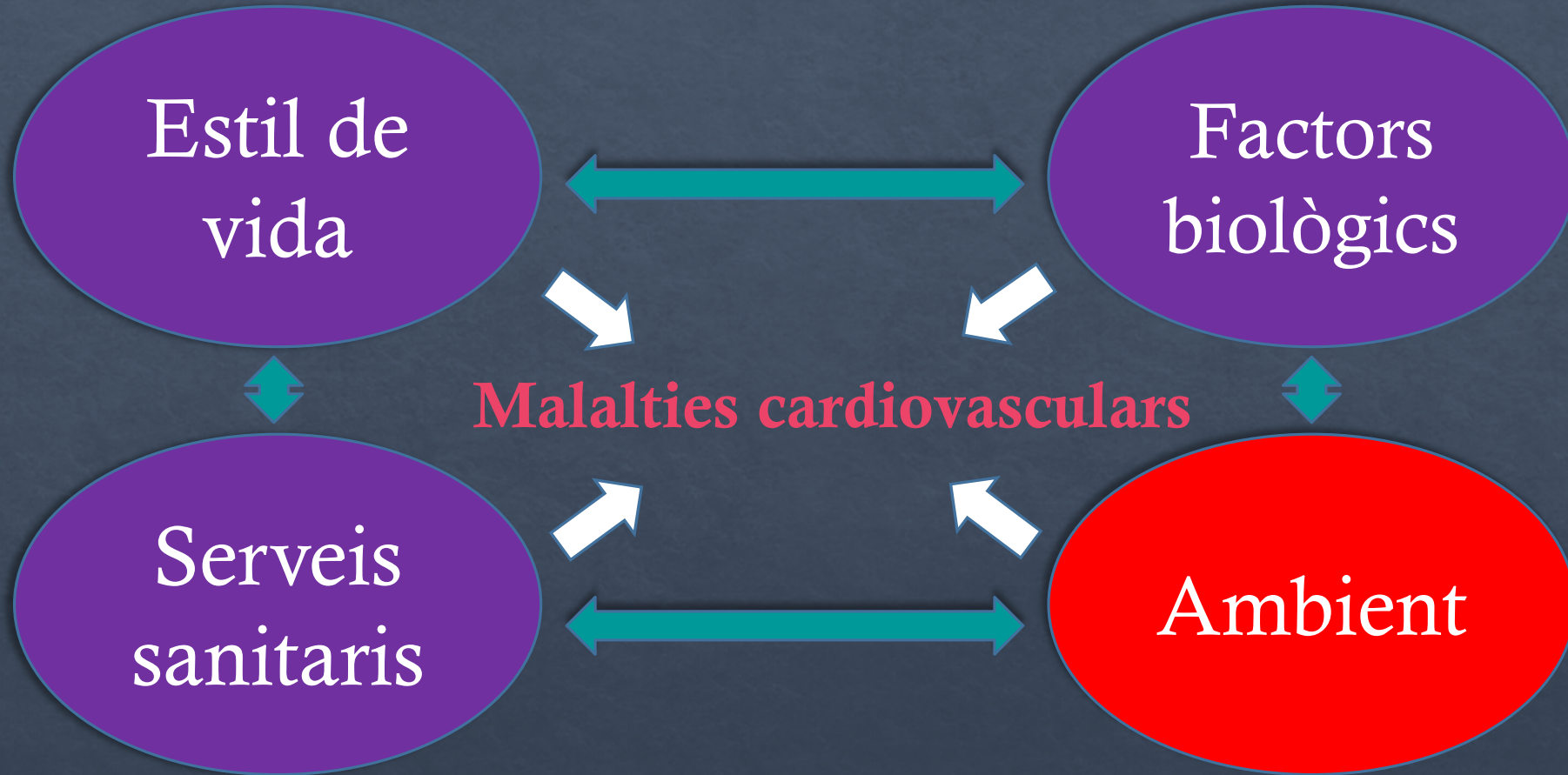
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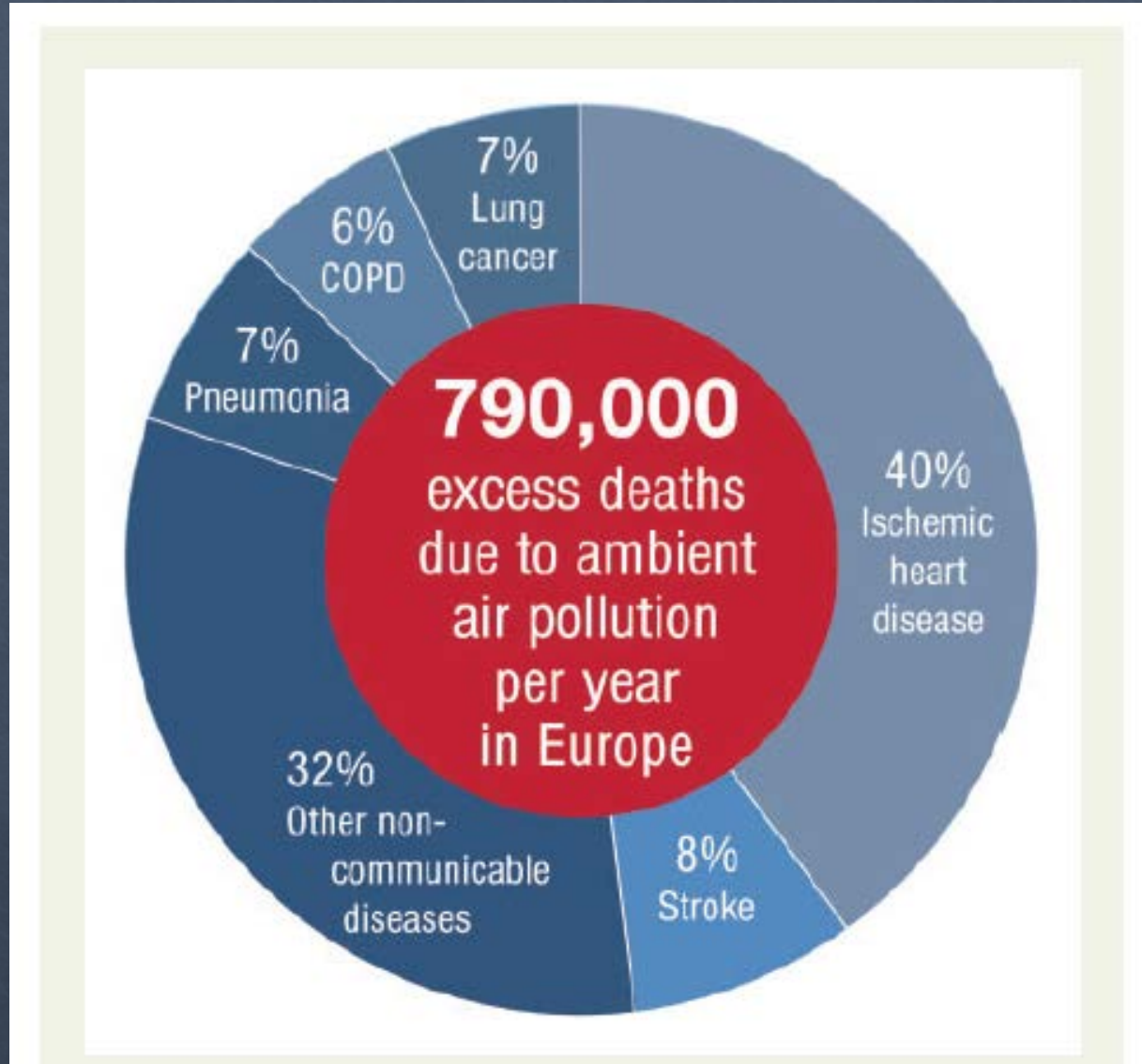
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Determinants de la salut



Determinants de la salut





Contaminació com a factor de risc cardiovascular

A Both sexes

Leading risks 1990

Leading risks 2007

Mean percentage change in number of DALYs, 2007-17

Mean percentage change in all-age DALY rate, 2007-17

Mean percentage change in age-standardised DALY rate, 2007-17

Leading risks 2017

Mean percentage change in number of DALYs, 2007-17

Mean percentage change in all-age DALY rate, 2007-17

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Leading risks 1990	Leading risks 2007	Mean percentage change in number of DALYs, 2007-17	Mean percentage change in all-age DALY rate, 2007-17	Mean percentage change in age-standardised DALY rate, 2007-17	Leading risks 2017	Mean percentage change in number of DALYs, 2007-17	Mean percentage change in all-age DALY rate, 2007-17	Mean percentage change in age-standardised DALY rate, 2007-17
1 Child wasting	1 High systolic blood pressure	22.0	-2.8	-19.4	1 High systolic blood pressure	20.0	6.3	-8.0
2 Short gestation for birthweight	2 Short gestation for birthweight	-24.2	-39.6	-24.2	2 Smoking	8.2	-4.1	-16.4
3 Low birthweight for gestation	3 Smoking	10.3	-12.1	-25.8	3 High fasting plasma glucose	25.5	11.2	-3.2
4 Smoking	4 Child wasting	-47.7	-58.3	-47.9	4 High body-mass index	36.7	21.1	6.8
5 High systolic blood pressure	5 Low birthweight for gestation	-22.5	-38.2	-22.7	5 Short gestation for birthweight	-21.3	-30.3	-24.0
6 Unsafe water source	6 High fasting plasma glucose	51.4	20.7	0.8	6 Low birthweight for gestation	-21.8	-30.8	-24.7
7 Household air pollution	7 High body-mass index	66.2	32.5	11.7	7 Alcohol use	5.5	-6.6	-13.1
8 Child underweight	8 Alcohol use	37.4	9.5	-2.9	8 High LDL cholesterol	17.2	3.8	-9.3
9 Unsafe sanitation	9 Unsafe water source	-38.2	-50.7	-41.8	9 Child wasting	-40.1	-46.9	-43.1
10 Vitamin A deficiency	10 Unsafe sex	302.2	220.6	187.4	10 Ambient particulate matter	12.8	-0.1	-9.3
11 High fasting plasma glucose	11 High LDL cholesterol	17.2	-6.6	-22.8	11 Low whole grains	15.5	2.3	-9.7
12 No access to handwashing facility	12 Household air pollution	-37.1	-49.9	-47.0	12 High sodium	22.7	8.7	-5.9
13 Child stunting	13 Ambient particulate matter	17.3	-6.5	-8.8	13 Low fruit	7.7	-4.6	-15.7
14 Alcohol use	14 Low whole grains	23.4	-1.6	-17.0	14 Unsafe water source	-29.1	-37.2	-35.7
15 High LDL cholesterol	15 Unsafe sanitation	-41.2	-53.1	-44.6	15 Impaired kidney function	20.3	6.6	-5.4
16 High body-mass index	16 Low fruit				16 Household air pollution			
17 Ambient particulate matter	17 Child underweight				17 Unsafe sex			
18 Low whole grains	18 High sodium				20 Unsafe sanitation			
20 Low fruit	19 No access to handwashing facility							
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	21 Vitamin A deficiency							
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Leading risks 2017

Mean percentage change in number of DALYs, 2007-17

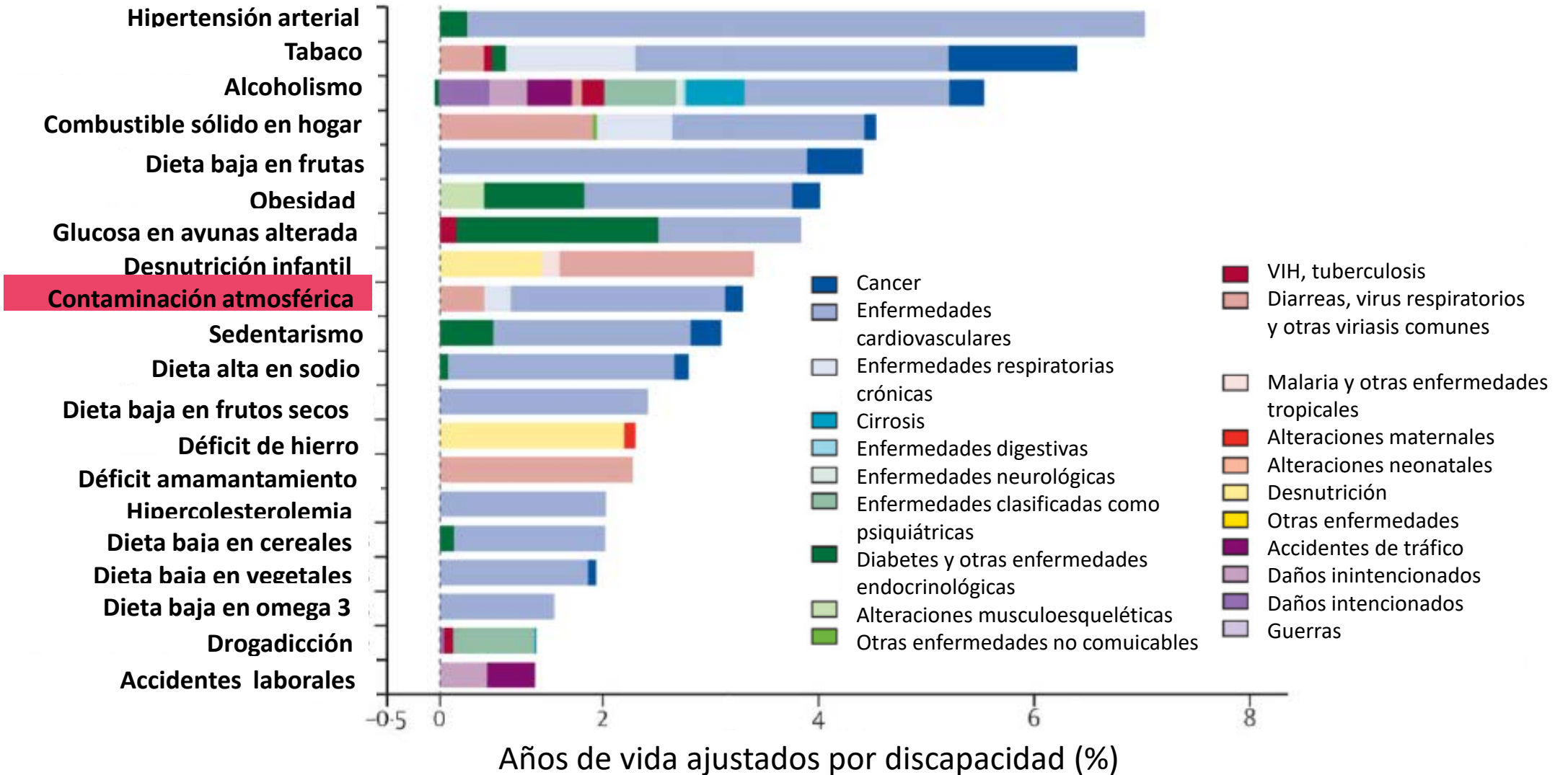
Mean percentage change in all-age DALY rate, 2007-17

