Assessment of studies on the health risk from particle matter (PM <2.5) from car emissions in relation to other risks in the study population
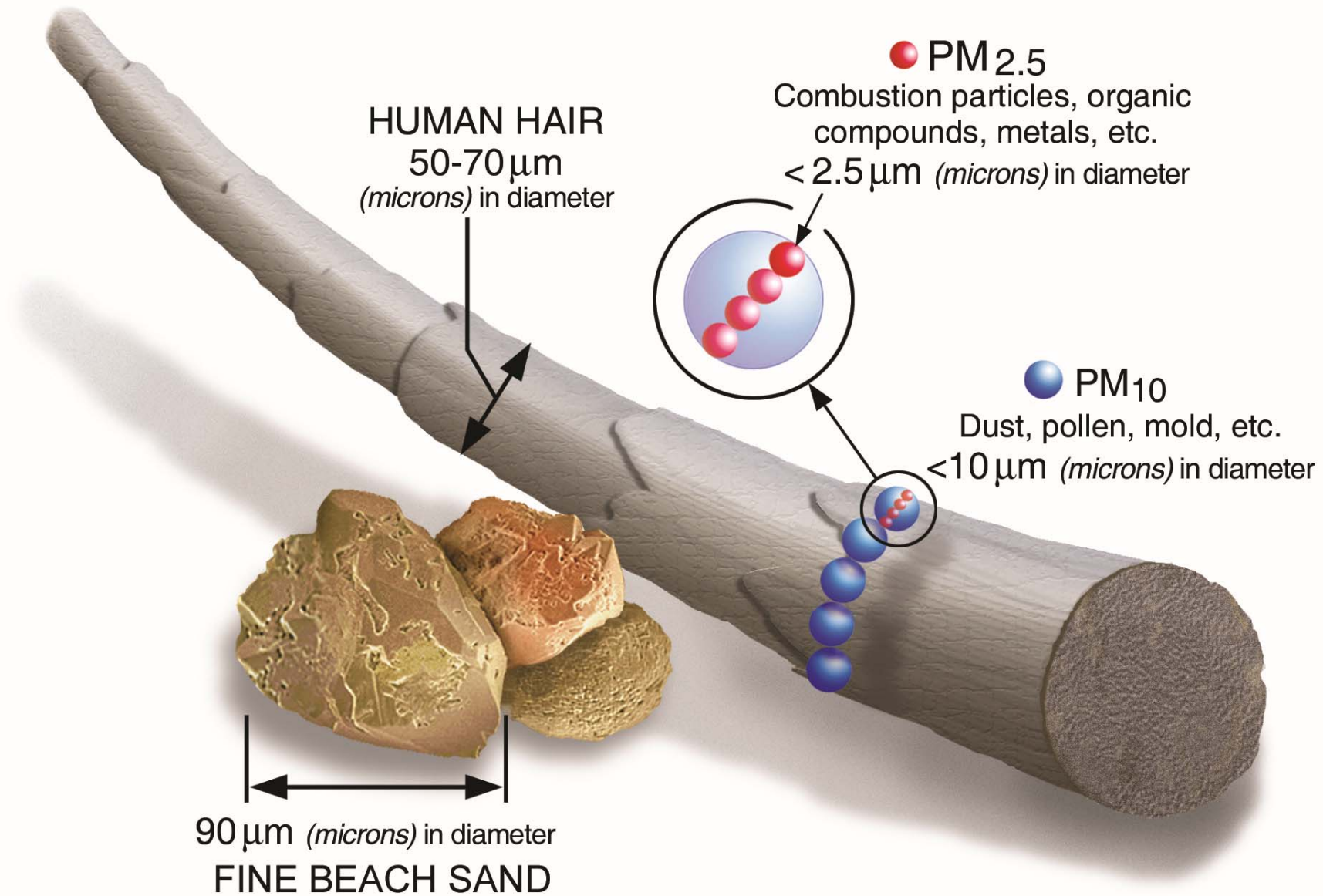

