

Quins efectes té la contaminació atmosfèrica en la nostra salut?

Ioar Rivas

Jornada Observatori Ambiental Litoral-Besos
Sant Adrià de Besòs, 11 d'octubre del 2022

ISGlobal
Barcelona
Institute for
Global Health

EXCELENCIA
SEVERO
OCHOA

Institució
CERCA
Centres de Recerca
mèdica catalana

A partnership of:

 "la Caixa" Foundation

CLÍNICA
BARCELONA
Hospital Universitari

Parc
de Salut
MAR

UNIVERSITAT DE
BARCELONA

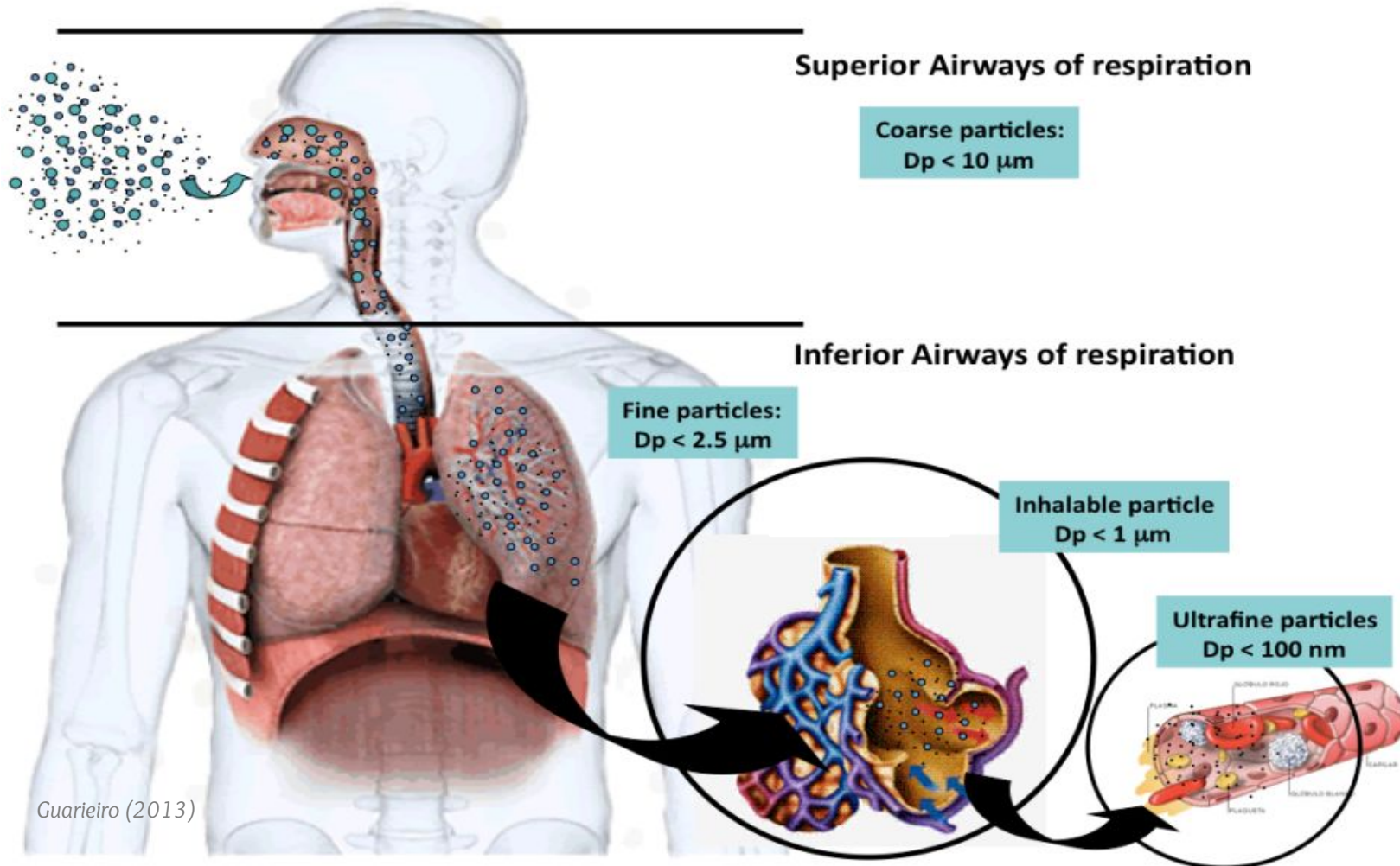
upf.
Universitat
Pompeu Fabra
Barcelona

 Generalitat
de Catalunya

 GOBIERNO
DE ESPAÑA

 Ajuntament de
Barcelona

Partículas: la mida sí importa



Guariero (2013)

Particules: la composició també

Mineral

Al_2O_3 , Mg, Ti, Fe, K, SiO_2 , CO_3^{2-} , P, Ca



Compostos carbonosos

Matèria orgànica+ Carboni elemental



Aerosols secundaris

NH_4^+ , SO_4^{2-} , NO_3^- , orgànics



Aerosol marí

Na^+ , Cl^-

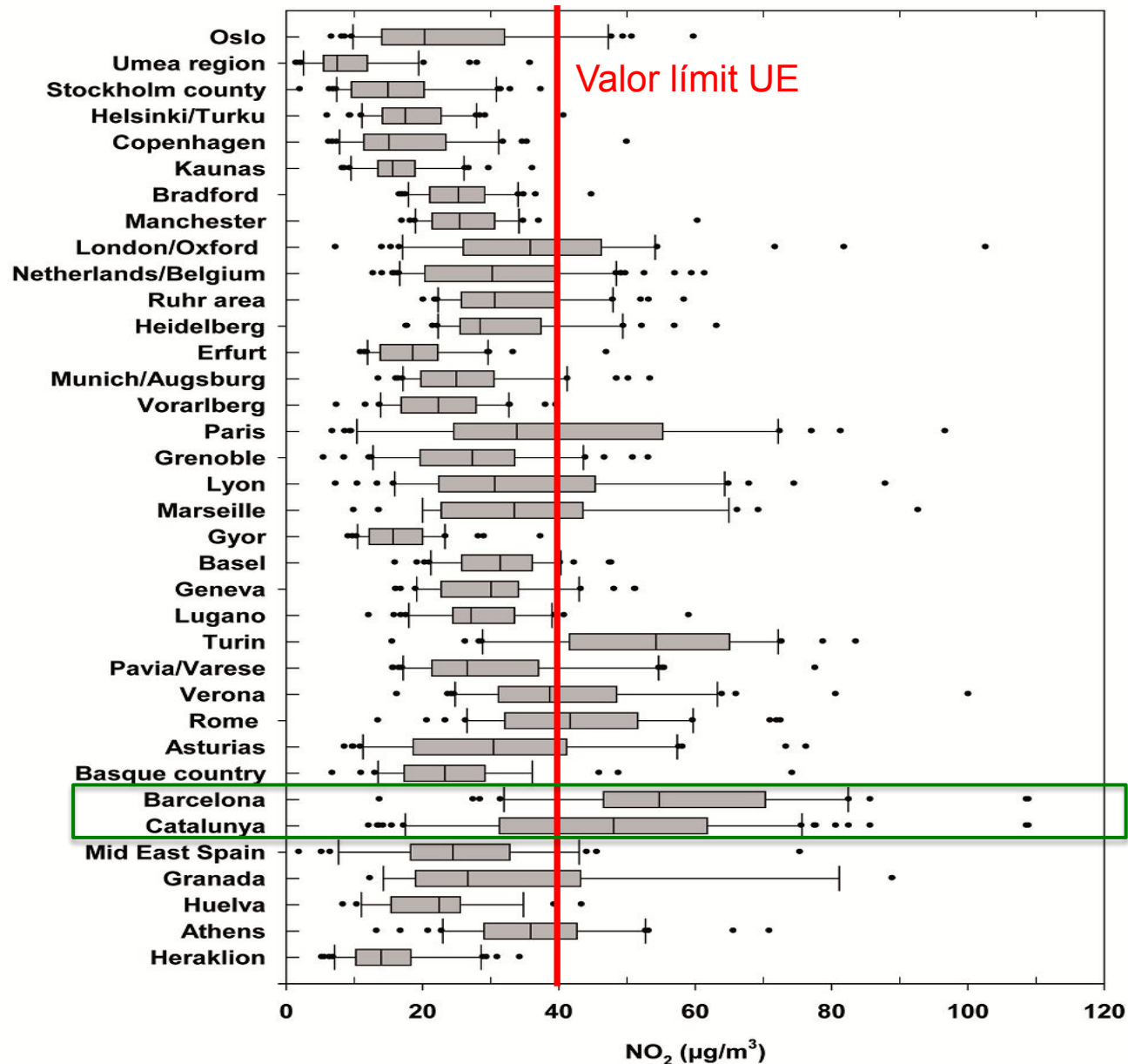


Elements traça

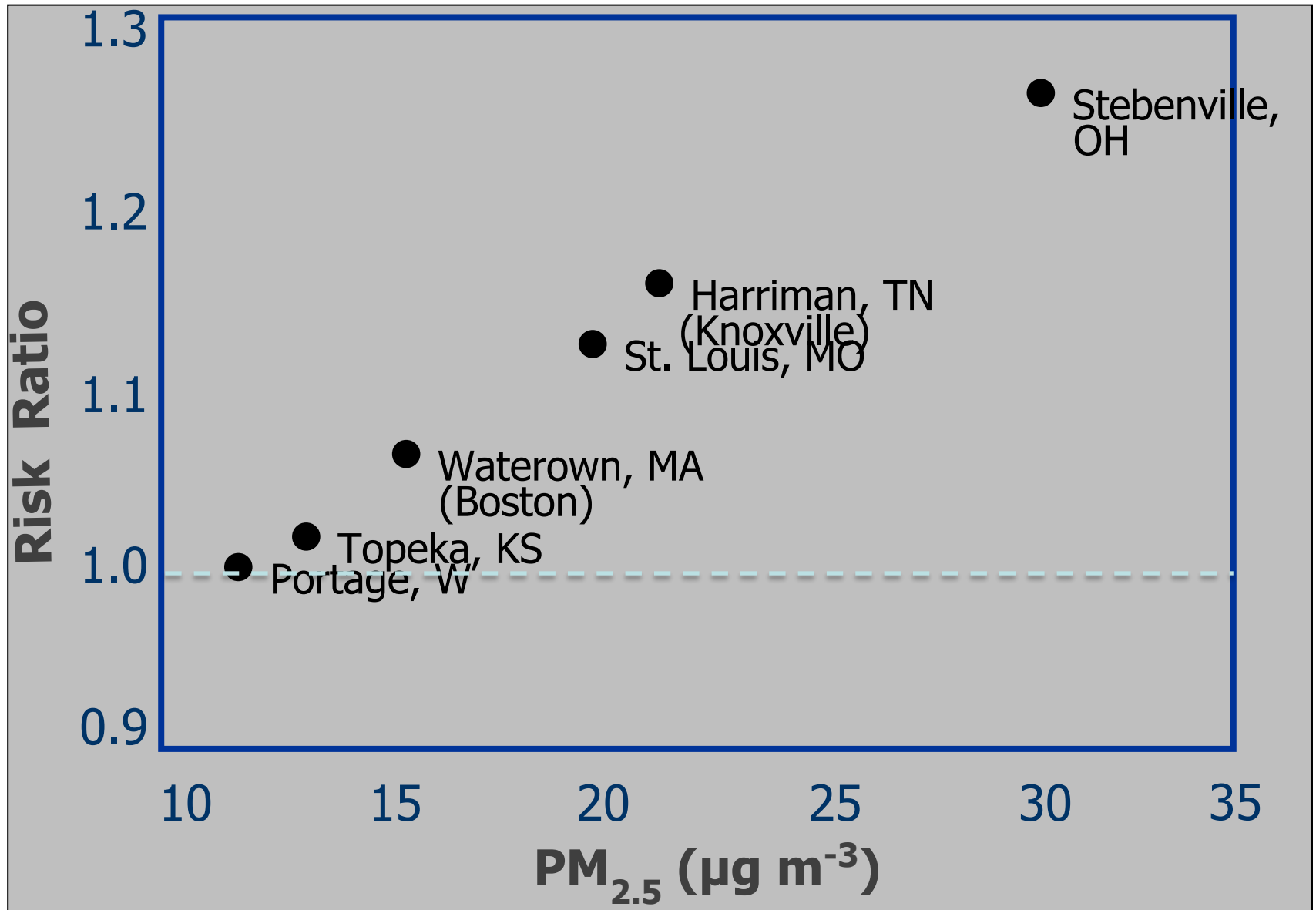
As, Ba, Bi, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Ga, Gd, Ge, Hf, La, Li, Mn, Mo, Nd, Ni, Pb, Pr, Rb, Sb, Sc, Se, Sm, Sn, Sr, Ta, Th, Ti, Tl, U, V, W, Yb, Zn, Zr