Mean percentage change in age-standardised DALY rate, 2007-17

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Impacte de la contaminació atmosfèrica

9º



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Composició dels contaminants

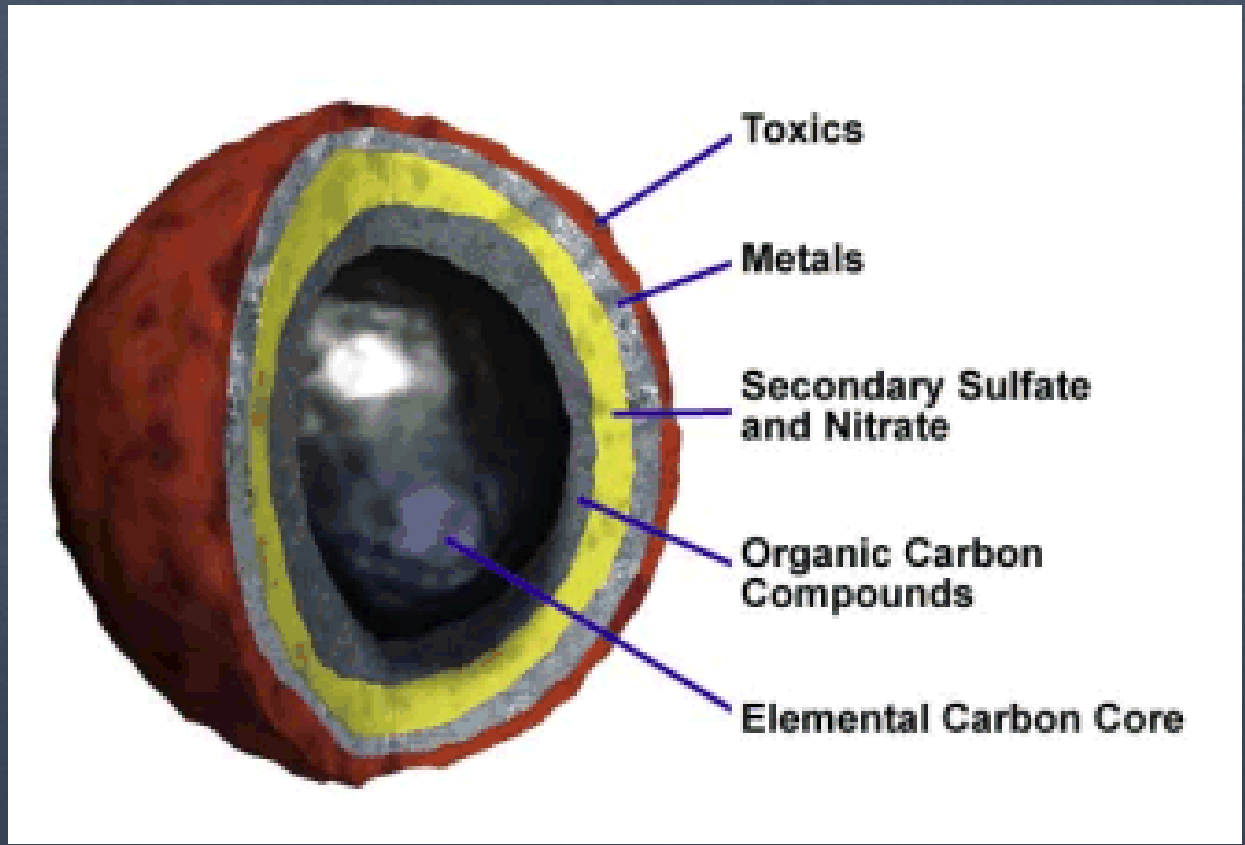
Biològics:
espores,
polen, bacteries

Gasos atmosfèrics:
CO₂, CO, NO,
SO₂, ozó

Compostos
orgànics volàtils
i semivolàtils

Inorgànics:
sulfats, nitrats,
amoni, clorur

Matèria particulada (PM)



Principales fuentes de emisión de las partículas finas y gruesas:

PM_{2.5} Partículas finas

Oxidación atmosférica de NO₂ (dióxido de nitrógeno), SO₂ (dióxido de azufre) y compuestos orgánicos, incluidos especies orgánicas biogénicas

Combustión de vehículos diésel

Combustión fósil (petróleo, carbón, gas natural) y combustible de biomasa, temperatura alta de procesos industriales, fundidoras, refinerías, acerías, etc.

PM₁₀ Partículas gruesas

Construcción y demolición

Cenizas de combustión de carbón no controlado, petróleo y madera

Resuspensión de partículas depositadas en las calles

Llantas, residuos de los caminos y de balatas de freno

Suspensión de suelos (cultivos, minería, calles no pavimentadas)

Brisa marina

Guidelines de la qualitat de l'aire

	EU	WHO
PM _{2.5}	25 µg/m ³ annual mean	10 µg/m ³ annual mean 25 µg/m ³ 24-hour mean
PM ₁₀	40 µg/m ³ annual mean 50 µg/m ³ 24-hour mean (limit can be exceeded 35 times per year)	20 µg/m ³ annual mean 50 µg/m ³ 24-hour mean
NO ₂	40 µg/m ³ annual mean 200 µg/m ³ 1-hour mean (limit can be exceeded 18 times per year)	40 µg/m ³ annual mean 200 µg/m ³ 1-hour mean
Ozone	120 µg/m ³ daily 8-hour mean (limit can be exceeded 25 days averaged over 3 years)	100 µg/m ³ 8-hour mean
PAHs	1 ng/m ³ (expressed as concentration of benzo(a)pyrene)	-

PM_{2.5}

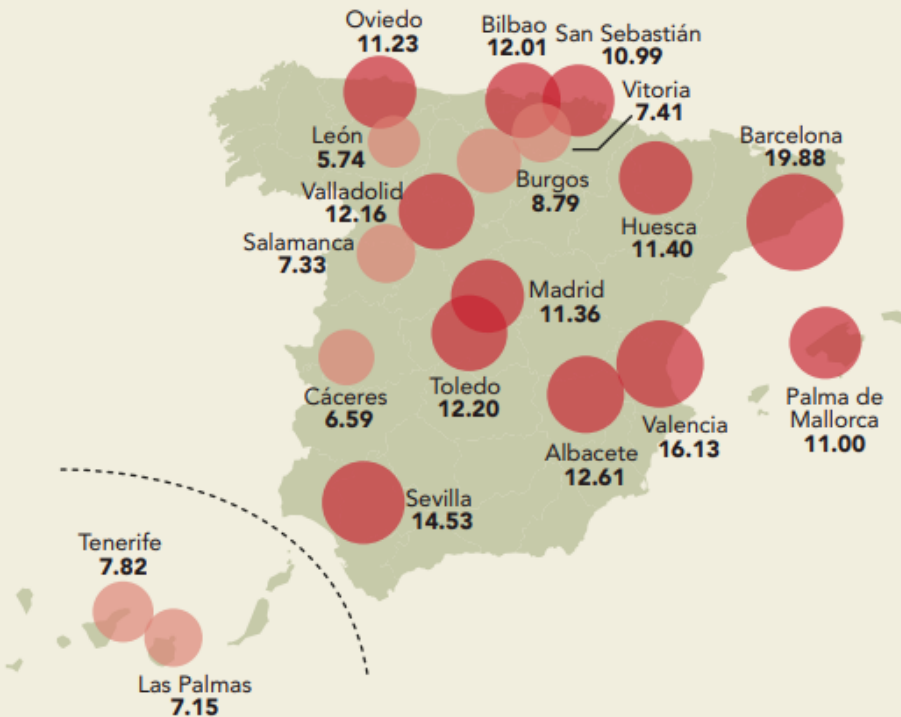
Límites establecidos

PM₁₀



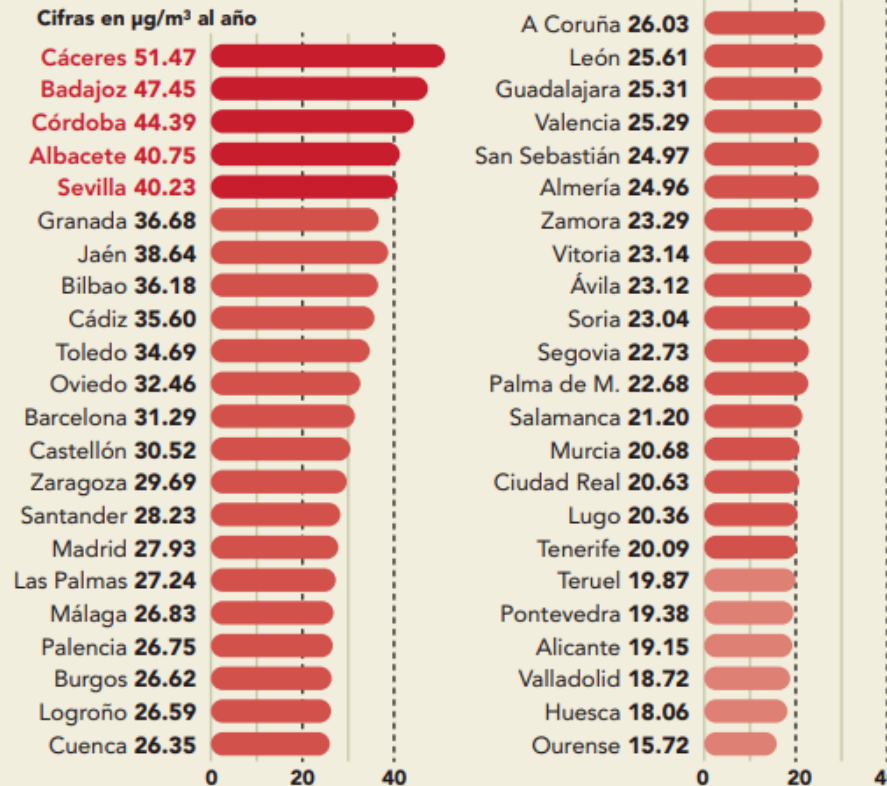
Media anual de PM_{2.5} en ciudades españolas (19 analizadas)

Cifras en $\mu\text{g}/\text{m}^3$ al año



Media anual de PM₁₀ en ciudades españolas (45 analizadas)

Cifras en $\mu\text{g}/\text{m}^3$ al año

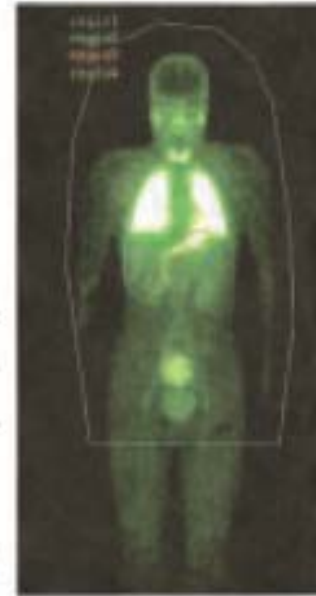
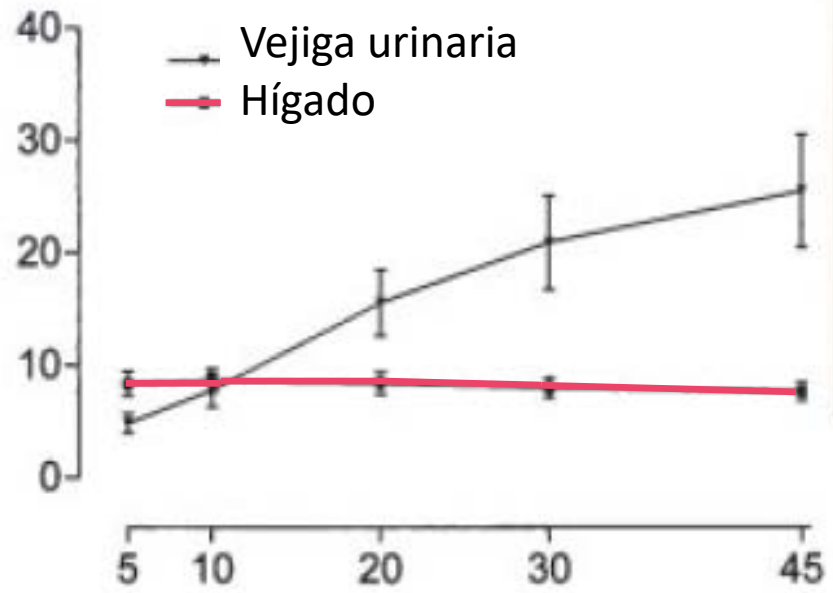