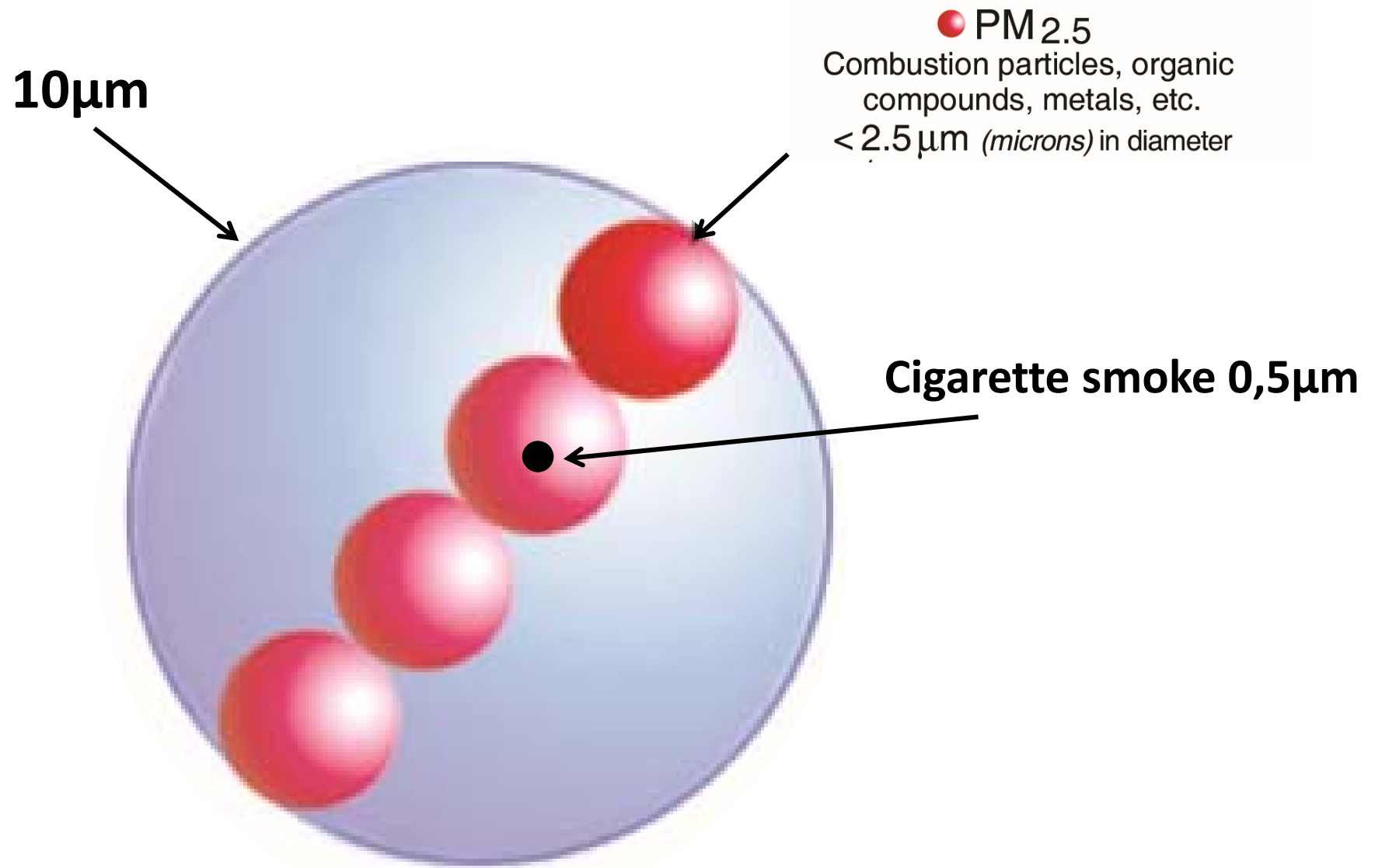**Dieter Köhler**

Conflicts of interest?

In no field

(exept in the common sense)

Solid particles, examples of size range

HUMAN HAIR
50-70 μm
(microns) in diameter

PM 2.5
Combustion particles, organic
compounds, metals, etc.
< 2.5 μm (microns) in diameter

PM 10
Dust, pollen, mold, etc.
<10 μm (microns) in diameter

90 μm (microns) in diameter
FINE BEACH SAND

Size of cigarette smoke

10µm

● PM2.5
Combustion particles, organic
compounds, metals, etc.
< 2.5 µm *(microns)* in diameter

Cigarette smoke 0,5µm

What is the basis for these calculations?