Nivells NO₂ a diverses ciutats Europees

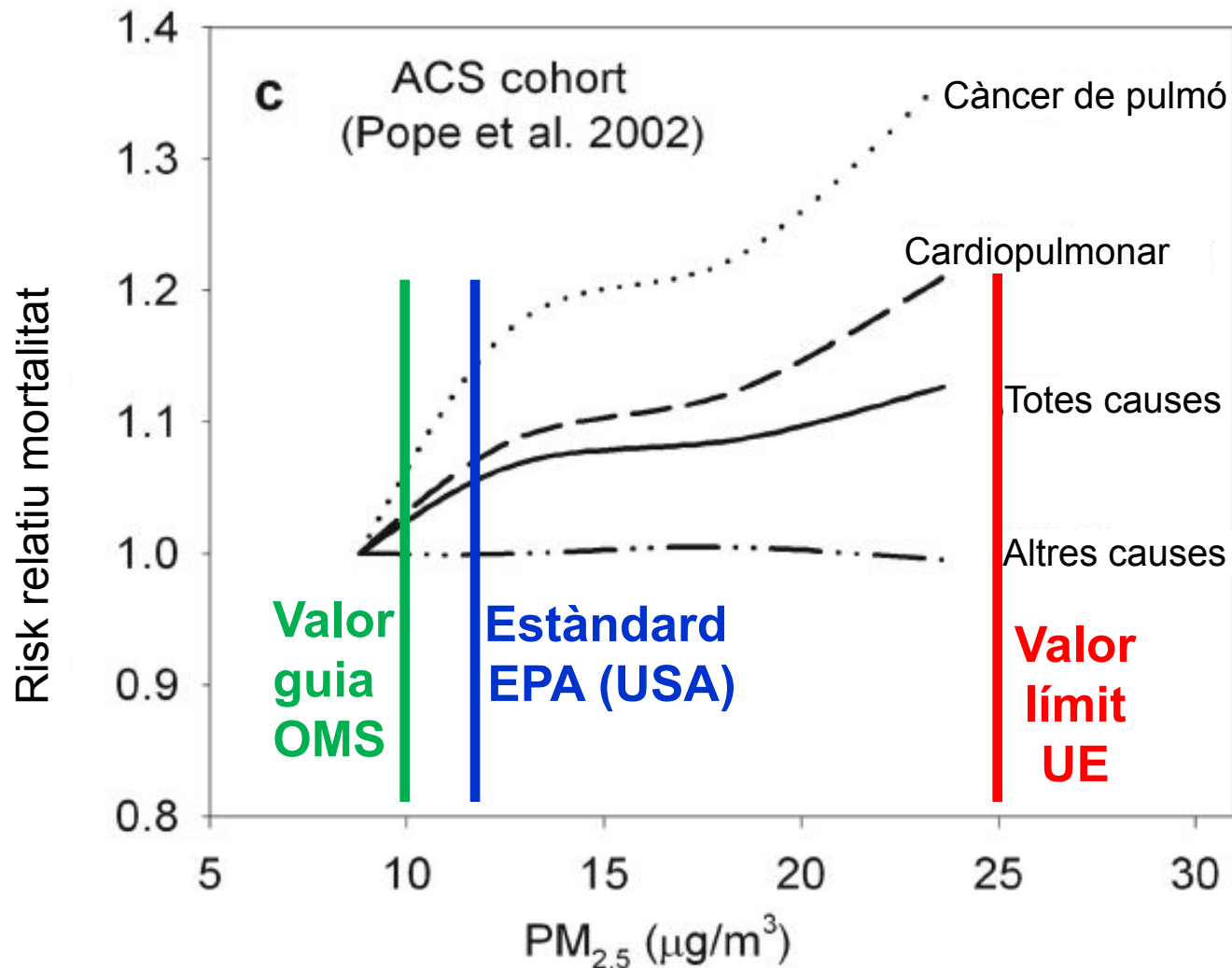


Estudi “The six cities”: Relació $\text{PM}_{2.5}$ i mortalitat



Dockery et al.(1993). An association between air pollution and mortality in six U.S. cities. N. Engl. J. Med. 329, 1753 – 1759.

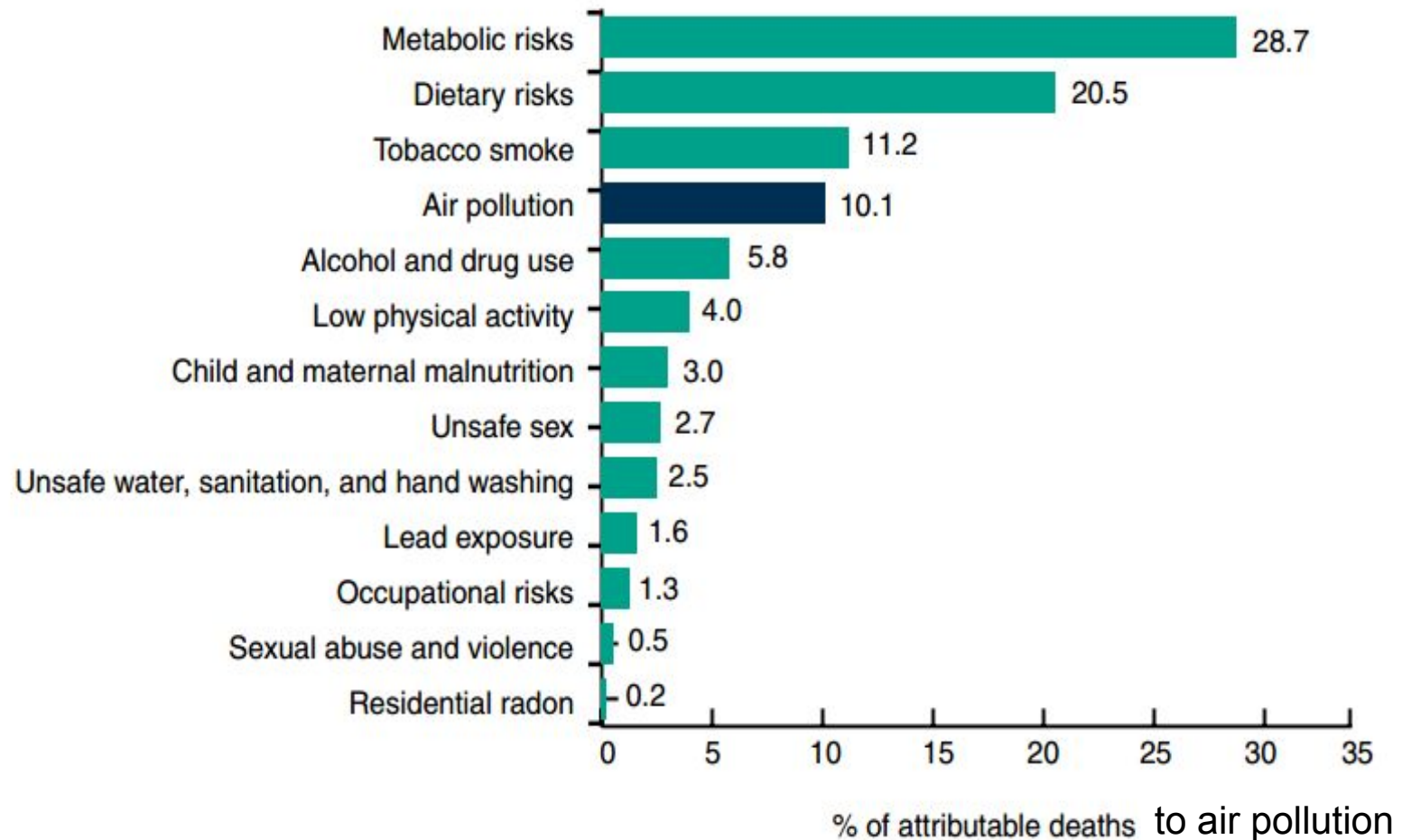
Cohort ACS: Valors guia PM_{2.5}



3.5 milions morts per exposició a PM exterior

WHO 2014

FIGURE 1.1 Percentage of Attributable Deaths by Risk Factor:
Globally, 2013



Sources: World Bank and IHME, using data from IHME, GBD 2013.