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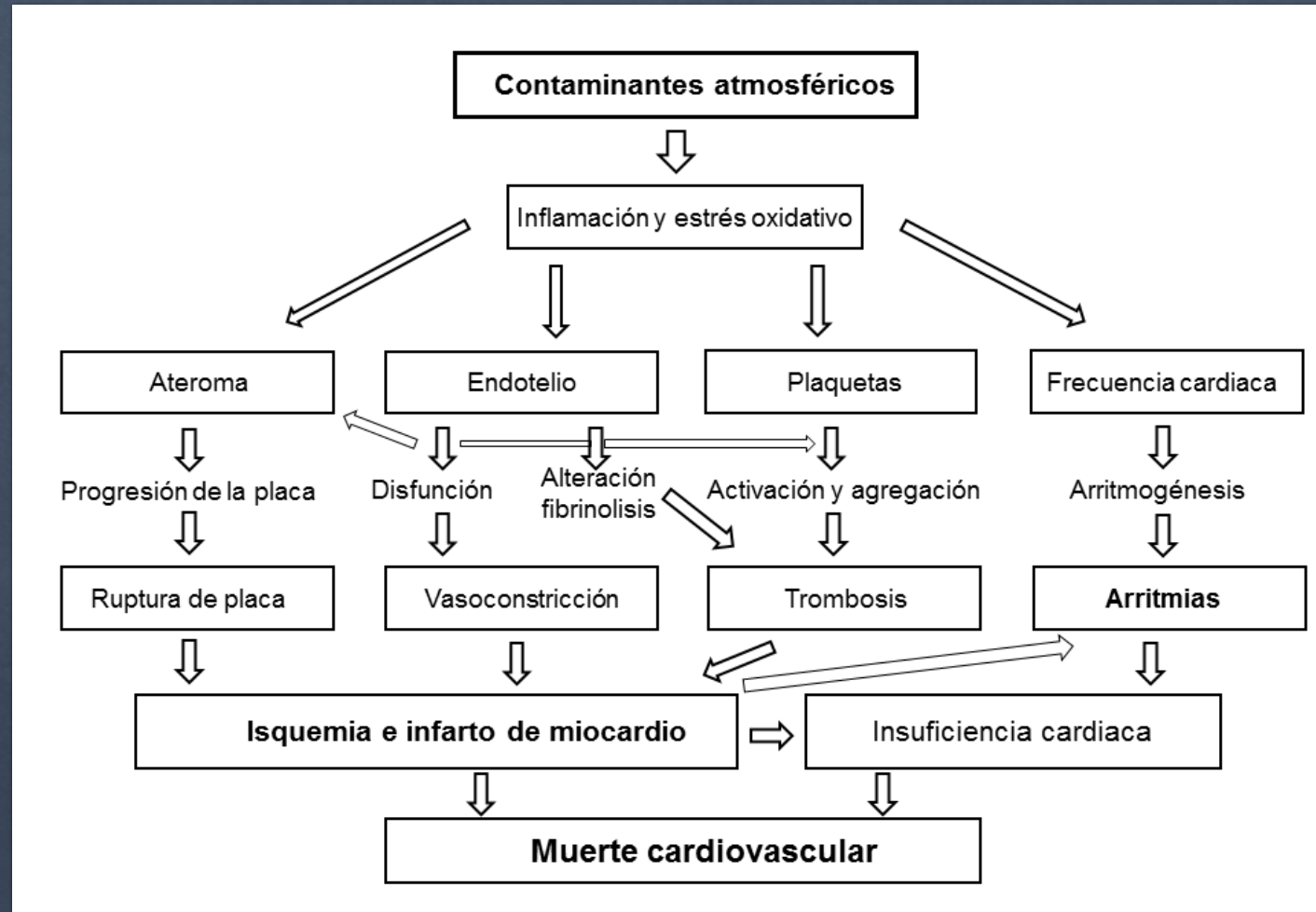
% de la radiactividad pulmonar

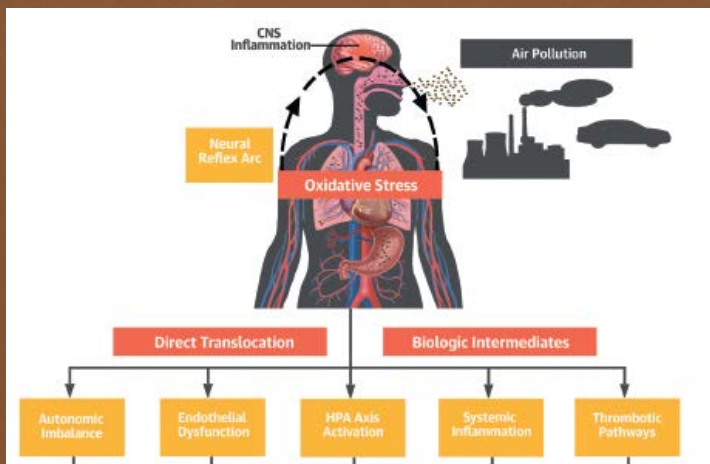
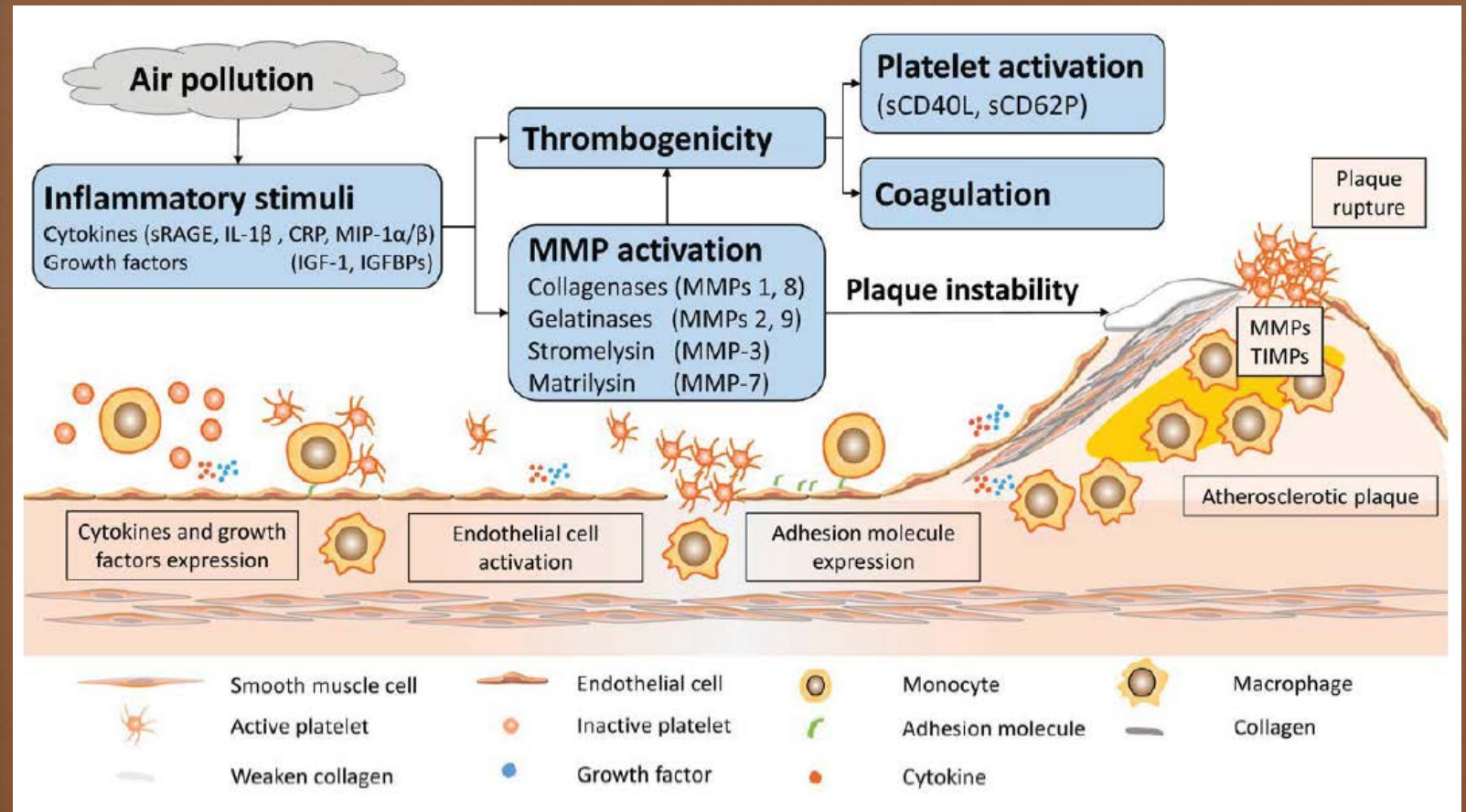
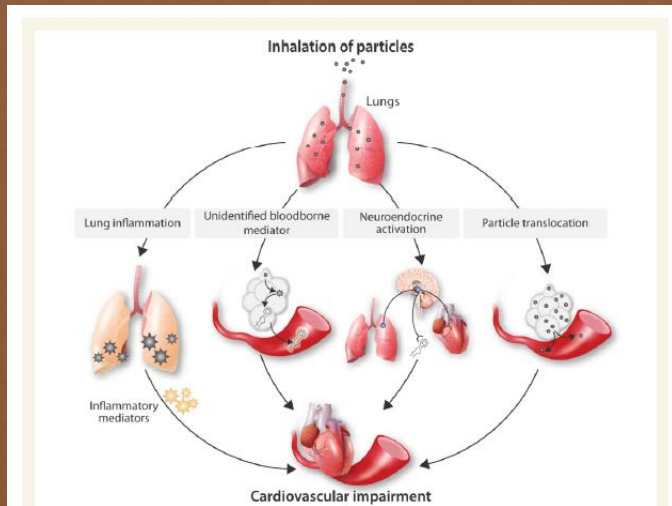
—•— Vejiga urinaria
—•— Hígado



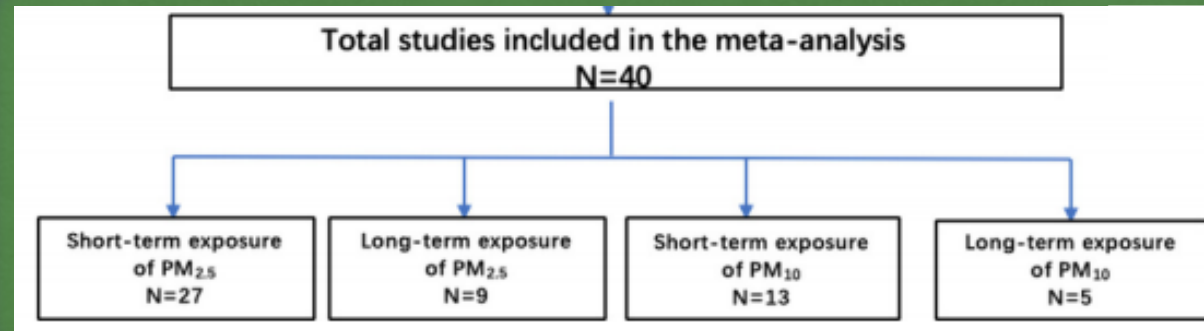
Tiempo (minutos)

Mecanismos fisiopatològics





Proteína C reactiva como marcador de polución

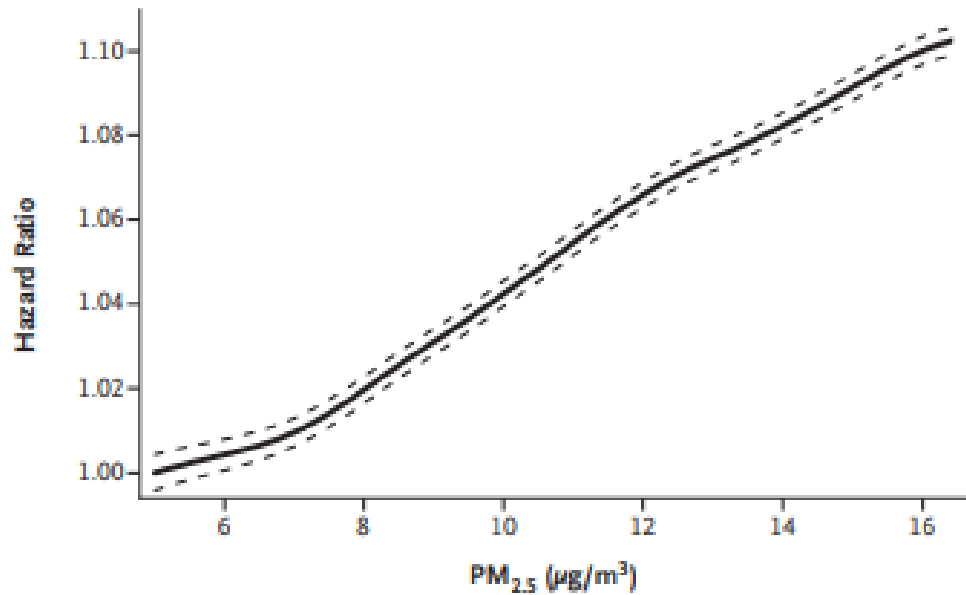


Meta-analysis of percent change in CRP in association with a $10 \mu\text{g}/\text{m}^3$ increase in ambient PM concentration