WHO: Weltweit jährlich drei Millionen Todes-
fälle durch Feinstaub in der Außenluft

Dienstag, 27. September 2016

Nachrichten > Auto > News > Abgas-Skandal > Diesel-Abgase: Rund 38.000 Tote durch mehr Diesel-Abgase

"Diesel-Todesliste" offenbart

Studie behauptet: Rund 38.000 Tote durch steigende Diesel-Abgase

/dpa

ZEIT ONLINE

Politik Gesellschaft Wirtschaft Kultur ▾ **Wissen** Digital Campus ▾ Arbeit

Abgase

So tödlich könnte der Dieselskandal gewesen sein

Rund 38.000 Todesfälle wären Forschern zufolge vermeidbar gewesen,
hätten Autobauer Abgasgrenzwerte für Dieselmotoren eingehalten.
Besonders gefährdet seien EU-Bürger.

Von **Simone Gaul**

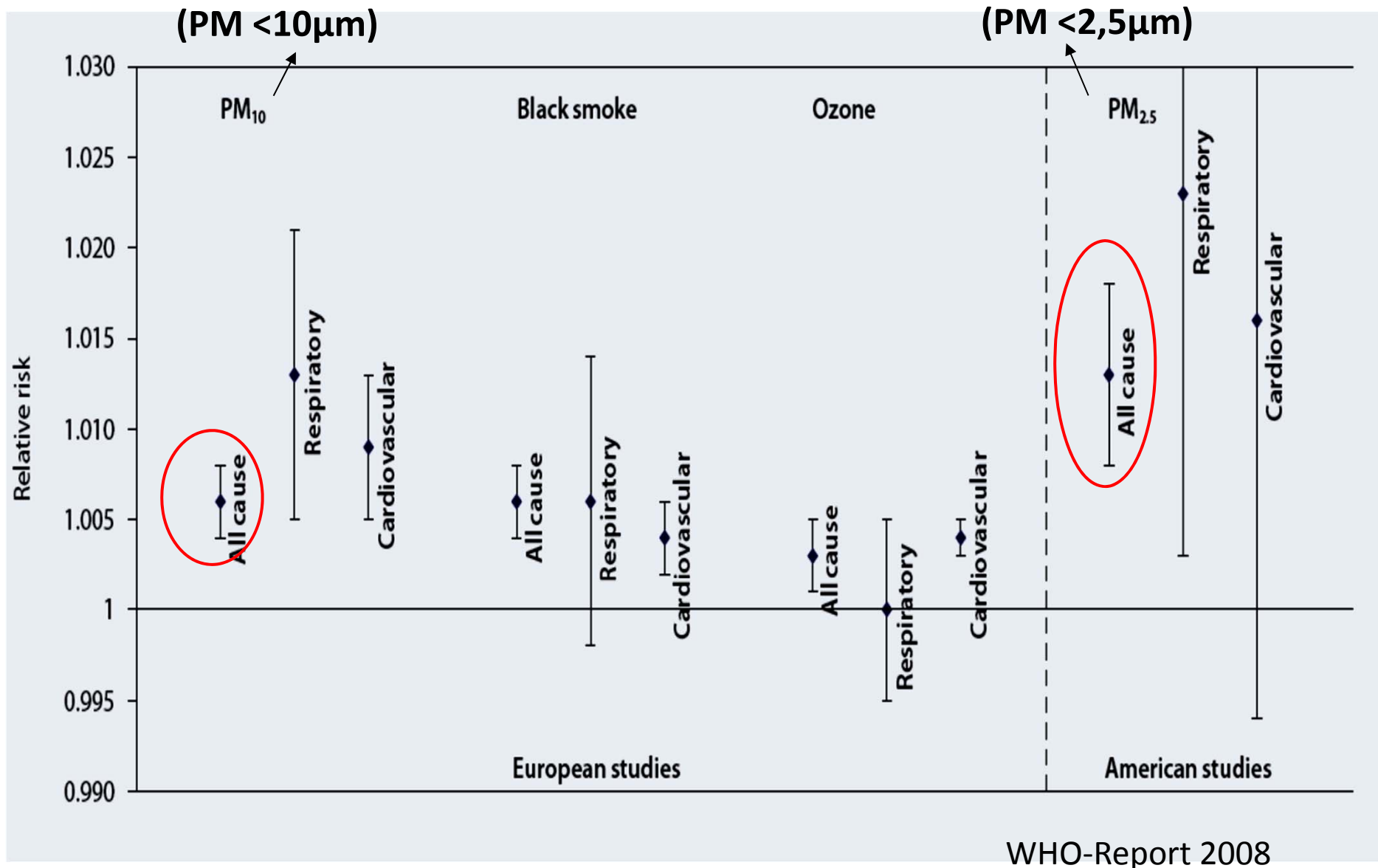15. Mai 2017, 17:34 Uhr / Quelle: ZEIT ONLINE, dpa / 232 Kommentare