9 milions morts per exposició PM total

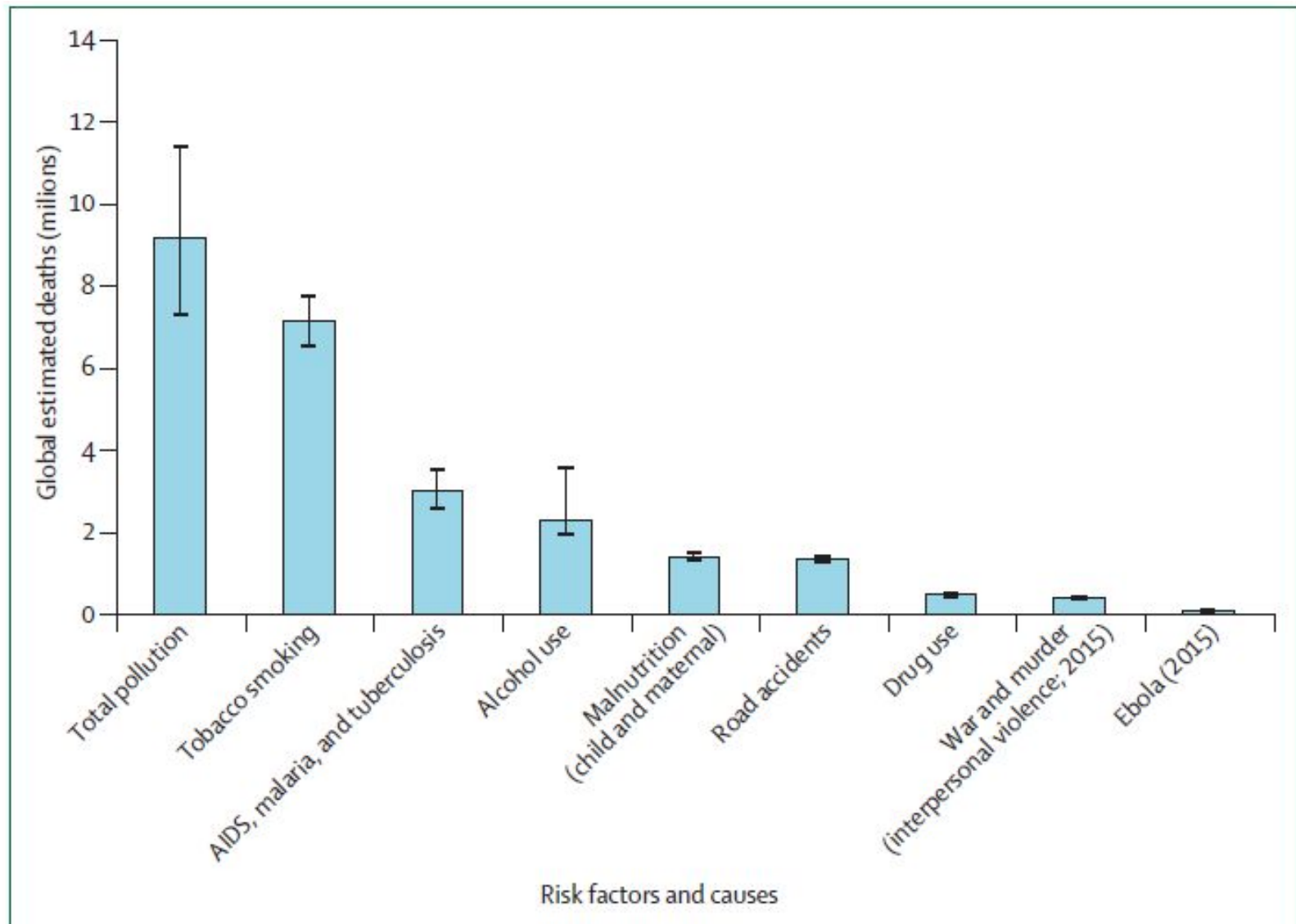
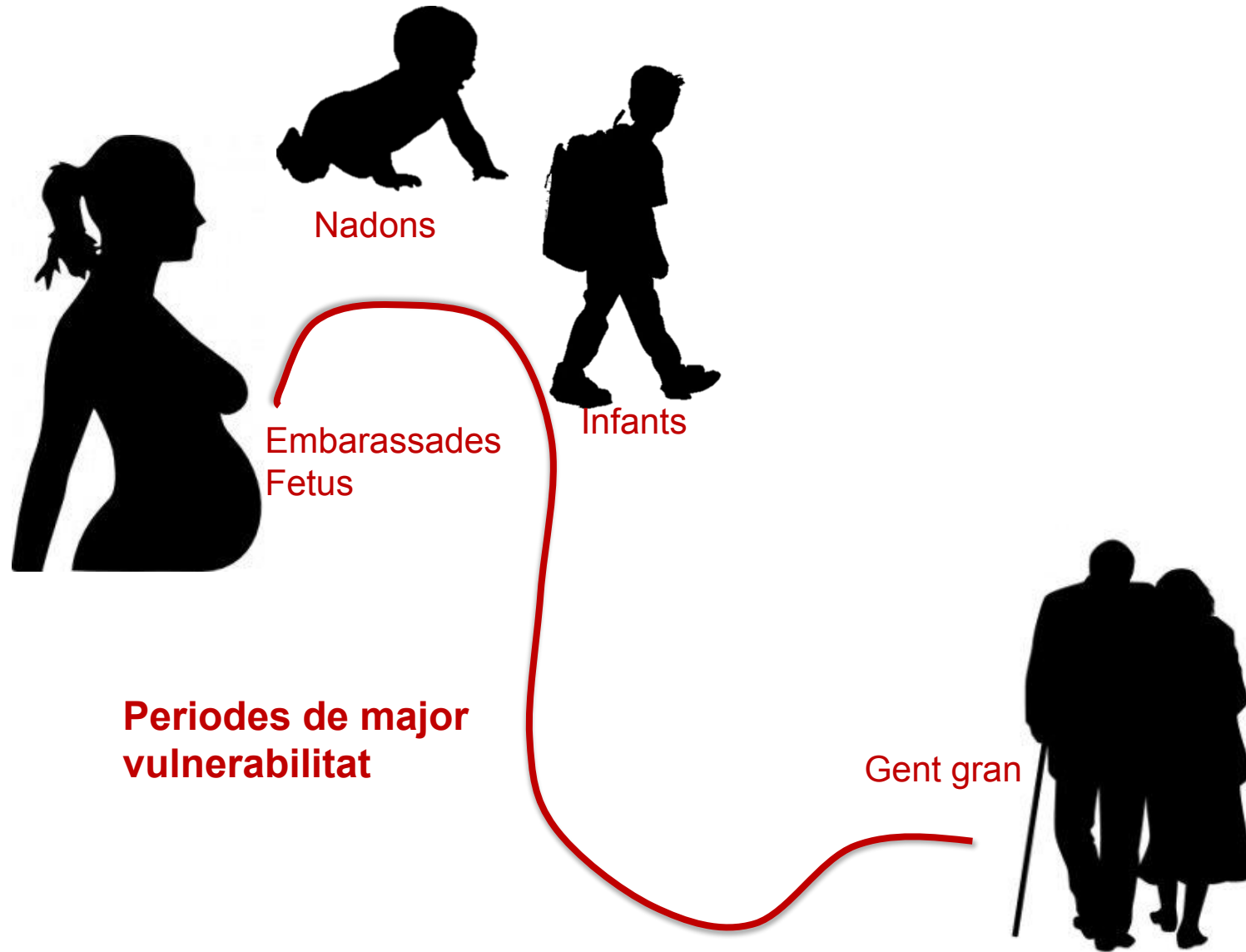


Figure 5: Global estimated deaths by major risk factor and cause, 2015

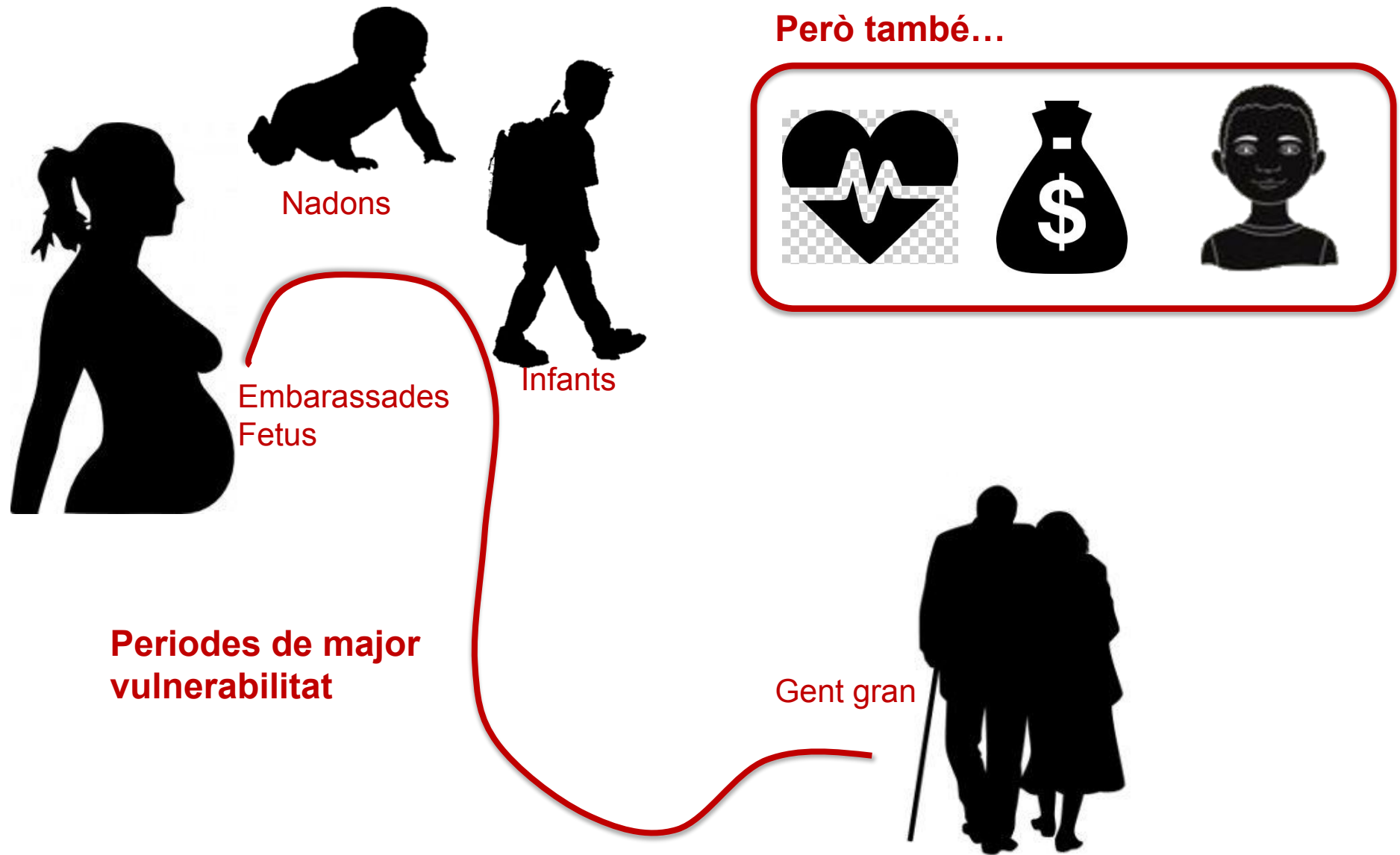
Using data from the GBD Study, 2016.⁴¹

The Lancet Commission on pollution and health. Lancet 2017.

Diferents graus de vulnerabilitat



Diferents graus de vulnerabilitat



Múltiples efectes en la salut

La contaminació afecta múltiples òrgans de forma immediata i té conseqüències a llarg termini