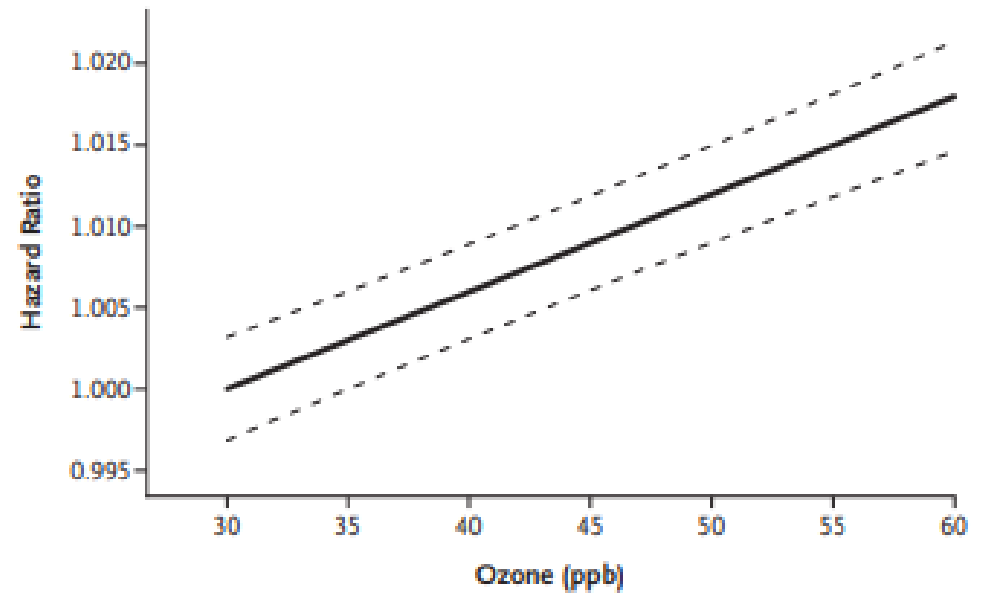
Overall analysis	Exposure	Pooled %-changes (95% CI)	Significance test (<i>P</i> value)	No. of effect estimates
PM _{2.5}	Short-term	0.83 (0.30, 1.37)	0.002	31
	Long-term	18.01 (5.96, 30.06)	0.003	9
PM ₁₀	Short-term	0.39 (−0.04, 0.82)	0.076	16
	Long-term	5.61 (0.79, 10.44)	0.023	5

Existeix un llindar de concentració mínima no perjudicial?

A Exposure to PM_{2.5}

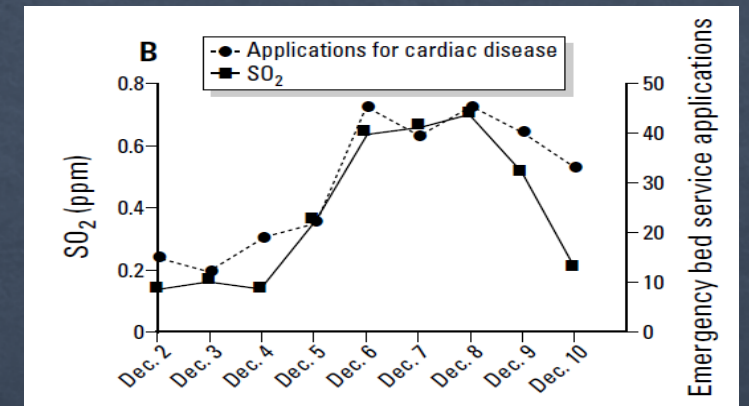


B Exposure to Ozone



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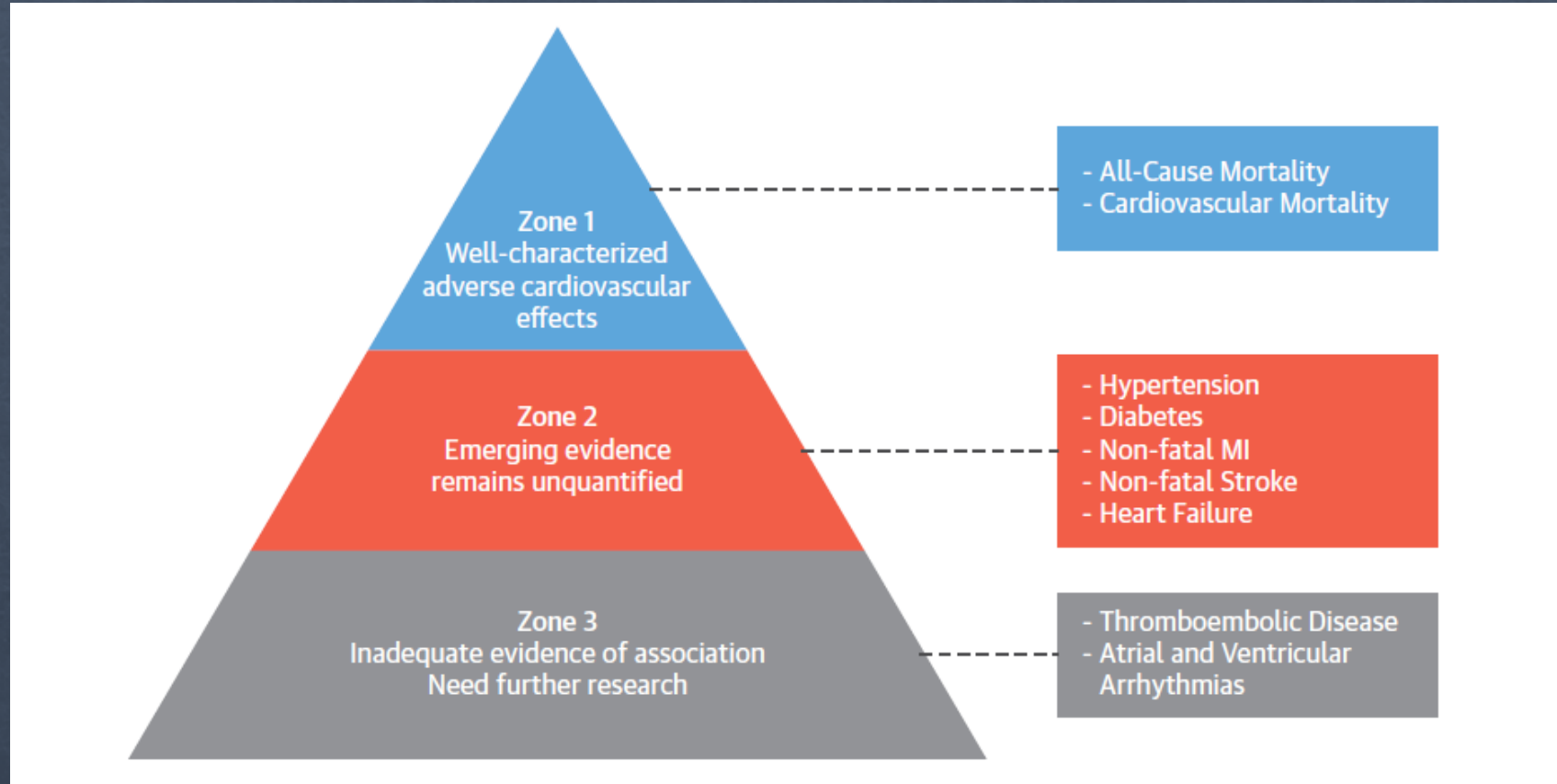


The Meuse Valley fog of 1930: an air pollution disaster.
Lancet 2001;357:704–8.

Donora, Pennsylvania: an environmental disaster of the 20th century.
Am J Public Health 2001;91:553.

Reassessment of the lethal London fog of 1952: novel indicators of acute and chronic consequences of acute exposure to air pollutants.
Environ Health Perspect 2001;109:389 –94.

Grau d' evidència



4. Grau d'evidència

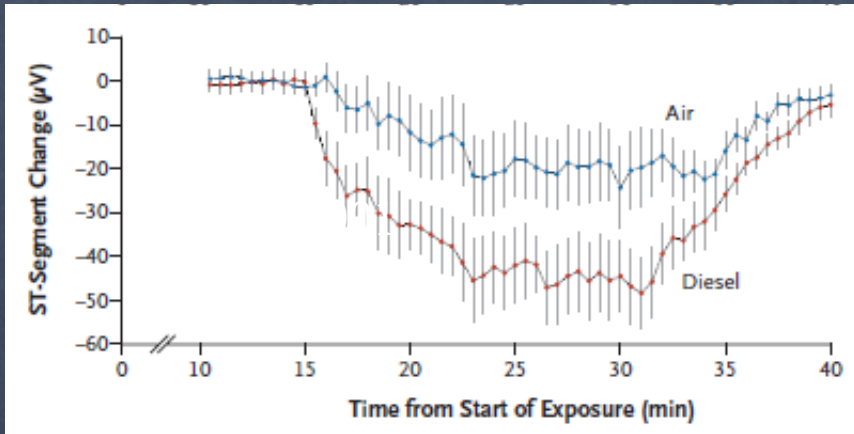
- Estudis experimentals
- Estudis epidemiològics
- Estudis clínics

4. Grau d'evidència

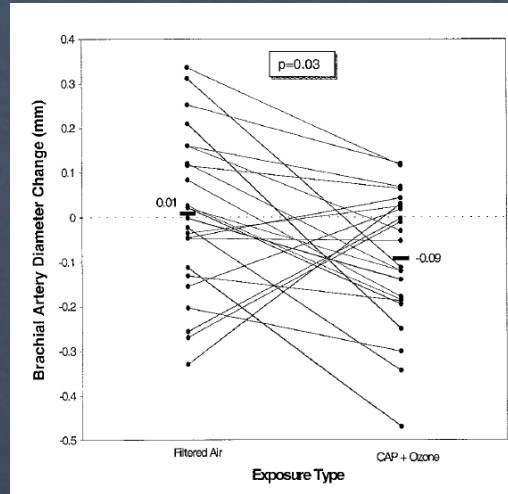
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Estudis experimentals

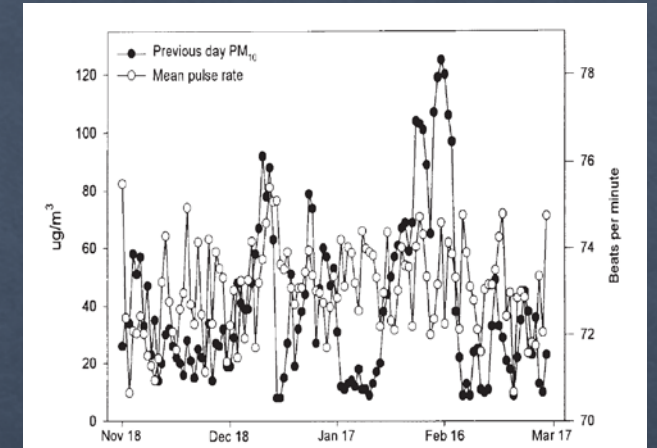
Isquèmia



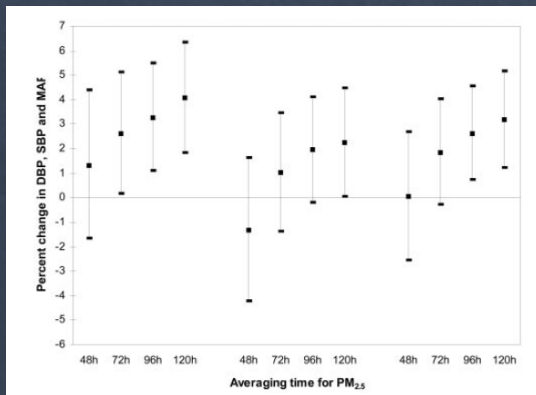
Vasoconstricció



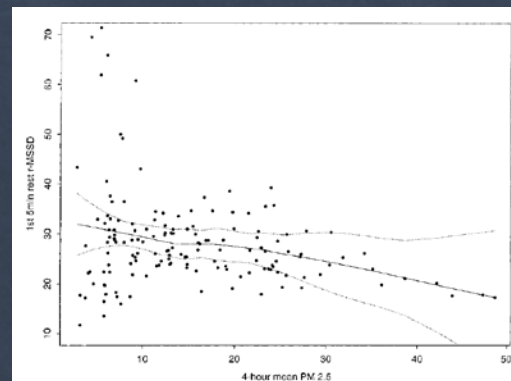
Variabilitat de la freqüència cardíaca



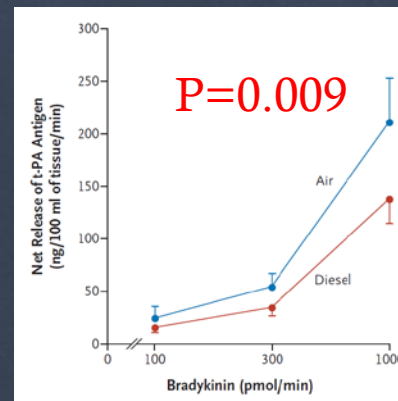
Pressió arterial



Variabilitat del RR

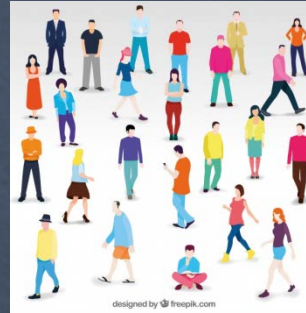


Efectes protrombòtics



Am J Respir Crit Care 1999;159:365–372.
 Circulation.2000 Mar 21;101(11):1267-73
 Circulation. 2004;110:2184-2189
 Circulation.2002 Apr 2;105(13):1534-6
 N Engl J Med 2007;357:1075-82.