Relative risk for all-cause mortality and a 10 µg/m³ increase in daily PM10 in Europe
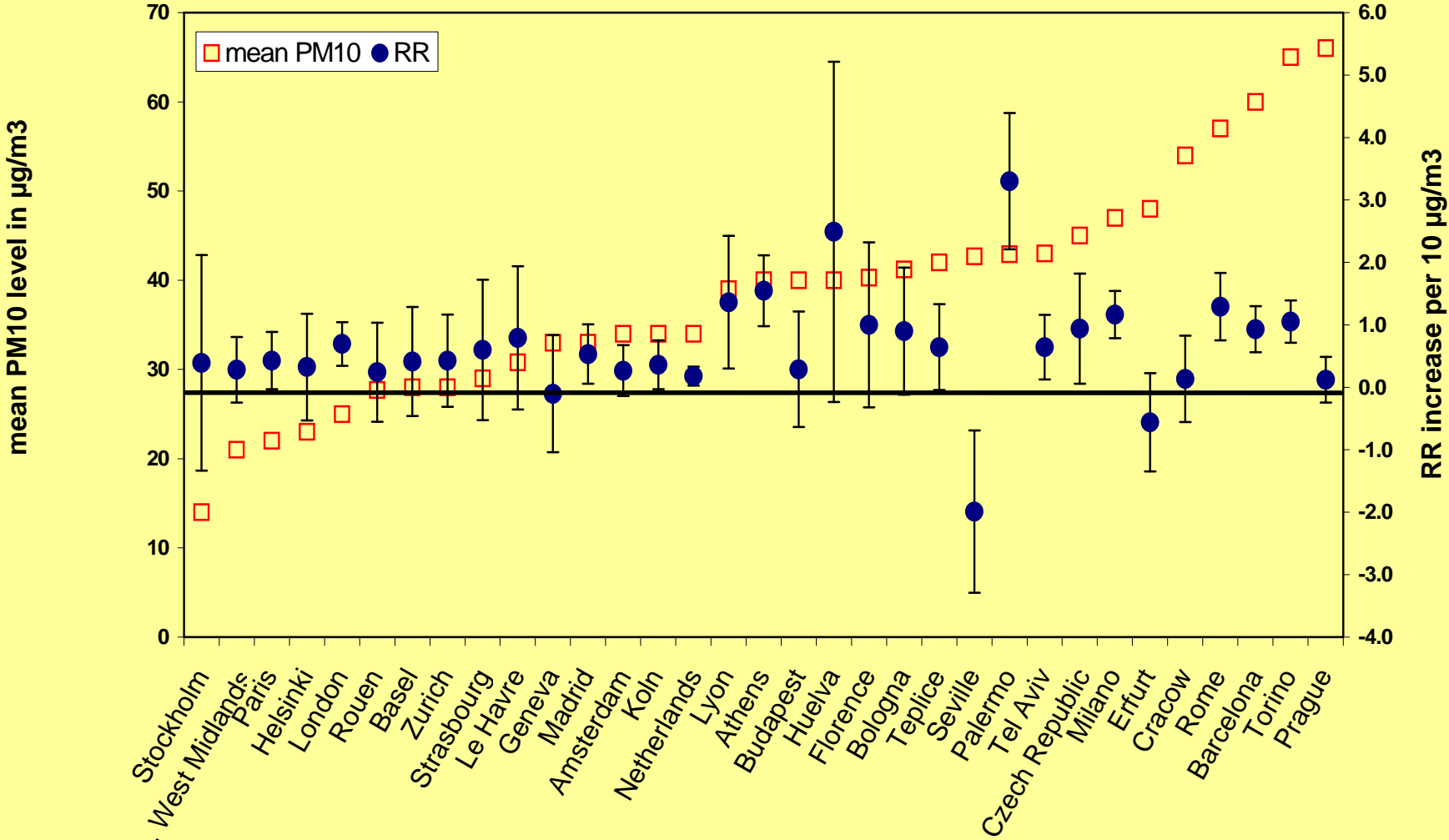
Source: WHO 2004