- **Mortalitat per malalties respiratòries**

- **Morbiditat per causes respiratòries**

- **Càncer de pulmó**

- **Pneumònia**

- Síntomes sist. respiratori superior i inferior

- Inflamació vies respiratòries

- Menor funció pulmonar

- Menor creixement del pulmó

- Resistència a la insulina

- **Diabetes Tipus 2**

- **Diabetes Tipus 1**

- Reducció òssia

- **Augment obesitat**

- **Alta pressió arterial**

- Disfunció endotelial

- Augment de la coagulació de la sang

- Inflamació sistèmica

- **Trombosis venoses profundes**

- **Embòlia**

- **Desenvolupament neurològic**

- **Salut mental**

- **Malalties neurodegeneratives**

- **Mortalitat per malalties cardiovasculars**

- **Morbiditat per malalties cardiovasculars**

- **Infart de miocardi**

- **Arítmia**

- **Insuficiència cardíaca congestiva**

- Canvis variabilitat ritme cardíac

- Depressió segment ST

- Envel·liment de la pell

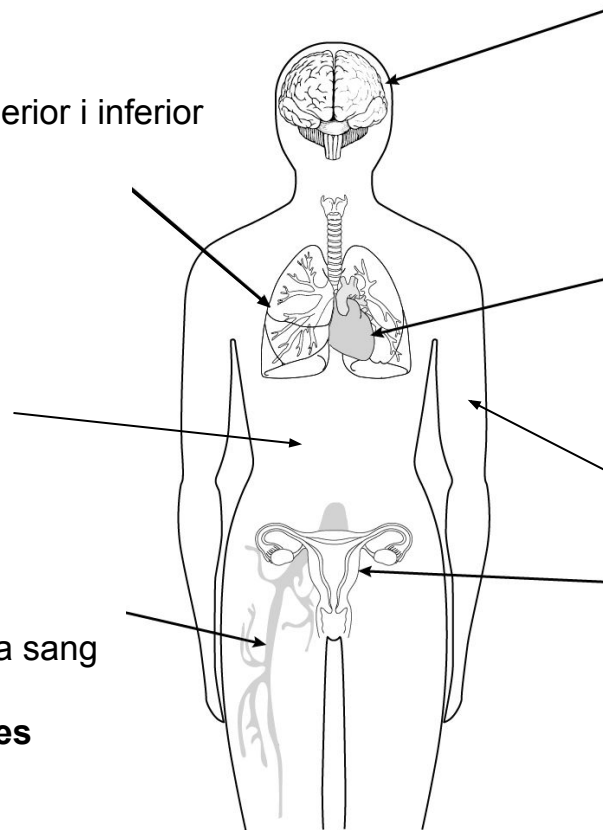
- **Naixement prematur**

- **Menor pes al néixer**

- **Menor creixement fetal**

- Menor qualitat de l'esperma

- Preclampsia

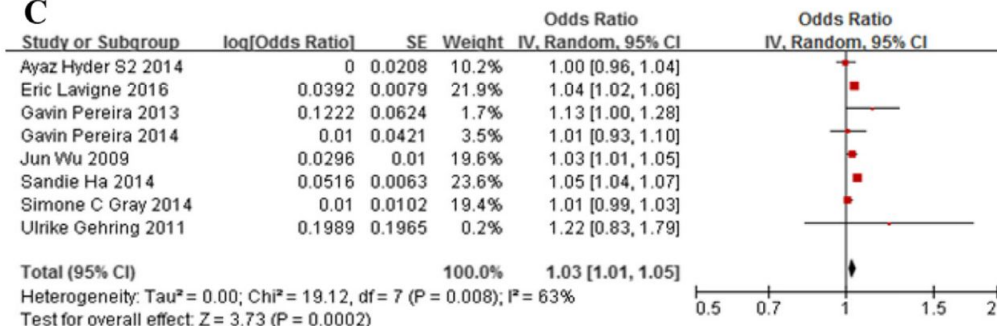


El fetus és susceptible als insults ambientals

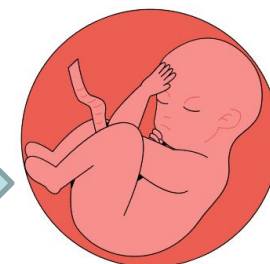
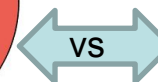
Effectes en el pes i part prematur

PM_{2.5} (increment IQR) and part prematur

C



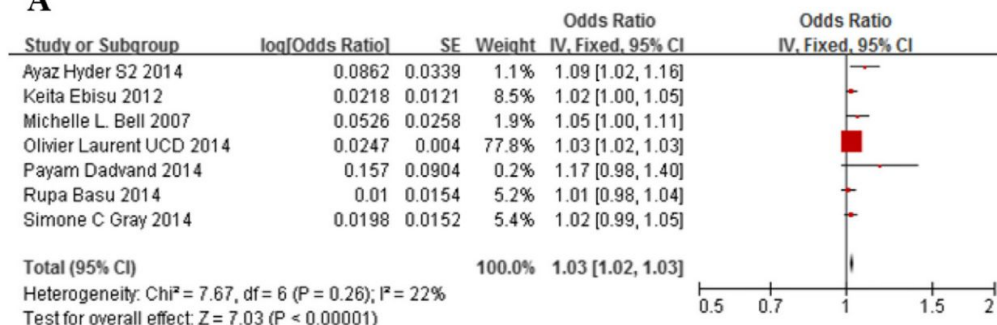
< 37 weeks
of gestation



≥ 37 weeks
of gestation

PM_{2.5} (increment) and baix pes al néixer (a termini)

A



< 2.5
kg

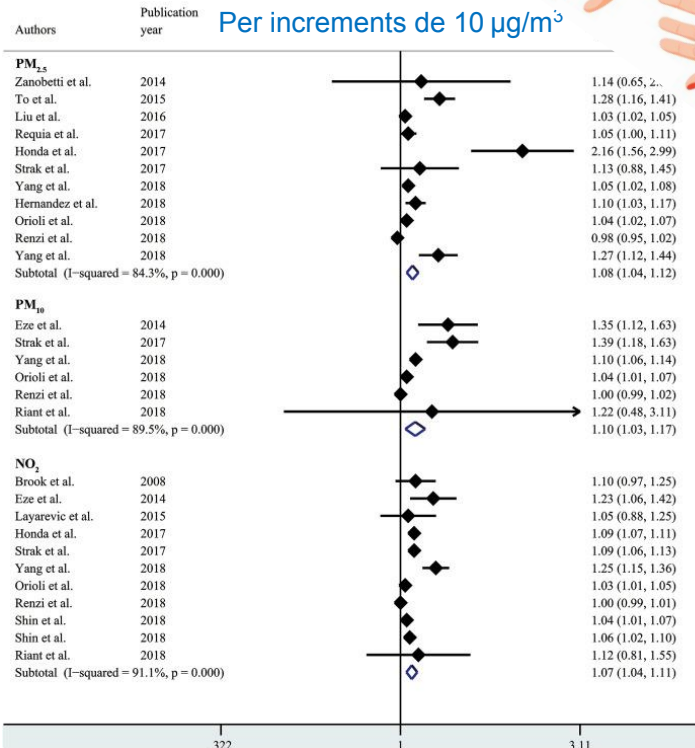


≥ 2.5
kg

Li et al. (2017). Association between ambient fine particulate matter and preterm birth or term low birth weight: An updated systematic review and meta-analysis. Environ. Pollut. 227, 596–605.

Diabetis i obesitat

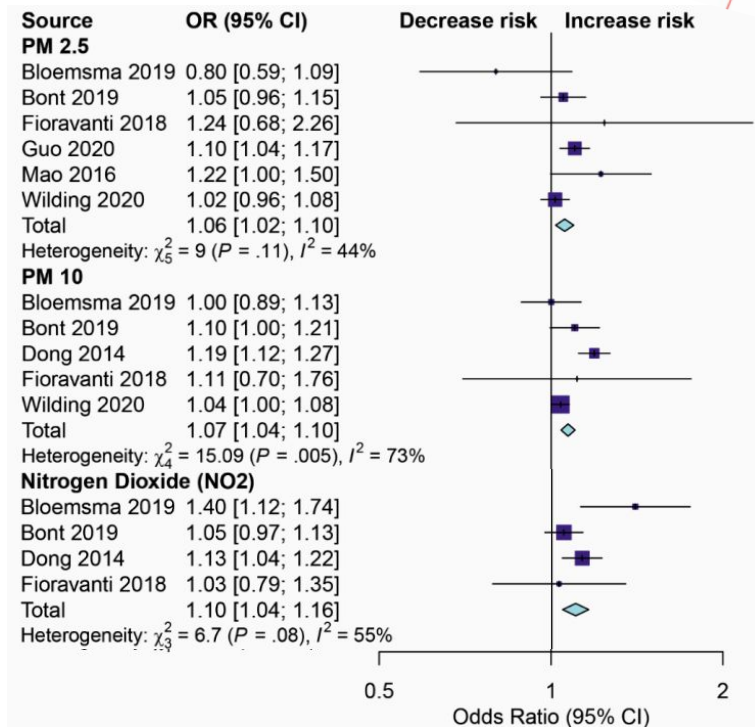
Prevalença Diabetes Tipus 2



Yang et al. (2020). Ambient air pollution and diabetes: A systematic review and meta-analysis. Environmental Research, 180(June 2019), 108817.

Obesitat

En infants



Parasin, N., Amnuaylojaroen, T., & Saokaew, S. (2021). Effect of air pollution on obesity in children: A systematic review and meta-analysis. Children, 8(5), 1–16.

Effectes en el cervell:

Neurodesenvolupament i malalties neurodegeneratives

Alzheimer



Environment International
Volume 157, December 2021, 106864



Associations between air pollution and biomarkers of Alzheimer's disease in cognitively unimpaired individuals

Silvia Alemany ^{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, aa, ab, ac, ad, ae, af, ag, ah, ai, aj, ak, al, am, an, ao, ap, aq, ar, as, at, au, av, aw, ax, ay, az, ba, bb, bc, bd, be, bf, bg, bh, bi, bj, bk, bl, bm, bn, bo, bp, bq, br, bs, bt, bu, bv, bw, bx, by, bz, ca, cb, cc, cd, ce, cf, cg, ch, ci, cj, ck, cl, cm, cn, co, cp, cq, cr, cs, ct, cu, cv, cw, cx, cy, cz, da, db, dc, dd, de, df, dg, dh, di, dj, dk, dl, dm, dn, do, dp, dq, dr, ds, dt, du, dv, dw, dx, dy, dz, ea, eb, ec, ed, ee, ef, eg, eh, ei, ej, ek, el, em, en, eo, ep, eq, er, es, et, eu, ev, ew, ex, ey, ez, fa, fb, fc, fd, fe, ff, fg, fh, fi, fj, fk, fl, fm, fn, fo, fp, fq, fr, fs, ft, fu, fv, fw, fx, fy, fz, ga, gb, gc, gd, ge, gf, gg, gh, gi, gj, gk, gl, gm, gn, go, gp, gq, gr, gs, gt, gu, gv, gw, gx, gy, gz, ha, hb, hc, hd, he, hf, hg, hh, hi, hj, hk, hl, hm, hn, ho, hp, hq, hr, hs, ht, hu, hv, hw, hx, hy, hz, ia, ib, ic, id, ie, if, ig, ih, ii, ij, ik, il, im, in, io, ip, iq, ir, is, it, iu, iv, iw, ix, iy, iz, ja, jb, jc, jd, je, jf, jg, jh, ji, jj, jk, jl, jm, jn, jo, jp, jq, jr, js, jt, ju, jv, jw, jx, jy, jz, ka, kb, kc, kd, ke, kf, kg, kh, ki, kj, kk, kl, km, kn, ko, kp, kq, kr, ks, kt, ku, kv, kw, kx, ky, kz, la, lb, lc, ld, le, lf, lg, lh, li, lj, lk, ll, lm, ln, lo, lp, lq, lr, ls, lt, lu, lv, lw, lx, ly, lz, ma, mb, mc, md, me, mf, mg, mh, mi, mj, mk, ml, mm, mn, mo, mp, mq, mr, ms, mt, mu, mv, mw, mx, my, mz, na, nb, nc, nd, ne, nf, ng, nh, ni, nj, nk, nl, nm, nn, no, np, nq, nr, ns, nt, nu, nv, nw, nx, ny, nz, oa, ob, oc, od, oe, of, og, oh, oi, oj, ok, ol, om, on, oo, op, oq, or, os, ot, ou, ov, ow, ox, oy, oz, pa, pb, pc, pd, pe, pf, pg, ph, pi, pj, pk, pl, pm, pn, po, pp, pq, pr, ps, pt, pu, pv, pw, px, py, pz, qa, qb, qc, qd, qe, qf, qg, qh, qi, qj, qk, ql, qm, qn, qo, qp, qq, qr, qs, qt, qu, qv, qw, qx, qy, qz, ra, rb, rc, rd, re, rf, rg, rh, ri, rj, rk, rl, rm, rn, ro, rp, rq, rr, rs, rt, ru, rv, rw, rx, ry, rz, sa, sb, sc, sd, se, sf, sg, sh, si, sj, sk, sl, sm, sn, so, sp, sq, sr, ss, st, su, sv, sw, sx, sy, sz, ta, tb, tc, td, te, tf, tg, th, ti, tj, tk, tl, tm, tn, to, tp, tq, tr, ts, tt, tu, tv, tw, tx, ty, tz, ua, ub, uc, ud, ue, uf, ug, uh, ui, uj, uk, ul, um, un, uo, up, uq, ur, us, ut, uu, uv, uw, ux, uy, uz, va, vb, vc, vd, ve, vf, vg, vh, vi, vj, vk, vl, vm, vn, vo, vp, vq, vr, vs, vt, vu, vv, vw, vx, vy, vz, wa, wb, wc, wd, we, wf, wg, wh, wi, wj, wk, wl, wm, wn, wo, wp, wq, wr, ws, wt, wu, wv, ww, wx, wy, wz, xa, xb, xc, xd, xe, xf, xg, xh, xi, xj, xk, xl, xm, xn, xo, xp, xq, xr, xs, xt, xu, xv, xw, xx, xy, xz, ya, yb, yc, yd, ye, yf, yg, yh, yi, yj, yk, yl, ym, yn, yo, yp, yq, yr, ys, yt, yu, yv, yw, yx, yy, yz, za, zb, zc, zd, ze, zf, zg, zh, zi, zj, zk, zl, zm, zn, zo, zp, zq, zr, zs, zt, zu, zv, zw, zx, zy, zz}