Biomarcadors inflamatoris i de preoxidació



26 adults sans
10 setmanes x 2
Edat mitjana : 23.8
anys



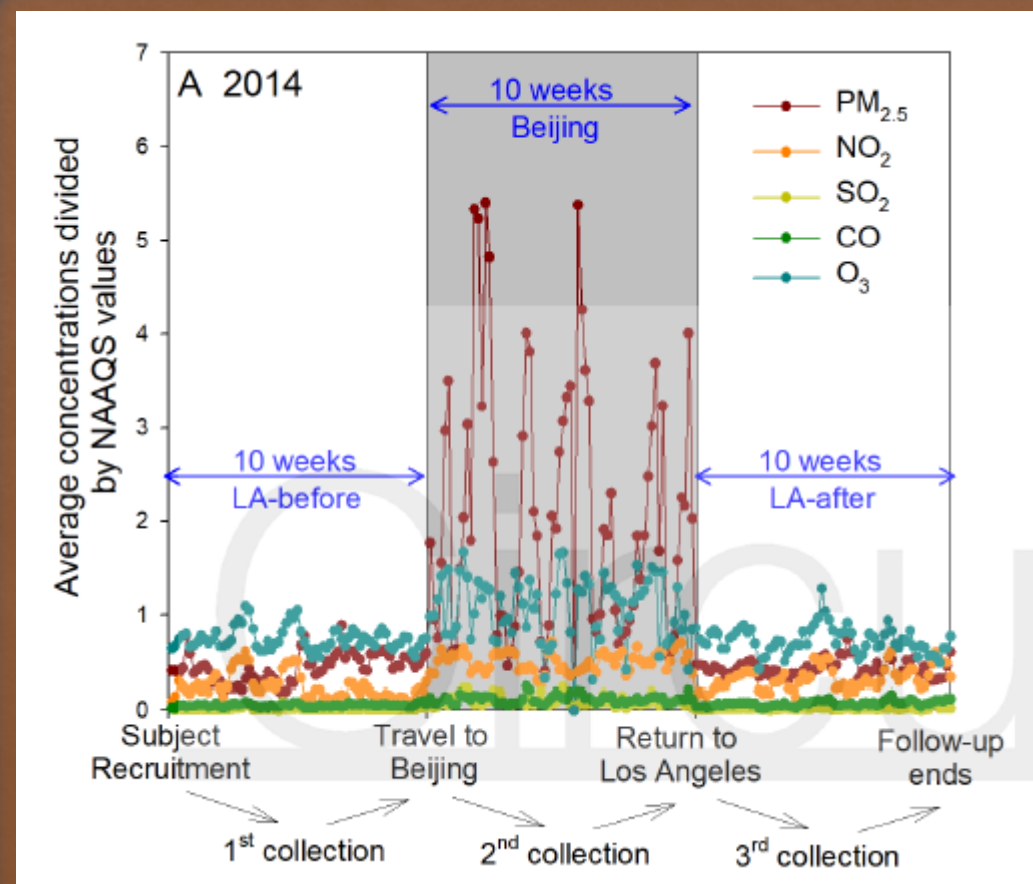
PM 2.5: 371% més elevat en Beijing

Biomaradors preoxidació lipídica

Via de la lipoxigenase (LO) → productes oxidatius
Via de la paraoxonase-1 (PON1)

Biomarcadors inflamatoris i de preoxidació

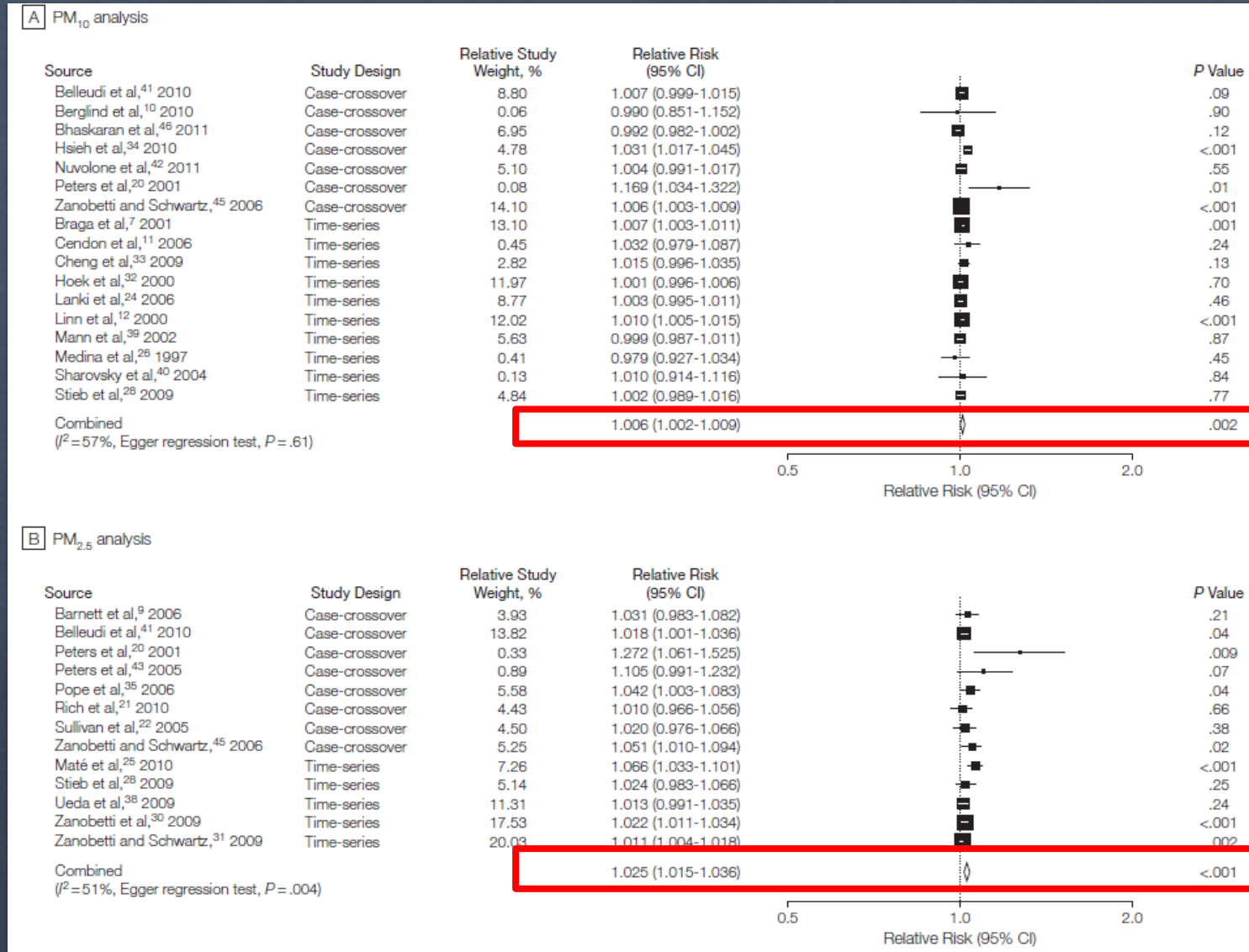
Biomarker	Biomarker concentrations		
	LA-before (n=23)	Beijing (n=25)	LA-after (n=24)
5-HETE, ng/mL	0.06 (0.02 - 0.12)	0.11 (0.07 - 0.20)	0.07 (0.05 - 0.11)
12-HETE, ng/mL	0.29 (0.08 - 0.60)	3.17 (2.11 - 4.79)	0.66 (0.45 - 1.21)
15-HETE, ng/mL	0.09 (0.08 - 0.13)	0.17 (0.13 - 0.22)	0.10 (0.09 - 0.12)
9-HODE, ng/mL	2.70 (2.14 - 3.48)	4.74 (3.95 - 5.27)	3.28 (2.40 - 4.74)
13-HODE, ng/mL	1.96 (1.55 - 2.63)	2.92 (2.47 - 3.39)	2.10 (1.58 - 2.69)
8-isoprostane, pg/mL	2.88 (1.37 - 5.10)	3.46 (1.67 - 7.38)	2.85 (1.85 - 3.46)
Paraoxonase	832 (333)	783 (291)	780 (95)
Arylesterase	266 (73)	227 (61)	264 (61)
C-reactive protein	0.69 (0.24 - 1.15)	1.37 (0.70 - 4.07)	0.67 (0.30 - 1.24)
Fibrinogen	0.43 (0.27 - 0.48)	0.64 (0.55 - 0.81)	0.40 (0.26 - 0.47)
von Willebrand factor	5.79 (4.44 - 11.9)	9.12 (6.77 - 13.6)	7.08 (4.73 - 10.6)
Total	84.9 (69.6 - 103)	80.5 (65.6 - 94.0)	90.5 (71.8 - 108)
HDL	32.1 (29.0 - 39.2)	31.7 (26.2 - 40.3)	33.0 (28.4 - 39.1)



4. Grau d'evidència

- Estudis experimentals
- **Estudis epidemiològics**
- Estudis clínics

Relació entre contaminació i infart de miocardi



Infarts de miocardi i contaminació a Barcelona

Generalitat de Catalunya
Departament de Salut

Full de recollida de dades de pacients atesos per Codi IAM

UNITAT PROVEÏDORA (hospital) _____

Identificació del pacient

CIP: _____ Cognoms i nom: _____
 Municipi residència: _____ Espai reservat per enganxar etiqueta identificativa
 Districte: _____ País: _____
 Data naixement: / / Edat: _____ Sexe: Home Dona
 Núm afectat SEM: _____ Núm HC: _____ Núm assistència (URG, ADM): _____

Primera atenció

HOSPITAL: PRIMERA ASSISTÈNCIA _____

Lloc de fa. assistència: SEM H comarcal CAP CUAP/CAC El propi H de Codi IAM

Qui fa la 1ª assistència: SEM H comarcal H Codi IAM Mege APS

Antecedents: IAM previ Diabetis Angiopàstia prèvia Cirurgia coronària prèvia Sosplata de Trombosi intrastent

ECG en lloc de la fa. assistència: SEM H comarcal H referència CUAP/CAC CAP

ECG: _____ Data: / / Hora: : : Valoració: Elevació ST No elevació ST Bloqueig BE ECG no diagnòstic (no permet descartar T ST)

Decisió terapèutica: Fibrinòlisi Angiopàstia primària Trastat urgent H codi IAM Trastat altre hospital Altres situacions

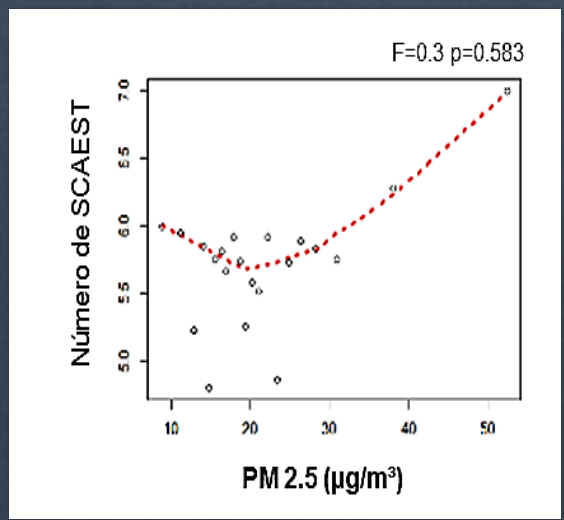
Complicacions: Fibril·lació ventricular Xoc Taquicàrdia ventricular Fibril·lació auricular Altres arrítmies

Desfibril·lació / Cardioversió: Si No

Èxitus: Si No

Motius per no fer fibrinòlisi 1ª assistència: Absència de criteris Finestra horària Contraindicacions Sense motiu conegut Cirurgia - trauma recent Risc excessiu d'hemorràgia Altres contraindicacions