Mortality due to particle matter (PM, Ozone). Summary of the studies till 2004

WHO-Report 2008

Increasing papers about the risk of PM resp. fine dust

PM10, PM2.5, (NO2) positive correlation with (>RR 1,02):
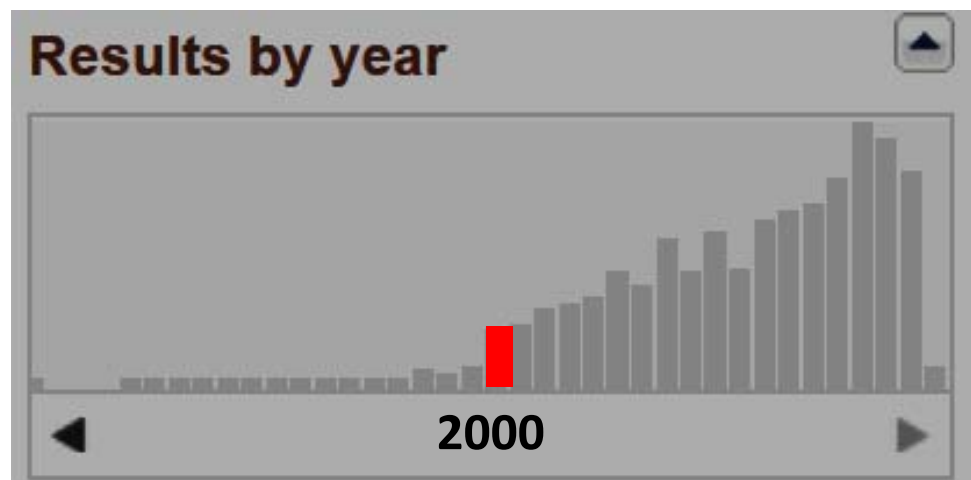
Lung cancer	Lamichhane DK, 2017, Andersen ZJ
Brain tumor	Andersen ZJ, 2017
Breast cancer	Andersen ZJ, 2017
Liver cancer	Andersen ZJ, 2017
Kidney cancer	Raaschou-Nielsen O, 2017
Monoklonal Gammopathia	Orban E, 2017
COPD	Cai Y, 2014, Liu J 2016
Lung fibrosis	Conti S, 2018
hypertension	Wong CM, 2007, 2014, Andersen ZJ
Cerebrovaskular events	Stafoggia M, 2014
Cardiovascular events	Dehbi HM, 2017
Diabetes	Strak M, 2017, Balti EV, 2014
Effect of walking on lung function neutralized	Sinharay R, 2017
Depression	Zijlema WL, 2016
Weight of birth	Clemens T, 2017
Sperm mobility	Jurewicz J, 2015

PM10, PM2.5, (NO_2) no correlation with (RR <1,01):