Parkinson



International Journal of Hygiene and Environmental Health
Volume 222, Issue 3, April 2019, Pages 402-409



Air pollution and Parkinson's disease: A systematic review and meta-analysis up to 2018

Maria-Iosifina Kasdagli ^a, Klea Katsouyanni ^{a, b}, Konstantina Dimakopoulou ^a, Evangelia Samoli ^{a, c, d}

Salut mental

(depressió, ansietat, suïcidi)

Problemes de comportament

(síntomes emocional, problemes de conducta, hiperactivitat/inatenció, problemes per relacionar-se)



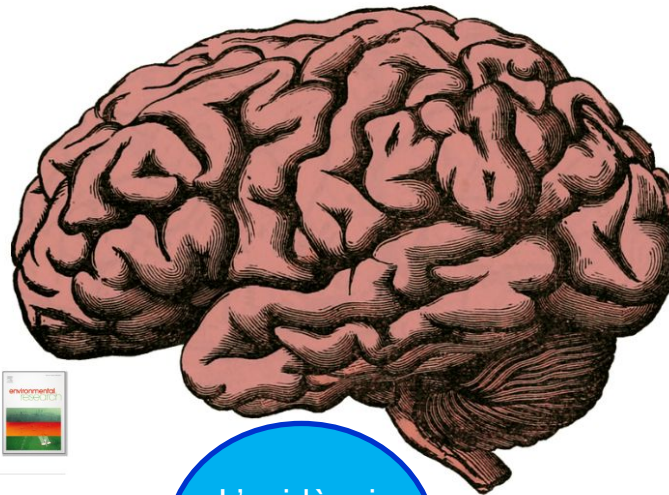
Environment International
Volume 118, September 2018, Pages 154-168



Review article

Is there a link between air pollution and mental disorders?

Massimiliano Buoli ^{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, aa, ab, ac, ad, ae, af, ag, ah, ai, aj, ak, al, am, an, ao, ap, aq, ar, as, at, au, av, aw, ax, ay, az, ba, bb, bc, bd, be, bf, bg, bh, bi, bj, bk, bl, bm, bn, bo, bp, bq, br, bs, bt, bu, bv, bw, bx, by, bz, ca, cb, cc, cd, ce, cf, cg, ch, ci, cj, ck, cl, cm, cn, co, cp, cq, cr, cs, ct, cu, cv, cw, cx, cy, cz, da, db, dc, dd, de, df, dg, dh, di, dj, dk, dl, dm, dn, do, dp, dq, dr, ds, dt, du, dv, dw, dx, dy, dz, ea, eb, ec, ed, ee, ef, eg, eh, ei, ej, ek, el, em, en, eo, ep, eq, er, es, et, eu, ev, ew, ex, ey, ez, fa, fb, fc, fd, fe, ff, fg, fh, fi, fj, fk, fl, fm, fn, fo, fp, fq, fr, fs, ft, fu, fv, fw, fx, fy, fz, ga, gb, gc, gd, ge, gf, gg, gh, gi, gj, gk, gl, gm, gn, go, gp, gq, gr, gs, gt, gu, gv, gw, gx, gy, gz, ha, hb, hc, hd, he, hf, hg, hh, hi, hj, hk, hl, hm, hn, ho, hp, hq, hr, hs, ht, hu, hv, hw, hx, hy, hz, ia, ib, ic, id, ie, if, ig, ih, ii, ij, ik, il, im, in, io, ip, iq, ir, is, it, iu, iv, iw, ix, iy, iz, ja, jb, jc, jd, je, jf, jg, jh, ji, jj, jk, jl, jm, jn, jo, jp, jq, jr, js, jt, ju, jv, jw, jx, jy, jz, ka, kb, kc, kd, ke, kf, kg, kh, ki, kj, kk, kl, km, kn, ko, kp, kq, kr, ks, kt, ku, kv, kw, kx, ky, kz, la, lb, lc, ld, le, lf, lg, lh, li, lj, lk, ll, lm, ln, lo, lp, lq, lr, ls, lt, lu, lv, lw, lx, ly, lz, ma, mb, mc, md, me, mf, mg, mh, mi, mj, mk, ml, mm, mn, mo, mp, mq, mr, ms, mt, mu, mv, mw, mx, my, mz, na, nb, nc, nd, ne, nf, ng, nh, ni, nj, nk, nl, nm, nn, no, np, nq, nr, ns, nt, nu, nv, nw, nx, ny, nz, oa, ob, oc, od, oe, of, og, oh, oi, oj, ok, ol, om, on, oo, op, oq, or, os, ot, ou, ov, ow, ox, oy, oz, pa, pb, pc, pd, pe, pf, pg, ph, pi, pj, pk, pl, pm, pn, po, pp, pq, pr, ps, pt, pu, pv, pw, px, py, pz, qa, qb, qc, qd, qe, qf, qg, qh, qi, qj, qk, ql, qm, qn, qo, qp, qq, qr, qs, qt, qu, qv, qw, qx, qy, qz, ra, rb, rc, rd, re, rf, rg, rh, ri, rj, rk, rl, rm, rn, ro, rp, rq, rr, rs, rt, ru, rv, rw, rx, ry, rz, sa, sb, sc, sd, se, sf, sg, sh, si, sj, sk, sl, sm, sn, so, sp, sq, sr, ss, st, su, sv, sw, sx, sy, sz, ta, tb, tc, td, te, tf, tg, th, ti, tj, tk, tl, tm, tn, to, tp, tq, tr, ts, tt, tu, tv, tw, tx, ty, tz, ua, ub, uc, ud, ue, uf, ug, uh, ui, uj, uk, ul, um, un, uo, up, uq, ur, us, ut, uu, uv, uw, ux, uy, uz, va, vb, vc, vd, ve, vf, vg, vh, vi, vj, vk, vl, vm, vn, vo, vp, vq, vr, vs, vt, vu, vv, vw, vx, vy, vz, wa, wb, wc, wd, we, wf, wg, wh, wi, wj, wk, wl, wm, wn, wo, wp, wq, wr, ws, wt, wu, wv, ww, wx, wy, wz, xa, xb, xc, xd, xe, xf, xg, xh, xi, xj, xk, xl, xm, xn, xo, xp, xq, xr, xs, xt, xu, xv, xw, xx, xy, xz, ya, yb, yc, yd, ye, yf, yg, yh, yi, yj, yk, yl, ym, yn, yo, yp, yq, yr, ys, yt, yu, yv, yw, yx, yy, yz, za, zb, zc, zd, ze, zf, zg, zh, zi, zj, zk, zl, zm, zn, zo, zp, zq, zr, zs, zt, zu, zv, zw, zx, zy, zz}



L'evidència
encara és
limitada

Cognició

BREATHE Brain Air School Investigation



Environmental Research
Volume 147, May 2016, Pages 383-398



Review article

Exposure to air pollution and cognitive functioning across the life course – A systematic literature review

Angela Clifford ^a, Linda Lang ^{a, b}, Ruoling Chen ^{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, aa, ab, ac, ad, ae, af, ag, ah, ai, aj, ak, al, am, an, ao, ap, aq, ar, as, at, au, av, aw, ax, ay, az, ba, bb, bc, bd, be, bf, bg, bh, bi, bj, bk, bl, bm, bn, bo, bp, bq, br, bs, bt, bu, bv, bw, bx, by, bz, ca, cb, cc, cd, ce, cf, cg, ch, ci, cj, ck, cl, cm, cn, co, cp, cq, cr, cs, ct, cu, cv, cw, cx, cy, cz, da, db, dc, dd, de, df, dg, dh, di, dj, dk, dl, dm, dn, do, dp, dq, dr, ds, dt, du, dv, dw, dx, dy, dz, ea, eb, ec, ed, ee, ef, eg, eh, ei, ej, ek, el, em, en, eo, ep, eq, er, es, et, eu, ev, ew, ex, ey, ez, fa, fb, fc, fd, fe, ff, fg, fh, fi, fj, fk, fl, fm, fn, fo, fp, fq, fr, fs, ft, fu, fv, fw, fx, fy, fz, ga, gb, gc, gd, ge, gf, gg, gh, gi, gj, gk, gl, gm, gn, go, gp, gq, gr, gs, gt, gu, gv, gw, gx, gy, gz, ha, hb, hc, hd, he, hf, hg, hh, hi, hj, hk, hl, hm, hn, ho, hp, hq, hr, hs, ht, hu, hv, hw, hx, hy, hz, ia, ib, ic, id, ie, if, ig, ih, ii, ij, ik, il, im, in, io, ip, iq, ir, is, it, iu, iv, iw, ix, iy, iz, ja, jb, jc, jd, je, jf, jg, jh, ji, jj, jk, jl, jm, jn, jo, jp, jq, jr, js, jt, ju, jv, jw, jx, jy, jz, ka, kb, kc, kd, ke, kf, kg, kh, ki, kj, kk, kl, km, kn, ko, kp, kq, kr, ks, kt, ku, kv, kw, kx, ky, kz, la, lb, lc, ld, le, lf, lg, lh, li, lj, lk, ll, lm, ln, lo, lp, lq, lr, ls, lt, lu, lv, lw, lx, ly, lz, ma, mb, mc, md, me, mf, mg, mh, mi, mj, mk, ml, mm, mn, mo, mp, mq, mr, ms, mt, mu, mv, mw, mx, my, mz, na, nb, nc, nd, ne, nf, ng, nh, ni, nj, nk, nl, nm, nn, no, np, nq, nr, ns, nt, nu, nv, nw, nx, ny, nz, oa, ob, oc, od, oe, of, og, oh, oi, oj, ok, ol, om, on, oo, op, oq, or, os, ot, ou, ov, ow, ox, oy, oz, pa, pb, pc, pd, pe, pf, pg, ph, pi, pj, pk, pl, pm, pn, po, pp, pq, pr, ps, pt, pu, pv, pw, px, py, pz, qa, qb, qc, qd, qe, qf, qg, qh, qi, qj, qk, ql, qm, qn, qo, qp, qq, qr, qs, qt, qu, qv, qw, qx, qy, qz, ra, rb, rc, rd, re, rf, rg, rh, ri, rj, rk, rl, rm, rn, ro, rp, rq, rr, rs, rt, ru, rv, rw, rx, ry, rz, sa, sb, sc, sd, se, sf, sg, sh, si, sj, sk, sl, sm, sn, so, sp, sq, sr, ss, st, su, sv, sw, sx, sy, sz, ta, tb, tc, td, te, tf, tg, th, ti, tj, tk, tl, tm, tn, to, tp, tq, tr, ts, tt, tu, tv, tw, tx, ty, tz, ua, ub, uc, ud, ue, uf, ug, uh, ui, uj, uk, ul, um, un, uo, up, uq, ur, us, ut, uu, uv, uw, ux, uy, uz, va, vb, vc, vd, ve, vf, vg, vh, vi, vj, vk, vl, vm, vn, vo, vp, vq, vr, vs, vt, vu, vv, vw, vx, vy, vz, wa, wb, wc, wd, we, wf, wg, wh, wi, wj, wk, wl, wm, wn, wo, wp, wq, wr, ws, wt, wu, wv, ww, wx, wy, wz, xa, xb, xc, xd, xe, xf, xg, xh, xi, xj, xk, xl, xm, xn, xo, xp, xq, xr, xs, xt, xu, xv, xw, xx, xy, xz, ya, yb, yc, yd, ye, yf, yg, yh, yi, yj, yk, yl, ym, yn, yo, yp, yq, yr, ys, yt, yu, yv, yw, yx, yy, yz, za, zb, zc, zd, ze, zf, zg, zh, zi, zj, zk, zl, zm, zn, zo, zp, zq, zr, zs, zt, zu, zv, zw, zx, zy, zz}