	CONTAMINANTE	RR (95% IC)	RA % (95% IC)
Número de SCAEST*	PM10 (bajo; lag.2)	1.004 (1.000 – 1.007)	0.39% (0.06%; 0.70%)
	PM2.5 (bajo)	1.005 (1.001 – 1.010)	0.54% (0.07%; 1.00%)
Número de muertes**	NO2 (alto; lag.2)	1.002 (1.000 – 1.003)	0.17% (0.00%; 0.33%)
	PM10 (media bajo)	1.036 (1.011 – 1.059)	3.43% (1.13%; 5.55%)
Número de arritmias ventriculares ***	PM2.5 (media bajo)	1.042 (1.012 – 1.070)	4.05% (1.17%; 6.56%)
	PM2.5 (alto; lag3)	1.016 (1.003 – 1.028)	1.53% (2.52%; 2.77%)

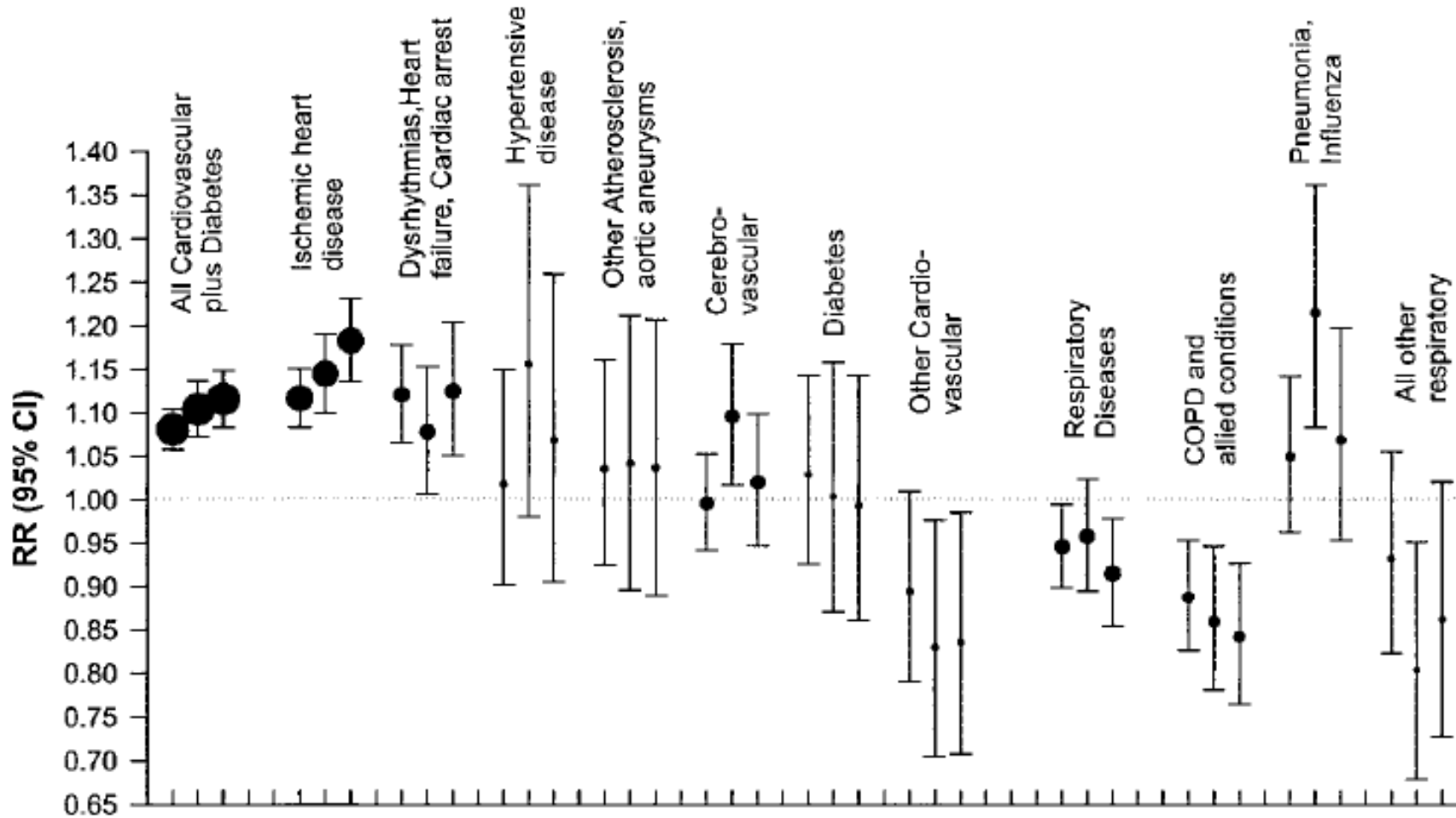


Desencadenants d' infart de miocardi

	Prevalencia de la exposició	Odds ratio	Fracció atribuïble poblacional
Contaminació atmosfèrica, variació de 30 µg / m³	100%	1.05 (1.03-1.07)	4.76% (2.63-6.28)
Alcohol	3.2%	3.1 (1.4-6.9)	5.03% (2.91-7.06)
Ira	1.5%	3.11 (1.8-5.4)	3.07% (1.19-6.16)
Cocaina	0.04%	23.7 (8.1-66.3)	0.90% (0.28-2.55)
Comidas copiosas	0.5%	7.00 (0.8-66)	2.69% (-0.09-23)
Marihuana	0.2%	4.8 (2.9-9.5)	0.75% (0.38-1.67)
Esfuerzo físico	2.4%	4.25 (3.17-5.68)	6.16% (4.20-8.64)
Actividad sexual	1.1%	3.11 (1.79-5.43)	2.21% (0.84-4.53)
Exposició al tràfic	4.1%	2.92 (2.22-3.83)	7.36% (4.81-10.49)

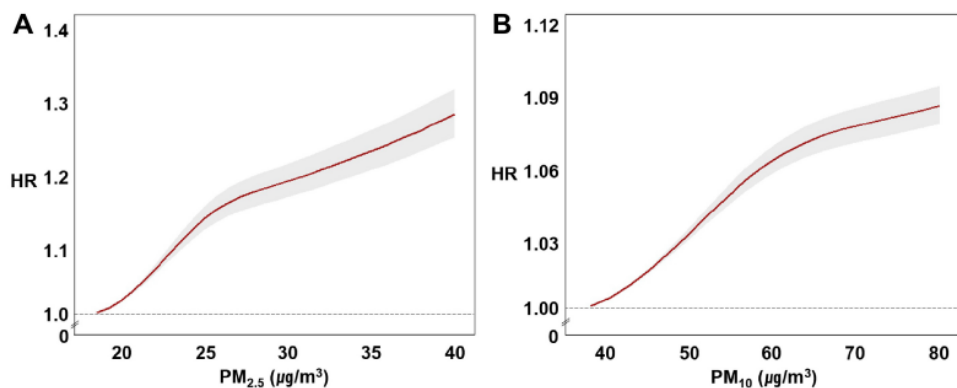
Adaptada de Nawlot et al. Lancet 2011.

Efectes de PM 2.5 en la mortalitat



Fibril.lació auricular

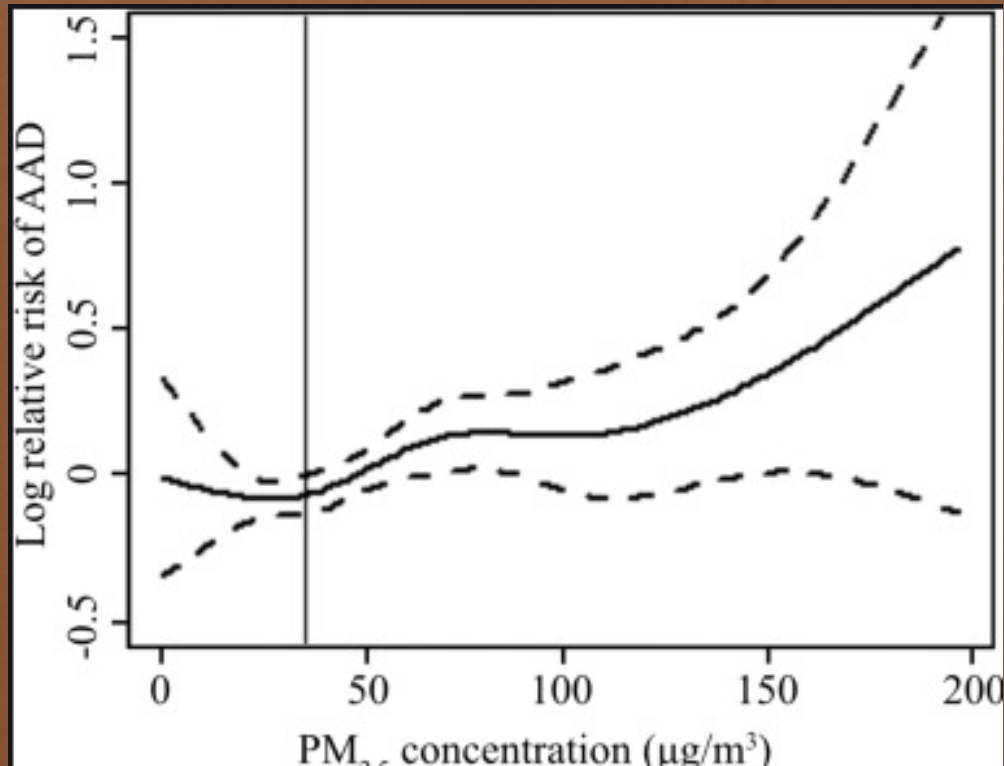
Particulate air pollutants and incident AF (Overall general population)



PM_{2.5} and incident AF according to subgroups (Overall general population)

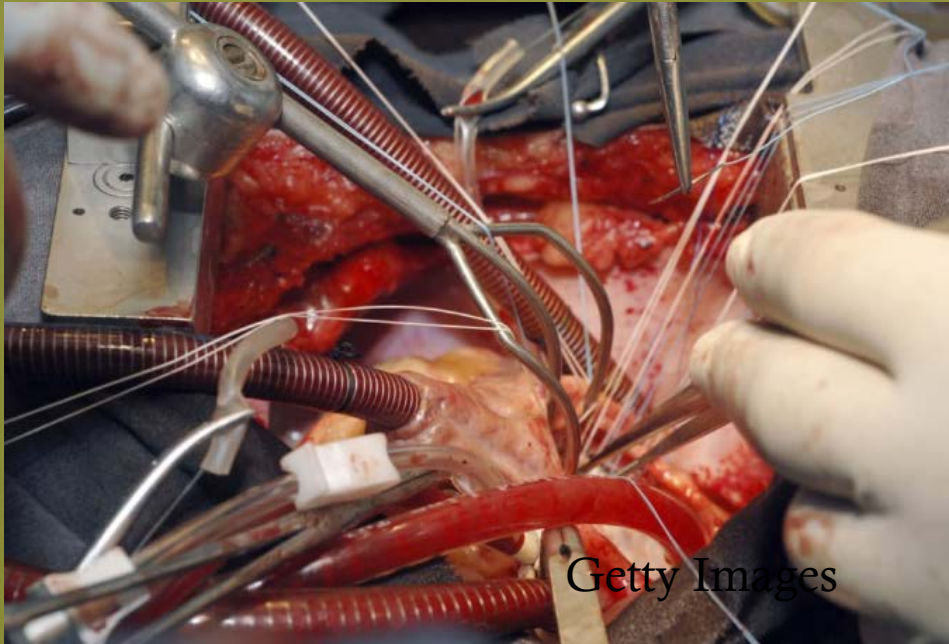
	N	Incident AF : age- sex- adjusted (per 100,000 person-year)	Adjusted HR (by 10µg/m ³ of PM _{2.5} increase)	P for interaction
Male	216,653	470 (455-485)	1.187 (1.183-1.192)	<0.001
Female	215,934	378 (365-392)	1.178 (1.174-1.182)	
Age≥60	96,114	1,225 (1,190-1,261)	1.194 (1.188-1.200)	<0.001
Age<60	336,473	194 (186-201)	1.173 (1.169-1.177)	
BMI <18.5 kg/m ²	18,107	386 (340-436)	1.184 (1.168-1.200)	0.687
BMI 18.5-22.9 kg/m ²	171,830	347 (333-362)	1.181 (1.177-1.185)	Ref
BMI 23.0-27.4 kg/m ²	191,303	459 (444-475)	1.185 (1.181-1.190)	0.163
BMI ≥27.5 kg/m ²	51,347	565 (532-600)	1.191 (1.183-1.199)	0.046
Smoking ≥20pyrs	56,551	640 (607-674)	1.178 (1.170-1.187)	0.164
Smoking <20pyrs	106,480	299 (282-316)	1.182 (1.176-1.189)	0.536
Non-smoker	269,556	421 (408-434)	1.187 (1.183-1.191)	Ref
Lower SES	170,809	404 (389-420)	1.185 (1.180-1.190)	0.332
Higher SES	261,778	438 (426-452)	1.180 (1.176-1.184)	
Previous MI (+)	4,396	3,764 (3,471-4,076)	1.203 (1.186-1.221)	0.001
Previous MI (-)	428,191	392 (383-402)	1.181 (1.178-1.184)	
Previous HF (+)	10,751	4,430 (4,226-4,642)	1.196 (1.184-1.211)	0.103
Previous HF (-)	421,836	327 (318-336)	1.181 (1.178-1.184)	
Previous Stroke (+)	16,731	2,139 (2,025-2,256)	1.194 (1.179-1.209)	0.071
Previous Stroke (-)	415,856	358 (349-368)	1.180 (1.177-1.184)	
HTN (+)	95,448	1,350 (1,313-1,388)	1.191 (1.185-1.197)	0.039
HTN (-)	337,139	164 (157-171)	1.178 (1.174-1.183)	
DM (+)	27,627	1,256 (1,188-1,326)	1.192 (1.179-1.205)	0.058
DM (-)	404,960	370 (360-380)	1.181 (1.177-1.185)	