Rheumatic Arthritis   Hart JE, 2013

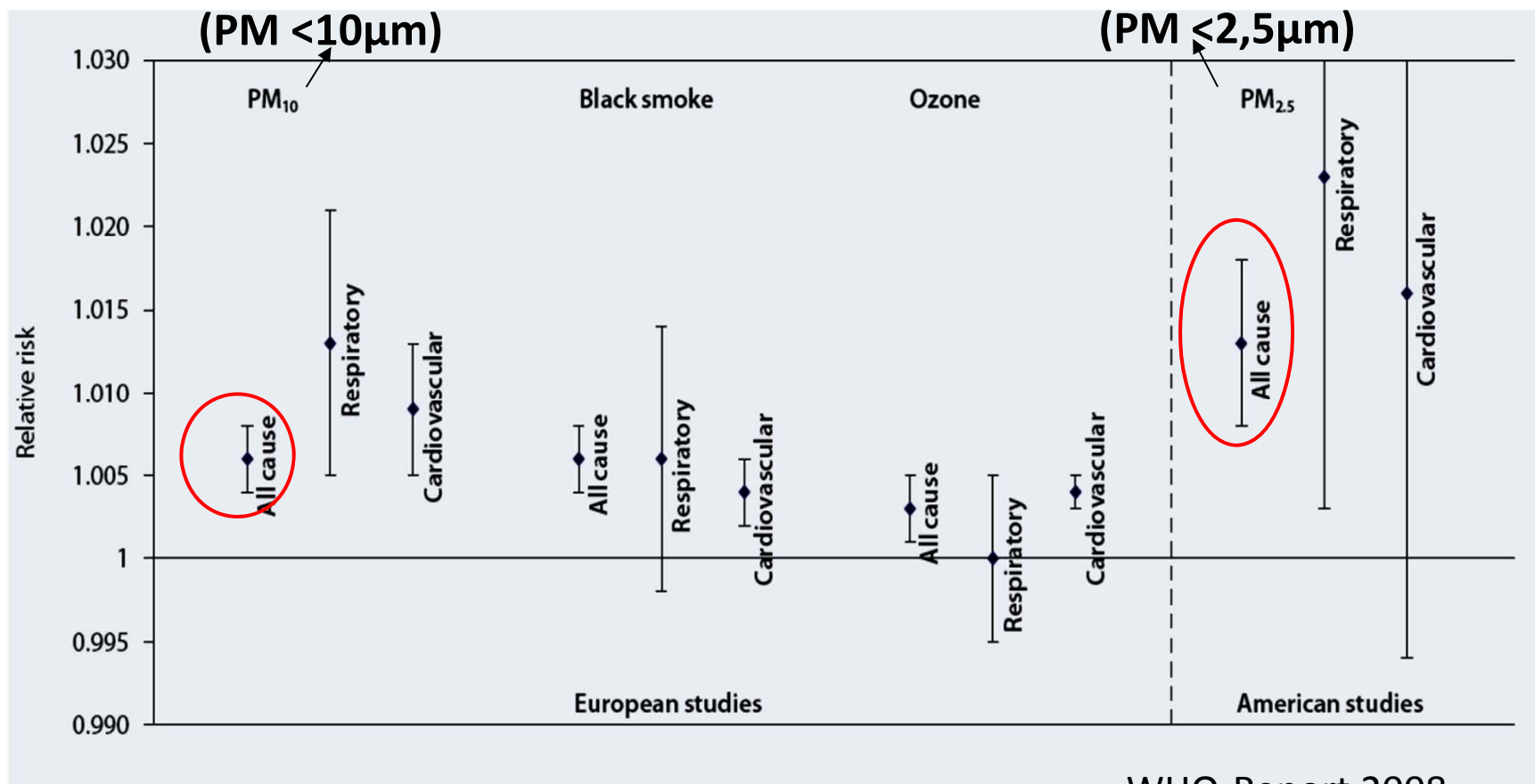Autismus   Guxens M, 2016

PM10, PM2.5, (NO2) positive correlation with (>RR 1,02):