Canvis en les estructures/funcions cerebrals

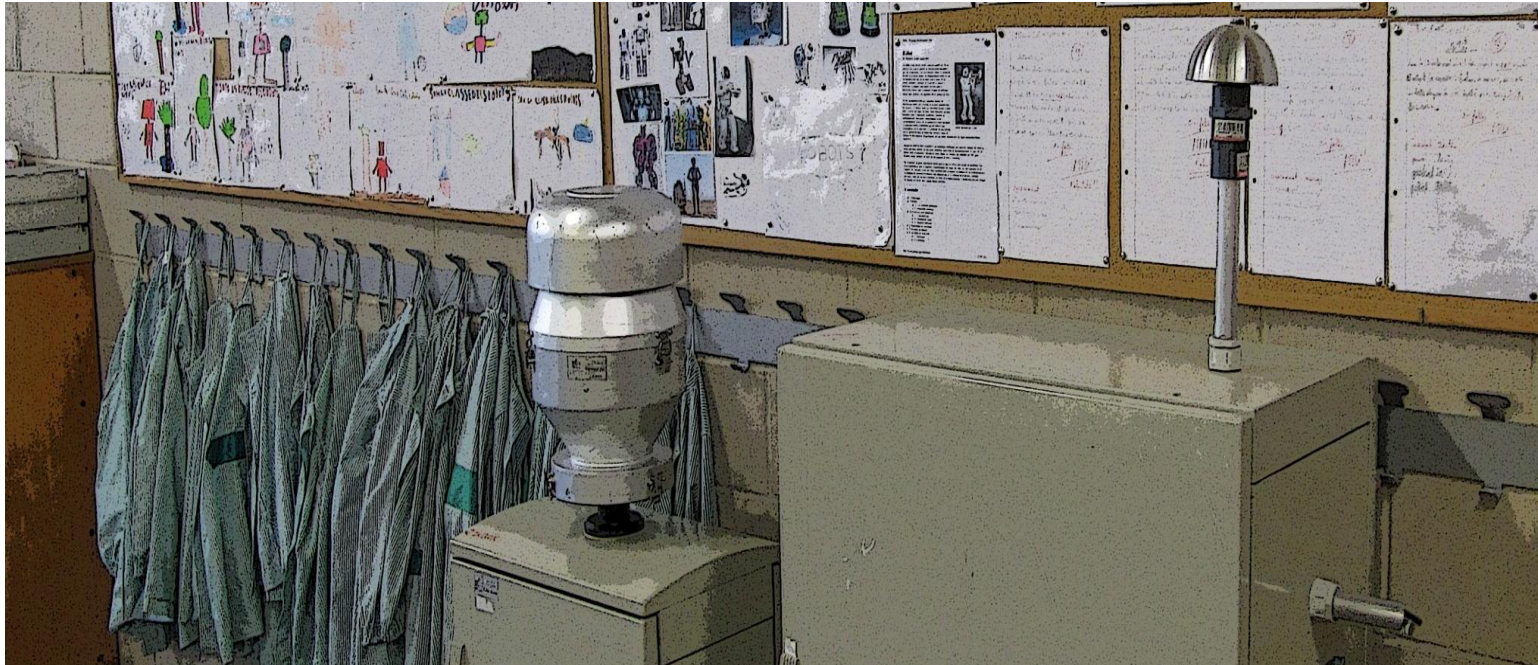
The Effects of Air Pollution on the Brain: a Review of Studies Interfacing Environmental Epidemiology and Neuroimaging

Paula de Prado Bert ^a, Elisabet Mae Henderson Mercader ^a, Jesus Pujol ^a, Jordi Sunyer ^a & Marion Mortamais ^{a, b}

Current Environmental Health Reports 5, 351–364 (2018) | [Cite this article](#)

El projecte **BREATHE**

Contaminació atmosfèrica a les escoles i neurodesenvolupament



centre de recerca
en epidemiologia
ambiental



idæ^a

BREATHE Brain Air
School
investigation

El projecte **BREATHE**: Disseny

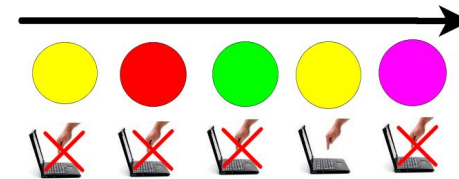
Mesura **contaminació** a les escoles:

- 39 escoles, emparellades alta amb baixa contaminació
- Mesura simultània pati i a la classe
- 2 escoles alhora per setmana



Mesura **neurodesenvolupament** alumnes:

- 2897 participants (7- 9 anys)
- 1 test per alumne cada 3 mesos (4 tests total)
- 10112 tests cognitius per ordinador



Ara RECORDA,
has de deixar dos entre mig



El projecte **BREATHE**: nivells BC a les escoles

Les escoles més contaminades es troben al centre de la ciutat,
més a prop del trànsit

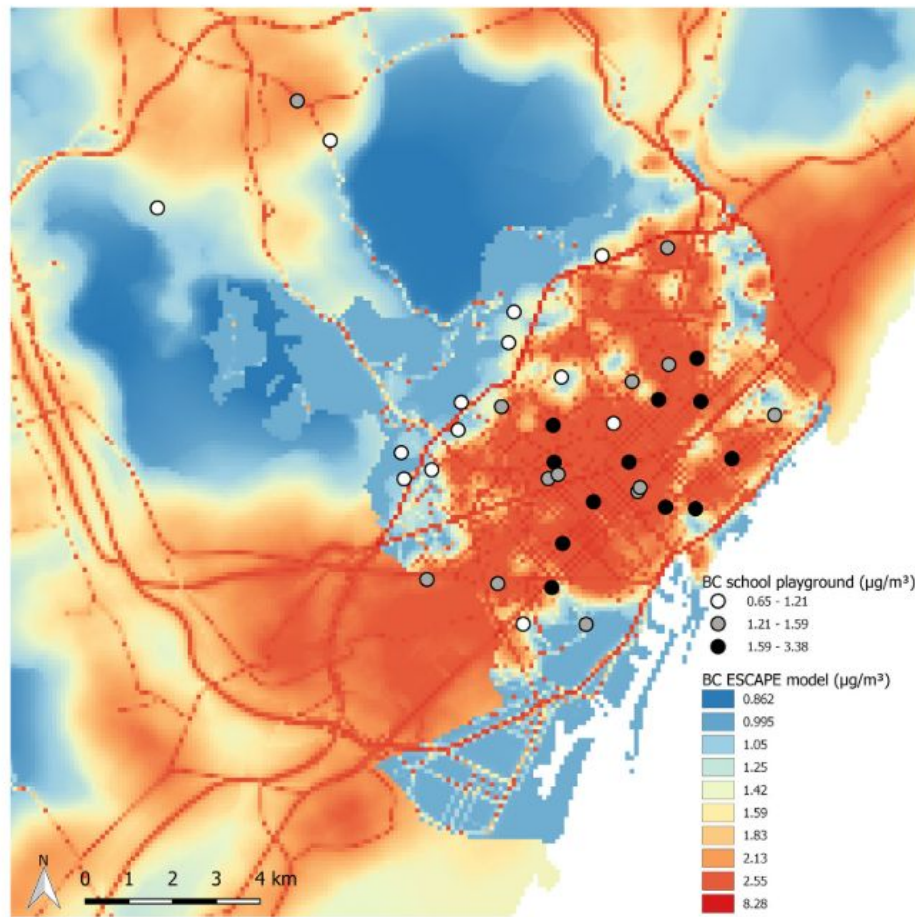
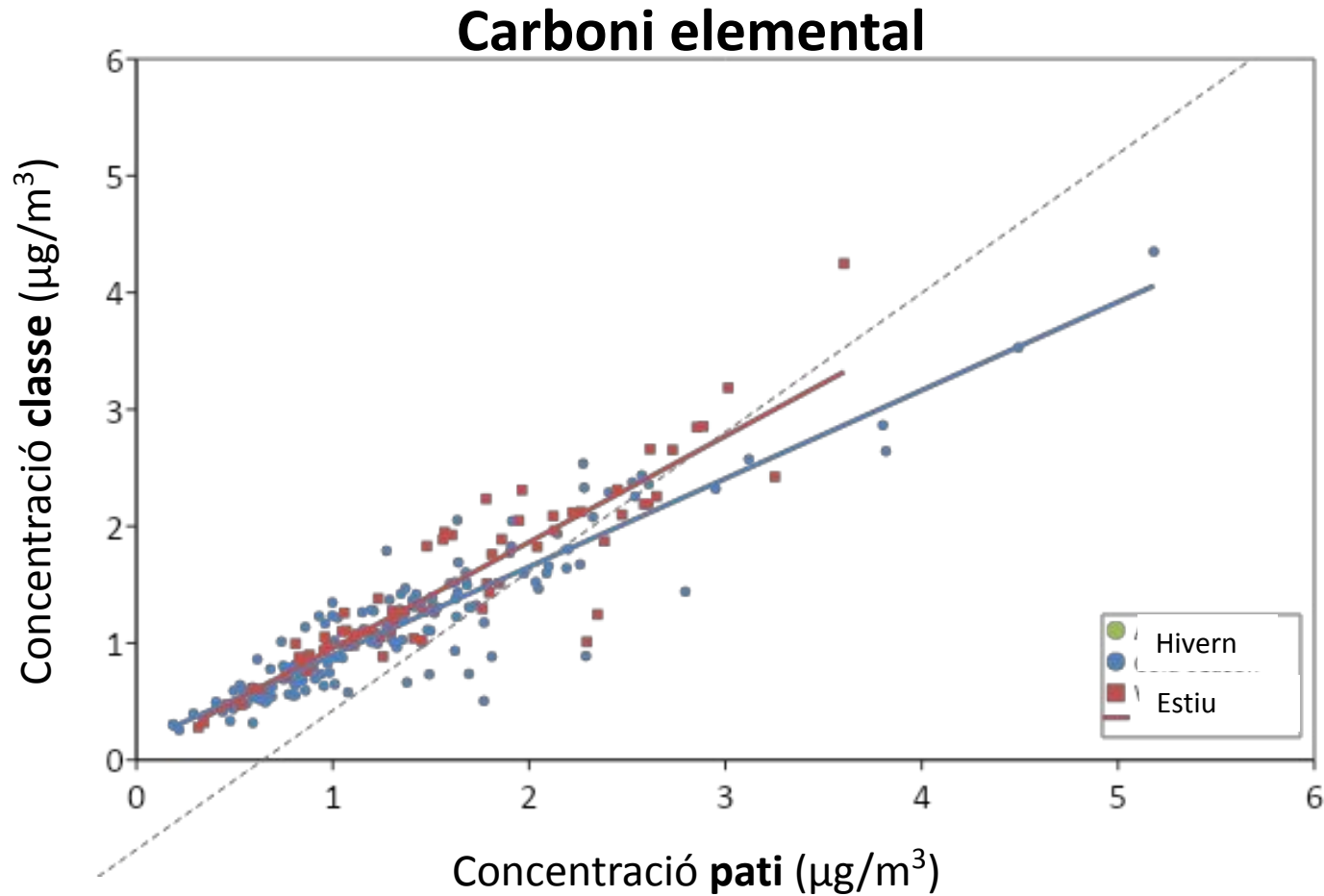
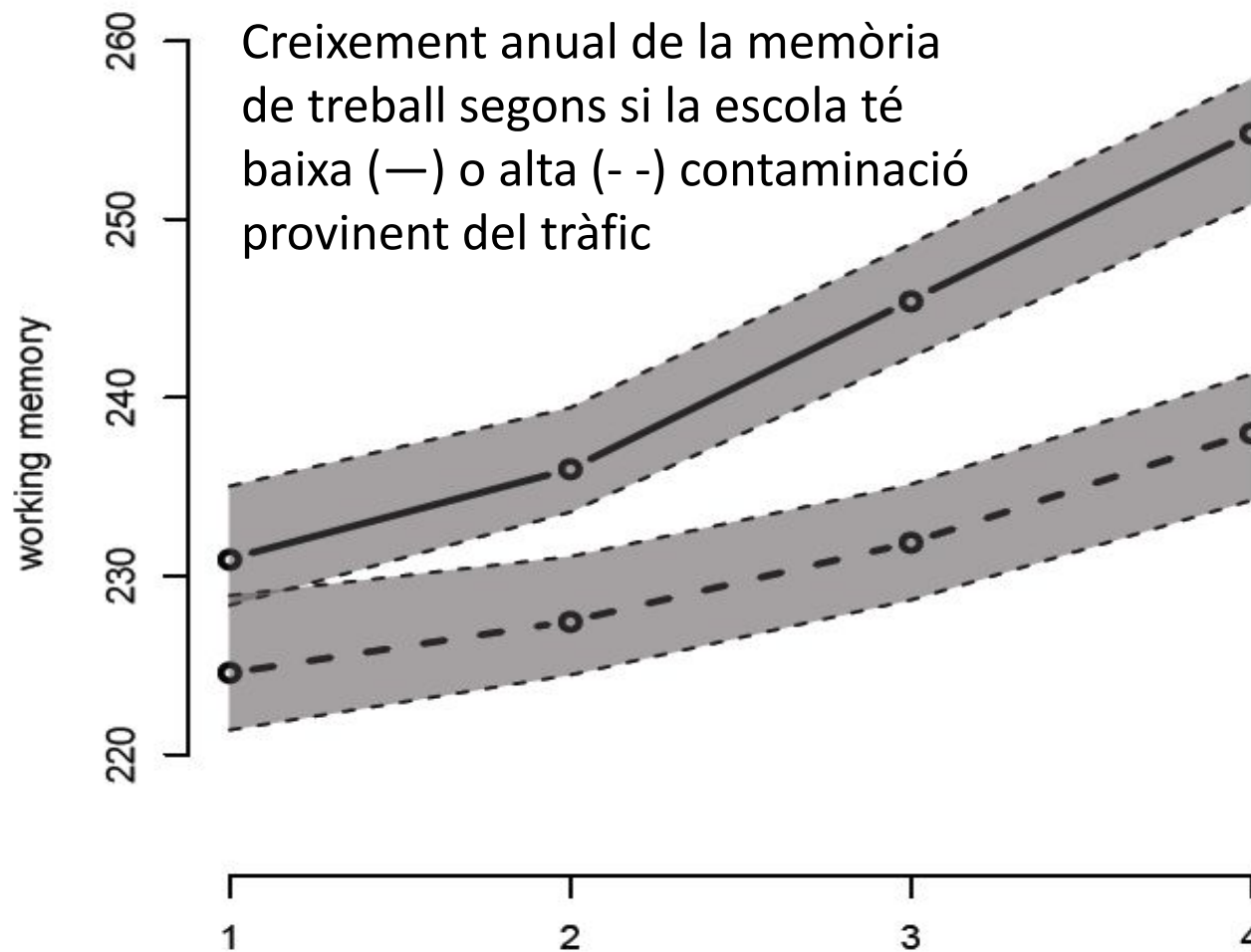