Dissecció d'aorta



Classification	Levels	Estimates
All	-	3.38 (1.02, 5.79)
Age	< 60 years	2.07 (-1.21, 5.46)
	> 60 years	4.82 (1.42, 8.33)
Gender	Males	3.67 (0.89, 6.53)
	Females	2.59 (-1.96, 7.36)
Season	Cool season	4.63 (1.84, 7.50)
	Warm season	1.72 (-3.74, 7.48)

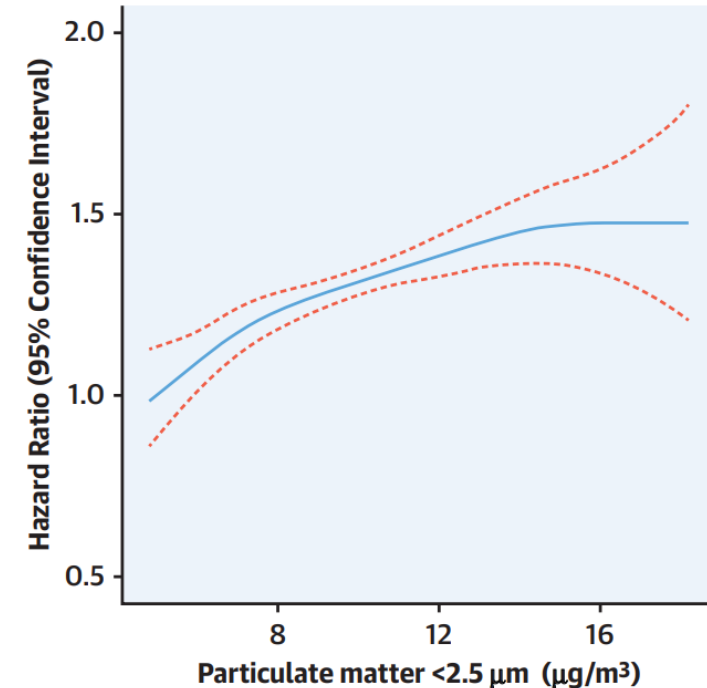
Trasplant cardiac



Getty Images

- 21,800 pacients trasplantats
- Mitjana de seguiment: 4.8 anys → 23.9% mortalitat: 23.9%
- HR mortalitat d'exposició anual PM_{2.5}: $10.6 \pm 2.3 \mu\text{g}/\text{m}^3$
- Mitjana mortalitat per un increment anual de $10 \mu\text{g}/\text{m}^3$: 1.26 (95% IC 1.11-1.43)

CENTRAL ILLUSTRATION Association Between Particulate Matter $<2.5 \mu\text{m}$ and Hazards of All-Cause Mortality in Heart Transplant Recipients



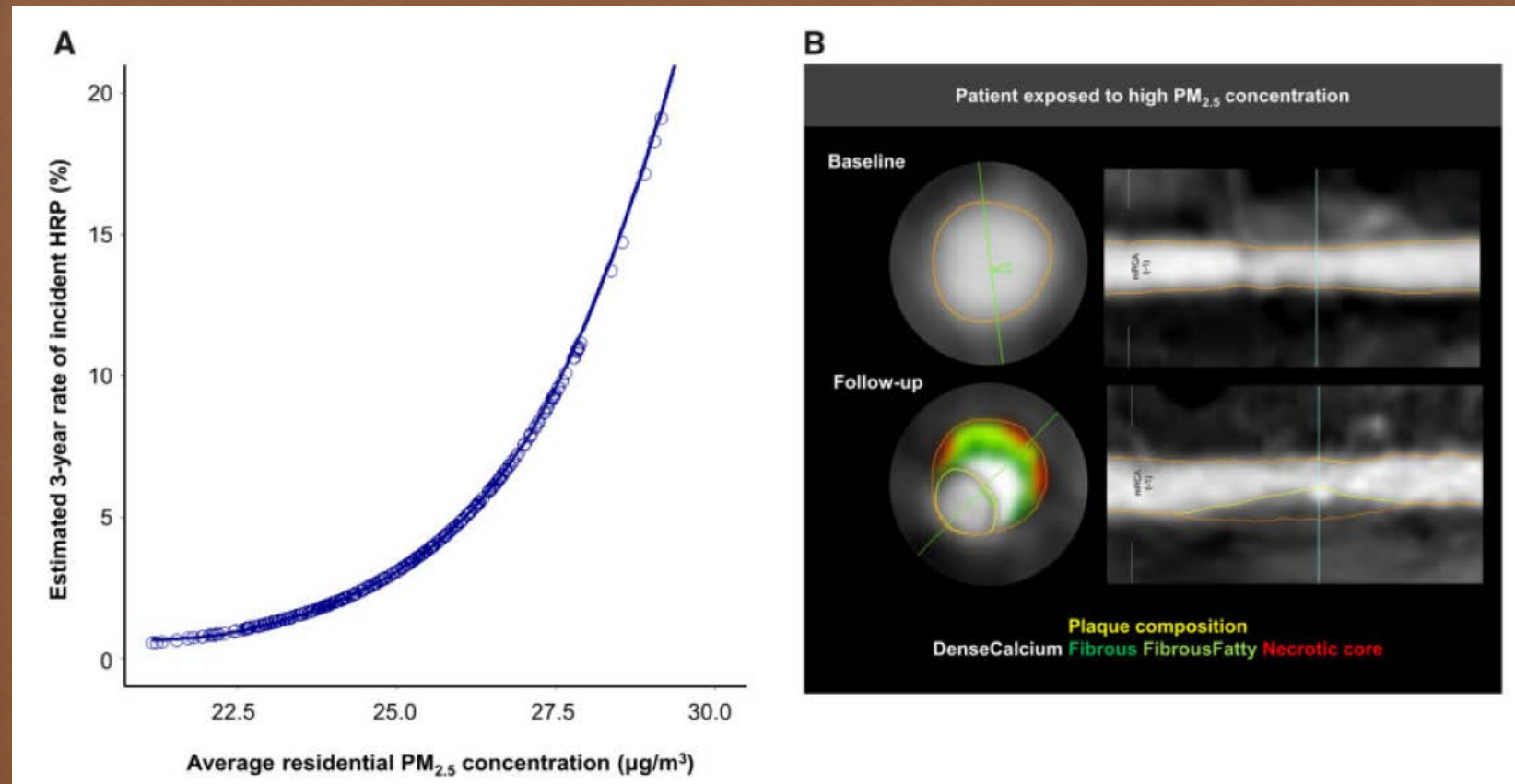
Al-Kindi, S.G. et al. *J Am Coll Cardiol.* 2019;74(24):3026-35.

The association was examined using Cox proportional hazard models, and particulate matter $<2.5 \mu\text{m}$ (PM_{2.5}) was modeled as a time-varying covariate and penalized smoothed splines. Hazard ratio (blue line) and 95% confidence interval for hazard ratio (dotted red lines) compared with patients exposed to $5 \mu\text{g}/\text{m}^3$ of PM_{2.5}. Figure is winsorized at 1st and 99th percentiles of PM_{2.5}.

4. Grau d'evidència

- Estudis experimentals
- Estudis epidemiològics
- **Estudis clínics**

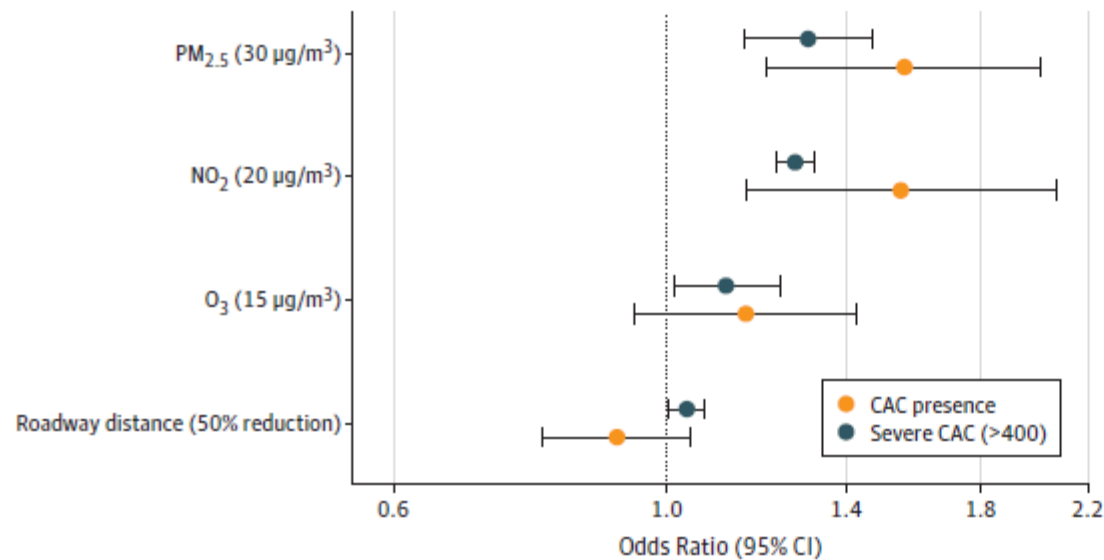
Contaminació i plaques coronàries



Objectiu principal: desenvolupament de placa d'alt risc (poca atenuació, spotty calciremodelat positiu)
Objectiu secundari: augment del volum de placa.

Contaminació i plaques coronàries

Figure 4. Odds Ratio of Detectable and High-Level Coronary Artery Calcium (CAC) Associated With Long-term Exposure Variables



Odds ratios and 95% CIs (error bars) for the presence of CAC and severe CAC (>400 Agatston units) adjusted for age, sex, body mass index, smoking status, smoking years, cigarettes per day, alcohol consumption, education, exercise, urbanization, region, distance to hospital, and Beijing residence (yes or no). NO₂ indicates nitrogen dioxide; O₃, ozone; and PM_{2.5}, particulate matter with aerodynamic diameter less than 2.5 µm.

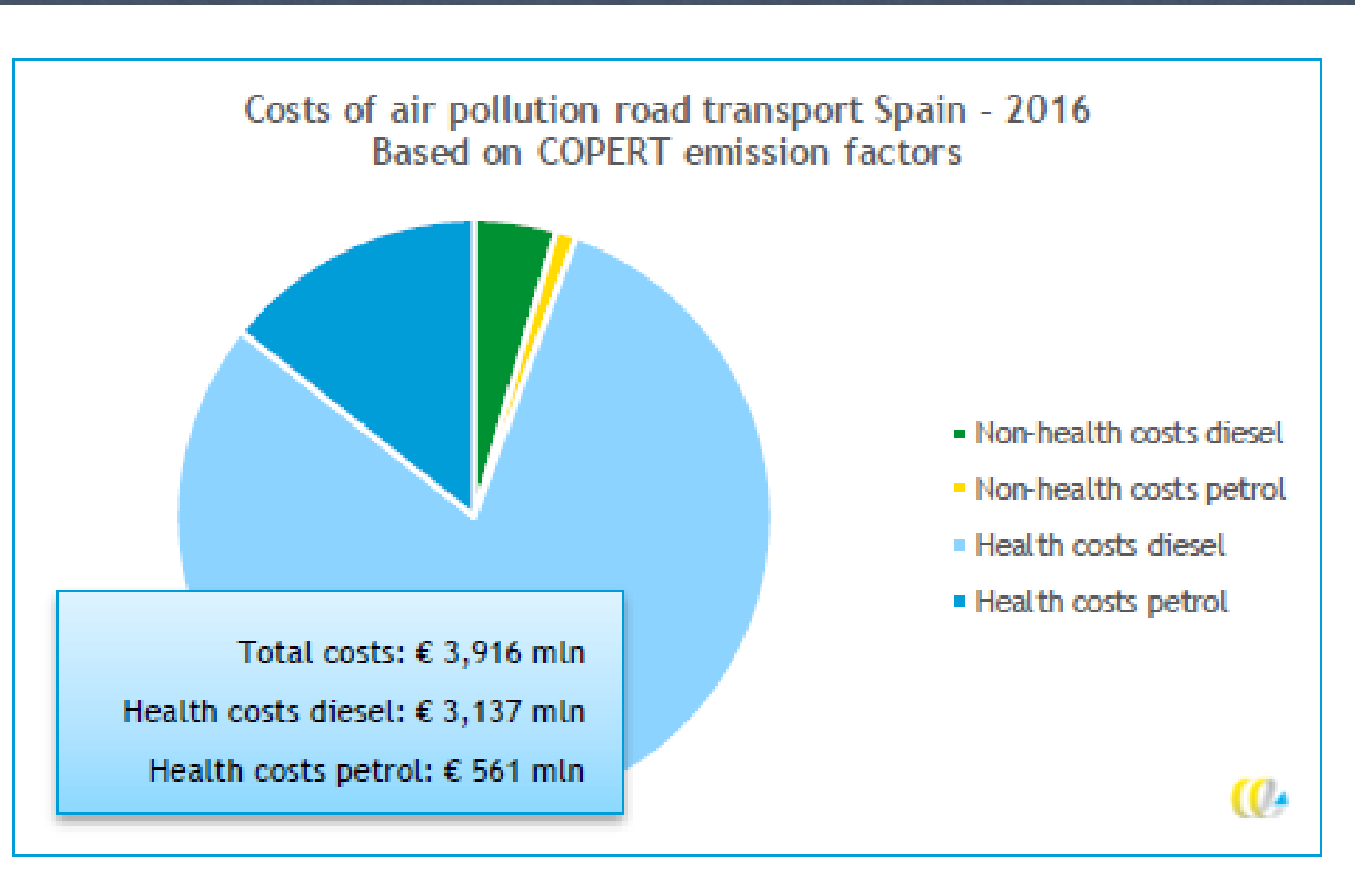
Índex

- ◇ 1. Magnitud del problema.
- ◇ 2. Contaminants implicats.
- ◇ 3. Mecanismes fisiopatològics.
- ◇ 4. Grau d'evidència.
- ◇ **5. Impacte econòmic i prevenció**

Impacte econòmic

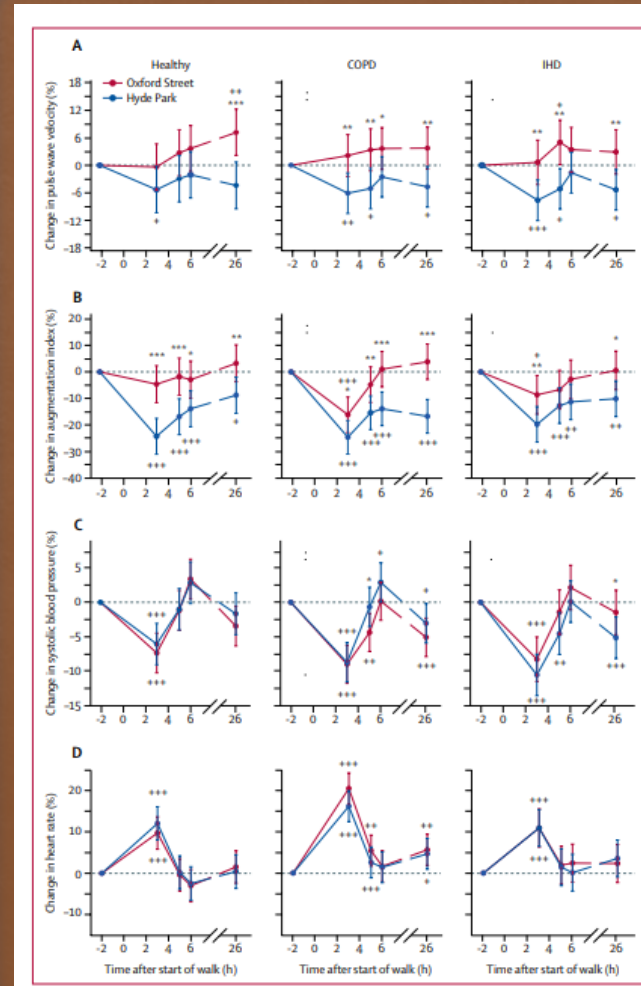
Cost in 2016 in million euro		Passenger car		Bus	Coach	MC	LCV		HGV	Total		
		Petrol	Diesel	Diesel	Diesel	Petrol	Petrol	Diesel	Diesel	Petrol	Diesel	Total
EU28		8,938	23,372	1,354	2,671	1,843	326	15,160	13,046	11,107	55,603	66,709
Austria	AT	119	828	23	100	33	3	654	247	155	1,853	2,007
Bulgaria	BG	197	145	32	34	1	1	41	160	199	413	612
Estonia	EE	29	33	4	4	0	0	11	12	29	64	93
Germany	DE	2,007	5,036	297	400	292	11	1,807	2,898	2,311	10,437	12,748
Hungary	HU	104	172	34	102	21	13	238	301	138	847	984
Poland	PL	775	628	163	97	19	23	395	1,433	817	2,716	3,533
Romania	RO	266	281	77	70	3	57	138	405	326	970	1,296
Slovenia	SI	34	120	3	17	2	1	58	120	36	317	354
Spain	ES	379	1,700	29	132	217	8	555	895	604	3,312	3,916

Impacte econòmic





Exercici físic



Exercici físic

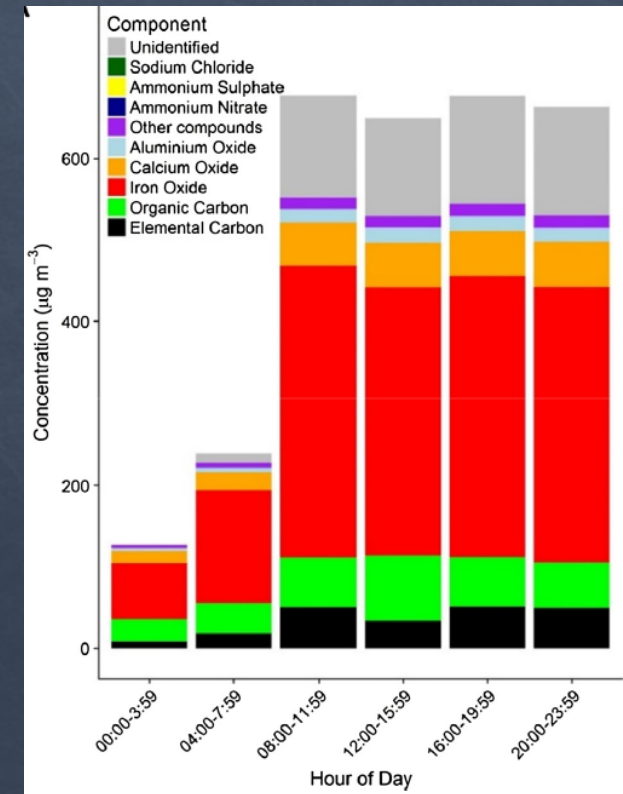
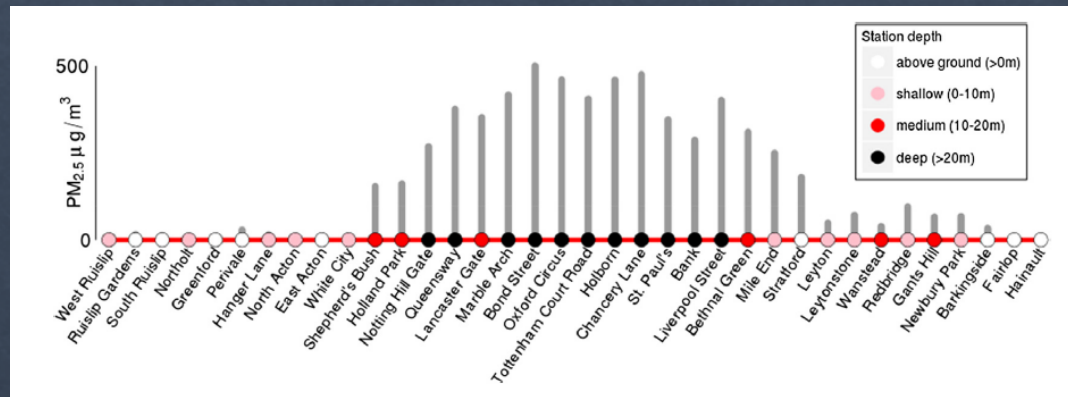
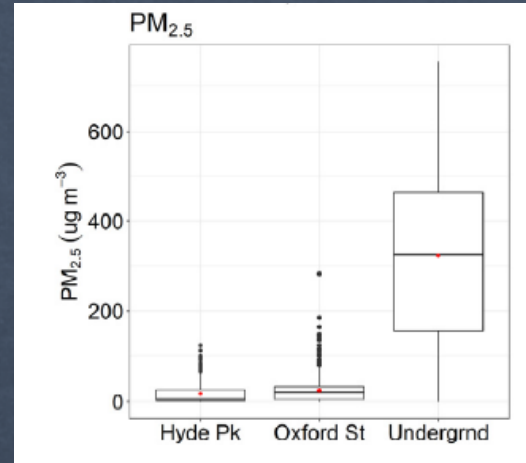


Table 4. The combined mortality effects of physical-activity type and long-term exposure to fine particulate matter in the Elderly Health Service Cohort ($n = 58\,643$)^a

	Low PM _{2.5} ($<35.3\ \mu\text{g}/\text{m}^3$)	High PM _{2.5} ($\geq 35.3\ \mu\text{g}/\text{m}^3$)	RERI	P-value for interaction
Cardiovascular				
Physical-activity type				0.16
Aerobic exercise	1.00 [Reference]	1.02 (0.81, 1.27)		
TCE	1.17 (0.97, 1.41)	1.13 (0.93, 1.36)	-0.061 (-0.351, 0.229)	
Stretching exercise	1.45 (1.23, 1.71)	1.53 (1.29, 1.80)	0.065 (-0.190, 0.321)	
Walking slowly	1.41 (1.18, 1.68)	1.73 (1.45, 2.06)	0.301 (0.024, 0.578)	
No exercise	1.53 (1.27, 1.84)	1.61 (1.34, 1.92)	0.063 (-0.092, 0.219)	

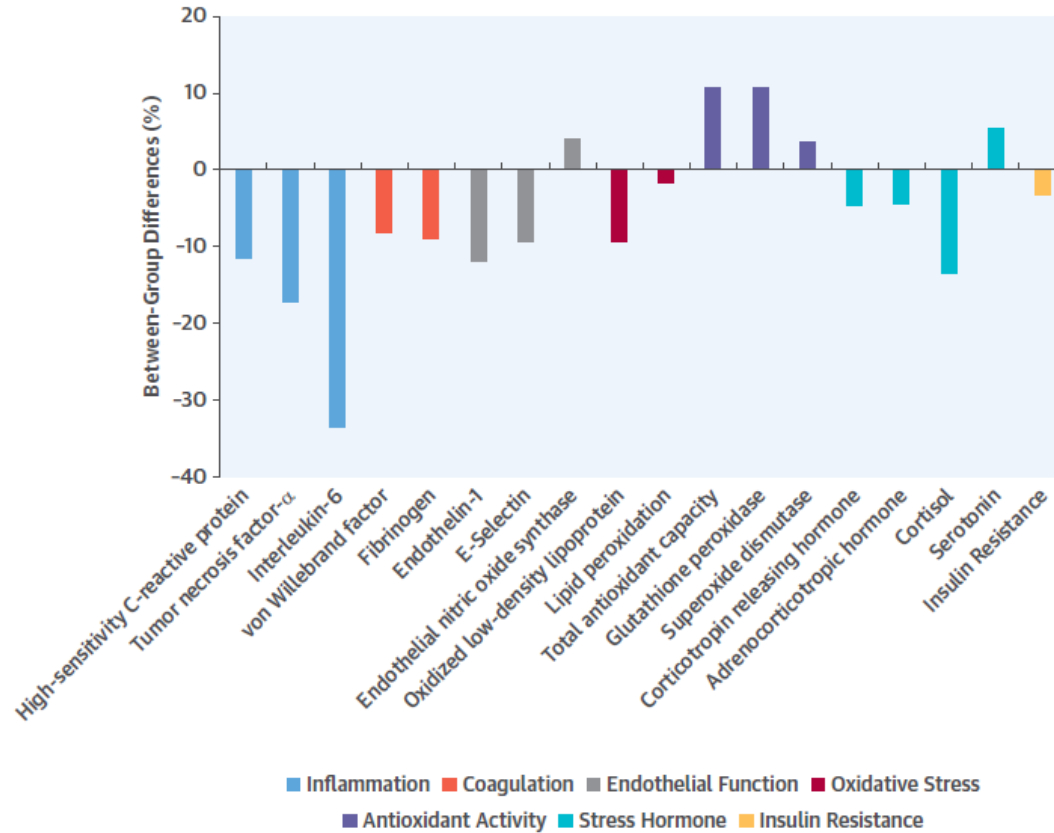


Transport amb metro



Àcids grassos omega 3

CENTRAL ILLUSTRATION Cardiovascular Benefits of Fish-Oil Supplementation Against Fine Particulate Matter Air Pollution



Lin, Z. et al. *J Am Coll Cardiol.* 2019;73(16):2076-85.

The differences in percentage changes of cardiovascular biomarkers associated with a 10- $\mu\text{g}/\text{m}^3$ increase of fine particulate matter concentrations comparing the fish-oil group to the placebo group.



CONCLUSIONS

- ◇ La contaminació atmosfèrica és un factor de risc cardiovascular. S'atribueixen quasi 800.000 morts anulas relacionades a Europa.
- ◇ El PM 2.5 i PM 10, el diòxid de nitrogen i l'ozó són els contamiants de més alt risc.
- ◇ Fenòmens inflamatoris, d'estrés oxidatiu, protrombòtics i de vasoconstricció estan implicats en la fisiopatologia.
- ◇ L'espectre de dany cardiovascular és clar: infarts de miocardi, moratllitat, fibril.lació auricular, dissecció d'aorta...
- ◇ El cost econòmic que suposa la contaminació en salut és molt elevat. Mentre no és baixin els nivells de contaminants s'ha de veure quines estartègies de prevenció són eficaces.

**MOLTES GRÀCIES PER
L'ATENCIÓ!!**

@JordiBaneras