Fig. 1. Map of Barcelona and the schools by tertiles of annual Black Carbon (BC) concentration average. The background of the map is coloured according to modelled BC for Barcelona within the ESCAPE Project (Eeftens et al., 2012).

Alta infiltració contaminants del pati a la classe



Disminució del creixement de la memòria de treball en alumnes que van a **escoles més contaminades**



Model ajustat per sexe, educació de la mare, estatus socioeconòmic del veïnat de residència i escola parella. Escola i subjecte com a efectes aleatoris (nested).



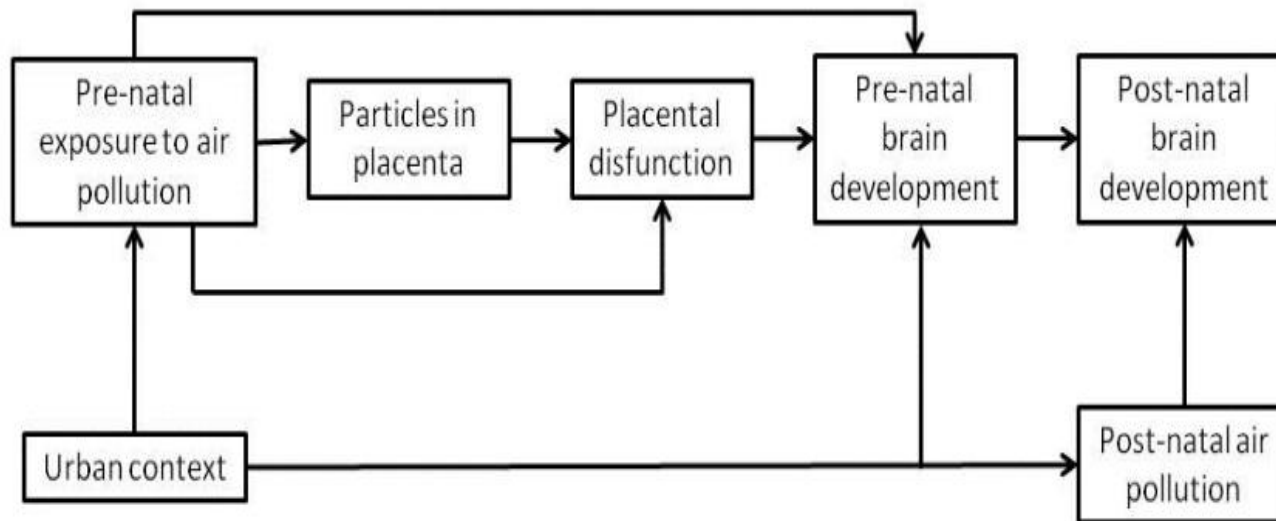
I ARA?

**BiSC és un estudi prospectiu
que crearà una cohort des
de la vida fetal fins la vida
adulta primerenca en una
població urbana.**

**L'estudi identificarà les
causes mediambientals
(i genètiques) del
creixement,
desenvolupament i salut.**

L'Estudi BiSC

Barcelona
Life
Study
Cohort



+ Salut mental
materna



"This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 886121".

L'Estudi BiSC

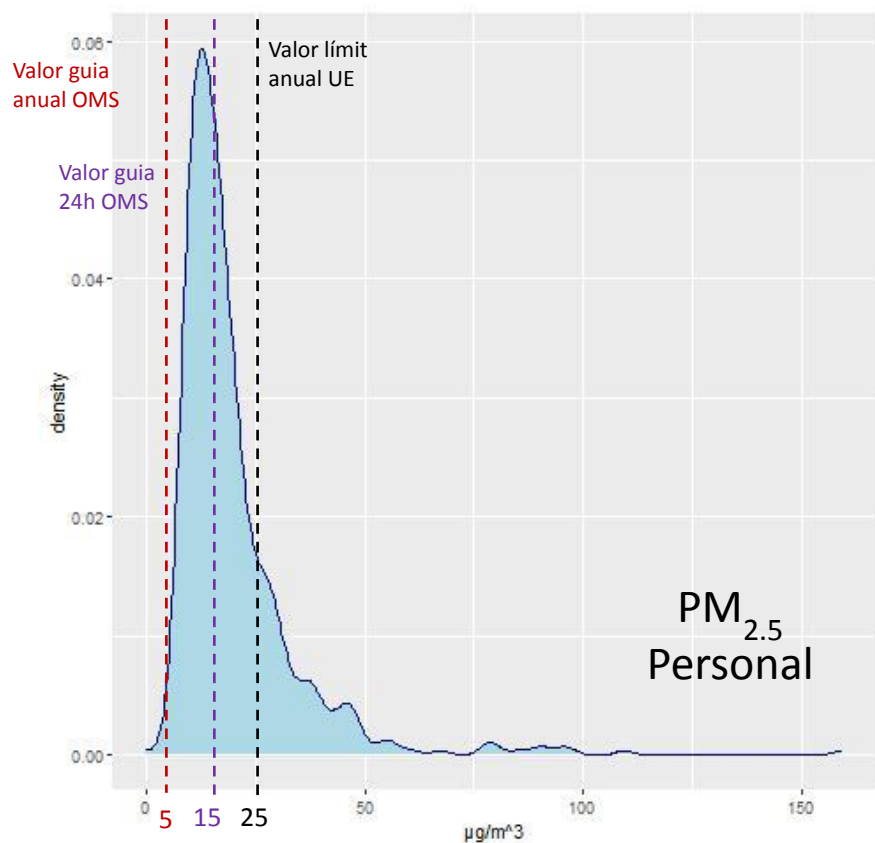
1080 dones embarassades

1017 naixements

Variable	Descripció
Edat de la mare (Mediana (IQR))	34.4 (5.7)
Ètnia materna	
Europea	73.5%
Llatinoamericana	23.3%
Altres	3.2%
Nivell educació materna	
Estudis primaris	4.6%
Estudis secundaris	26.4%
Estudis universitaris	70.0%

L'Estudi BiSC

Resultats preliminars



Valor
límit
anual UE

% mostres per sobre
dels $25 \mu\text{g m}^{-3}$ → 21.3 %

Valor guia
anual
OMS

% mostres per sobre
dels $5 \mu\text{g m}^{-3}$ → 99.6 %

Valor guia
24h OMS

% mostres per sobre
dels $15 \mu\text{g m}^{-3}$ → 55.5 %

N	Mitjana $\pm$ SD ($\mu\text{g m}^{-3}$)
498	20.13 ± 14.83

Mortalitat evitable a Barcelona

EFFECTES SECUNDARIS DE L'ÚS VEHICLES A MOTOR A LA CIUTAT

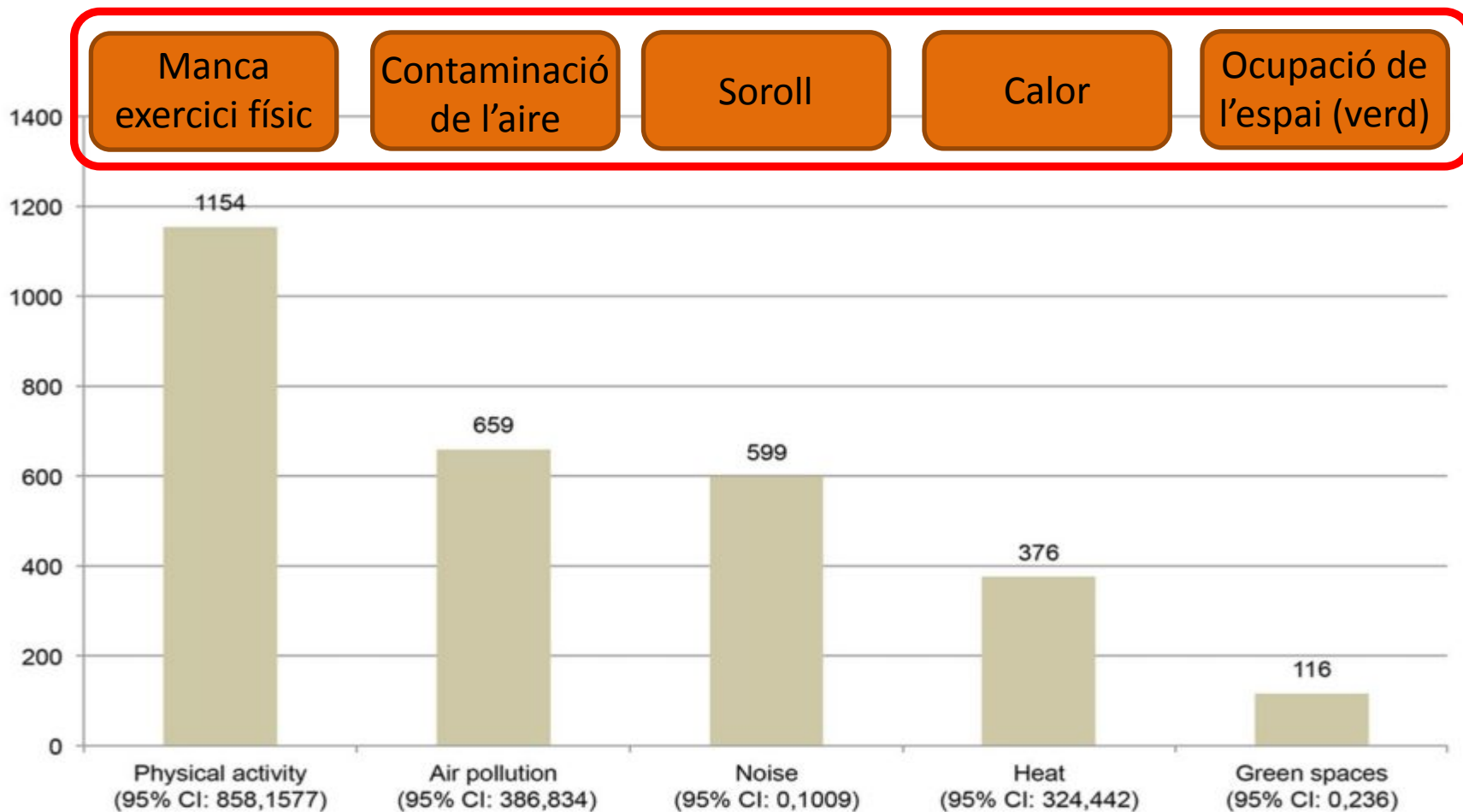


Figure 3. Estimated preventable deaths under compliance with exposure recommendations by exposure domain. The exposure response functions (ERF) for physical activity, air pollution and green spaces were obtained from meta-analyses. The ERF for noise was taken from an ecological study. The ERF for heat was taken from a population-level time-series study. CI, confidence interval.

A quin punt ens trobem?

Tenim la diagnosi ben feta

- Una ciutat amb l'aire contaminat
- La contaminació s'origina sobretot pel trànsit
- La contaminació originada pel trànsit és un problema de salut de dimensions importants

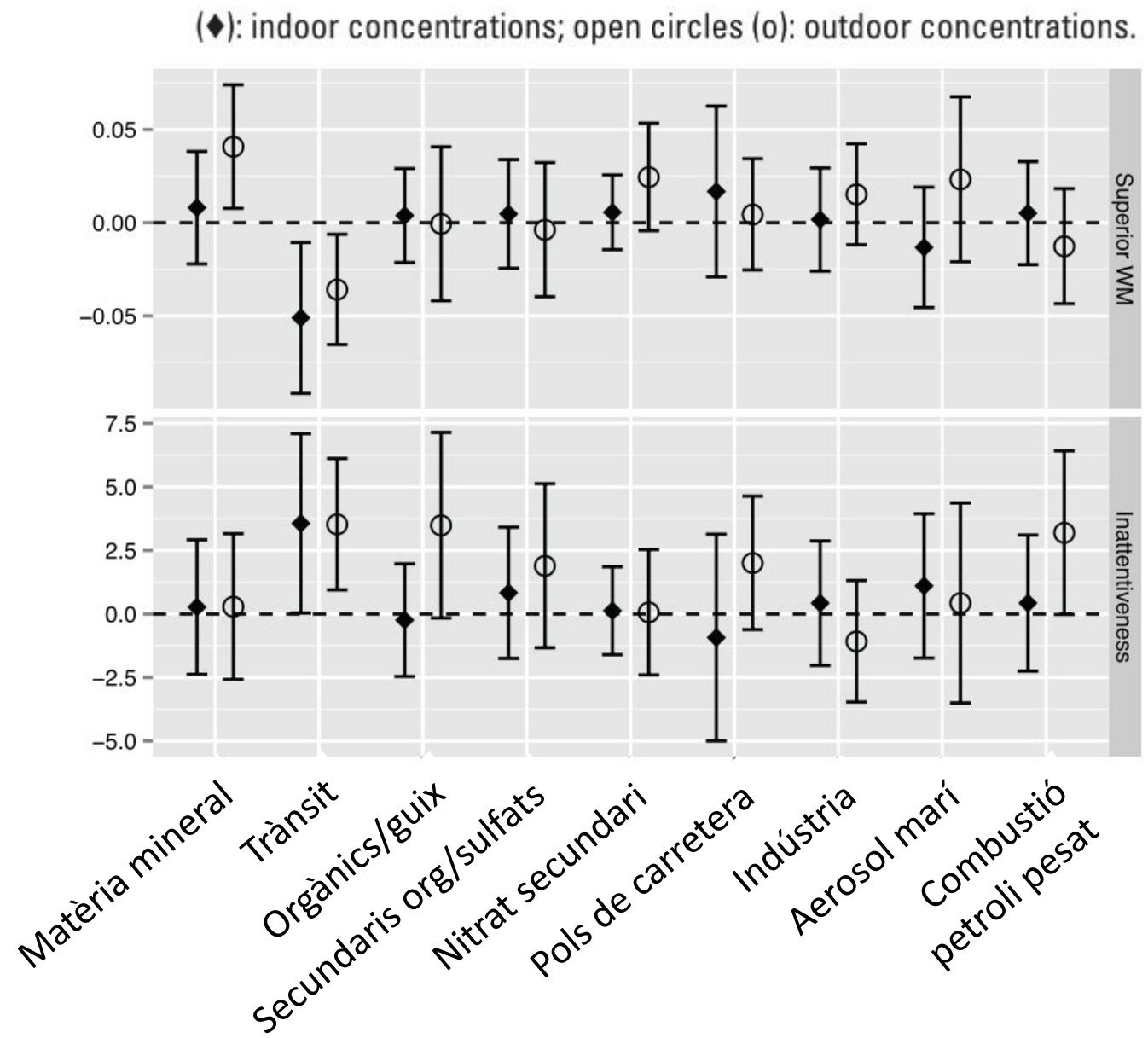
Ara toca trobar solucions.



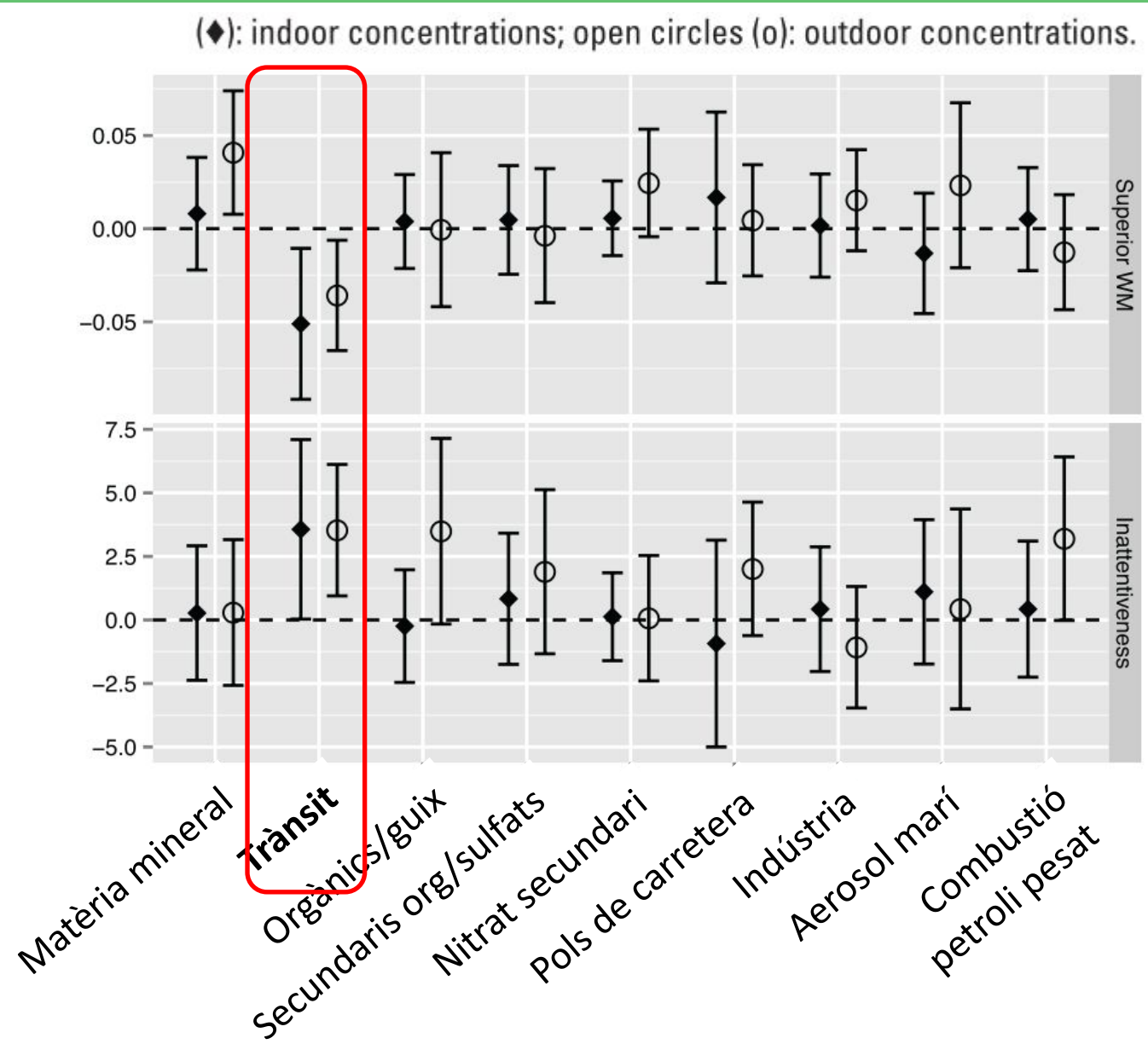
Gràcies

Ioar Rivas (ioar.rivas@isglobal.org)
Sant Adrià del Besòs, 11 d'octubre del 2022

Trànsit rodat: única font associada amb menor neurodesenvolupament



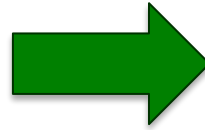
Trànsit rodat: única font associada amb menor neurodesenvolupament



Ciutats més saludables

Intervencions:

- Reducció dels vehicles a la ciutat:
 - Corredors verds
 - Carril bici
- Més i millor transport públic
- Transport més net



Beneficis:

- Reducció contaminació
- Ambient més tranquil (soroll)
- Major contacte social i exercici físic
- Més espais verds, que reduexien la temperatura local