Lung cancer — Lamichhane DK, 2017, Andersen ZJ

Brain tumor — Andersen ZJ, 2017

Breast cancer — Andersen ZJ, 2017

Liver cancer — Andersen ZJ, 2017

Kidney cancer — ~~~~

Monoklonal Gammopathia — ~~~~

COPD

Lung ~~~~

hypert~~~~ , 2014, Andersen ZJ

Cerebr~~~~ — Stafoggia M, 2014

Cardiov~~~~ — Dehbi HM, 2017

Diabete~~~~ — Strak M, 2017, Balti EV, 2014

Effect of walking on lung function neutralized — Sinharay R, 2017

Depression — Zijlema WL, 2016

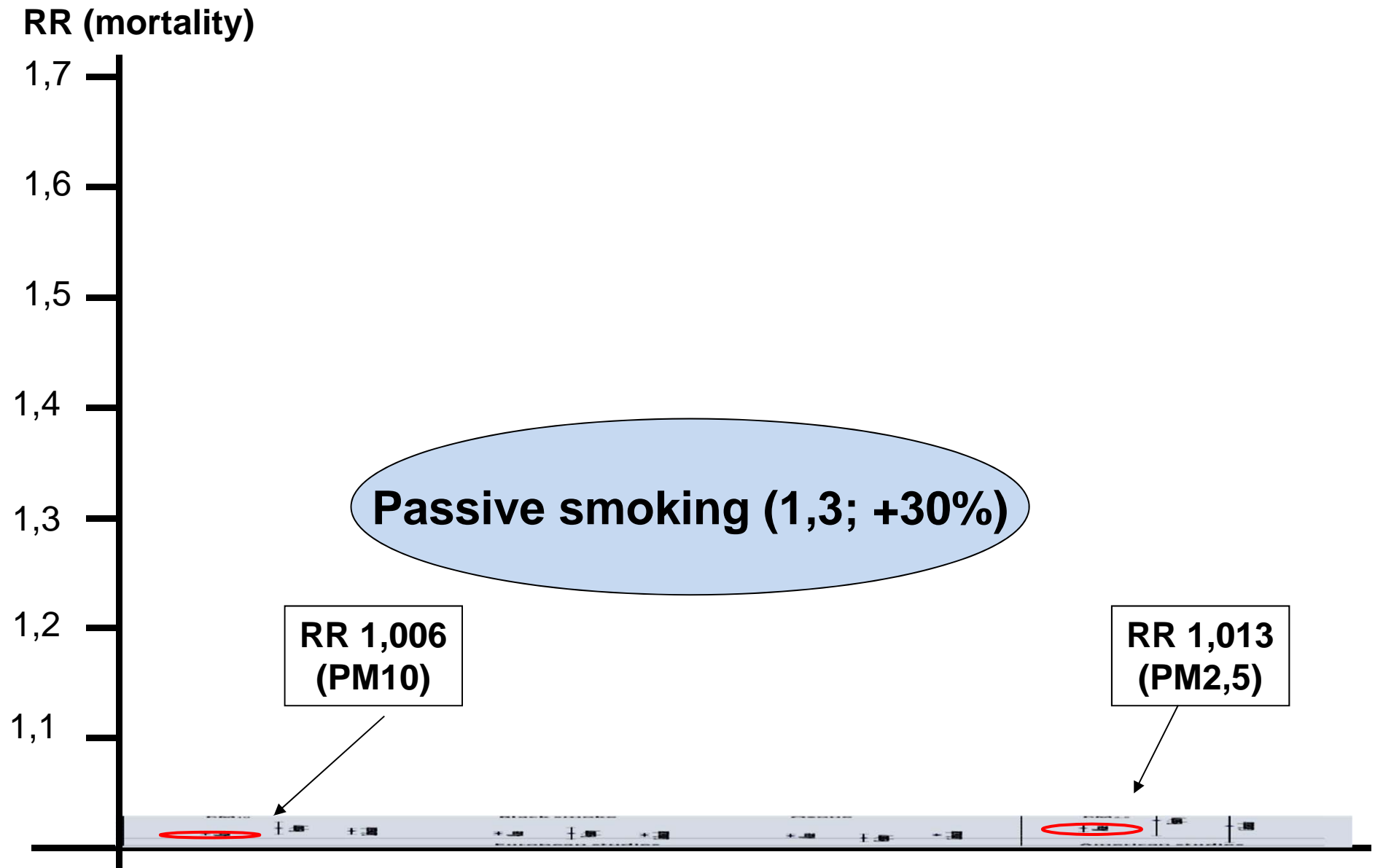Weight of birth — Clemens T, 2017

Sperm mobility — Jurewicz J, 2015

Most of the RR are not significant, but in the most cases this didn't influence the conclusion about the risks
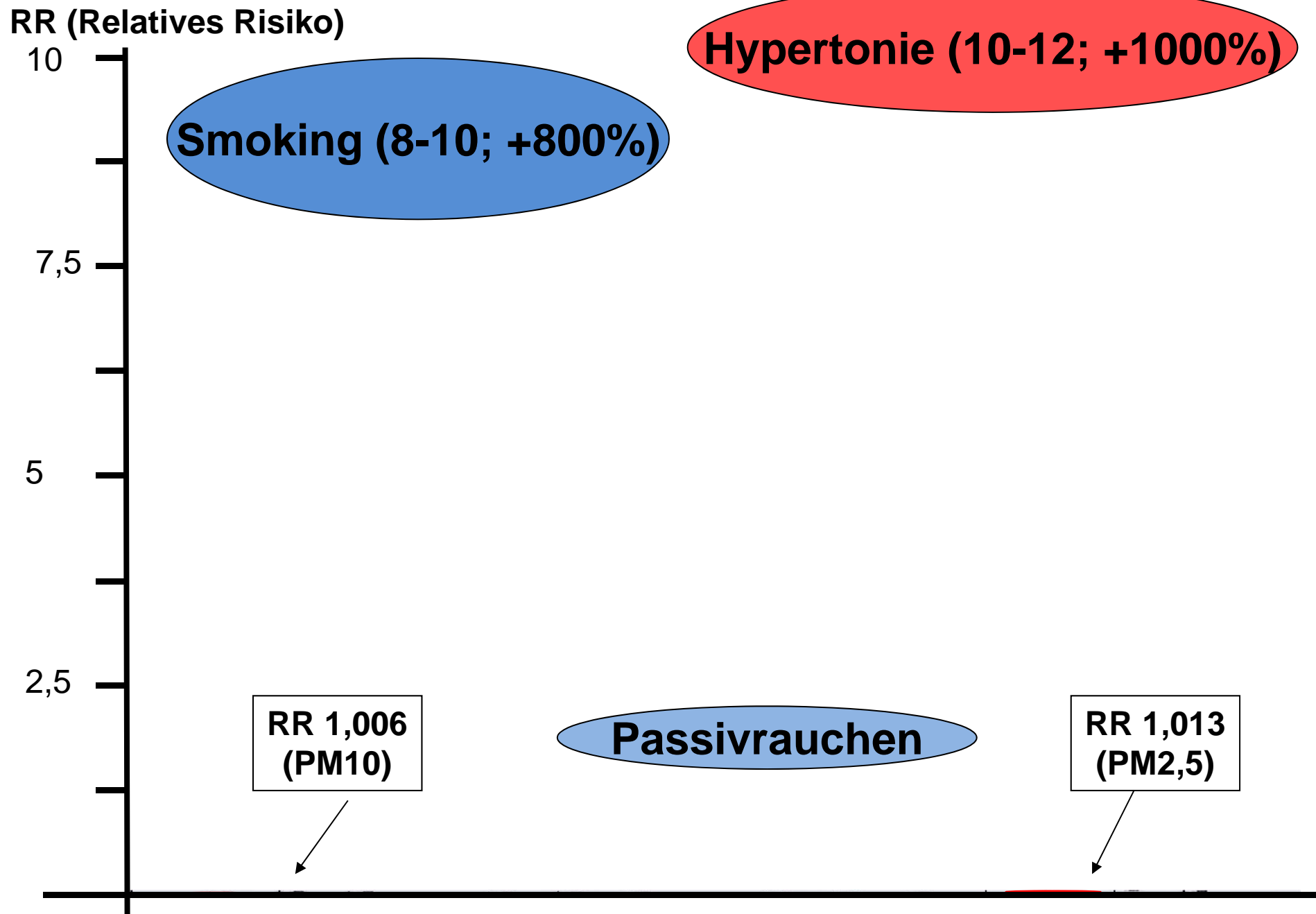
RR = 1,014 (=1,4%)
How are the relationships to other risks?

WHO-Report 2008

RR (mortality)

- 1,7
- 1,6
- 1,5
- 1,4
- 1,3
- 1,2
- 1,1

Passive smoking (1,3; +30%)

RR 1,006 (PM10)

RR 1,013 (PM2,5)

Aus: Köhler D. Voshaar T, Schönhofer B
Pneumologie Thieme 2. Aufl. 2014

RR (Relatives Risiko)

Hypertonie (10-12; +1000%)

Smoking (8-10; +800%)

10

7,5

5

2,5

RR 1,006 (PM10)

Passivrauchen

RR 1,013 (PM2,5)

Aus: Köhler D. Voshaar T, Schönhofer B; Pneumologie Thieme 2. Aufl. 2014

# Confounder can not be eliminated if they are huge in relation to the measured variable

Variations of <1% in the answers in the questionaires can fully explain the results of PM and NOx on health because they influence remarkably the survival:

- smoking behavior
- comorbidities
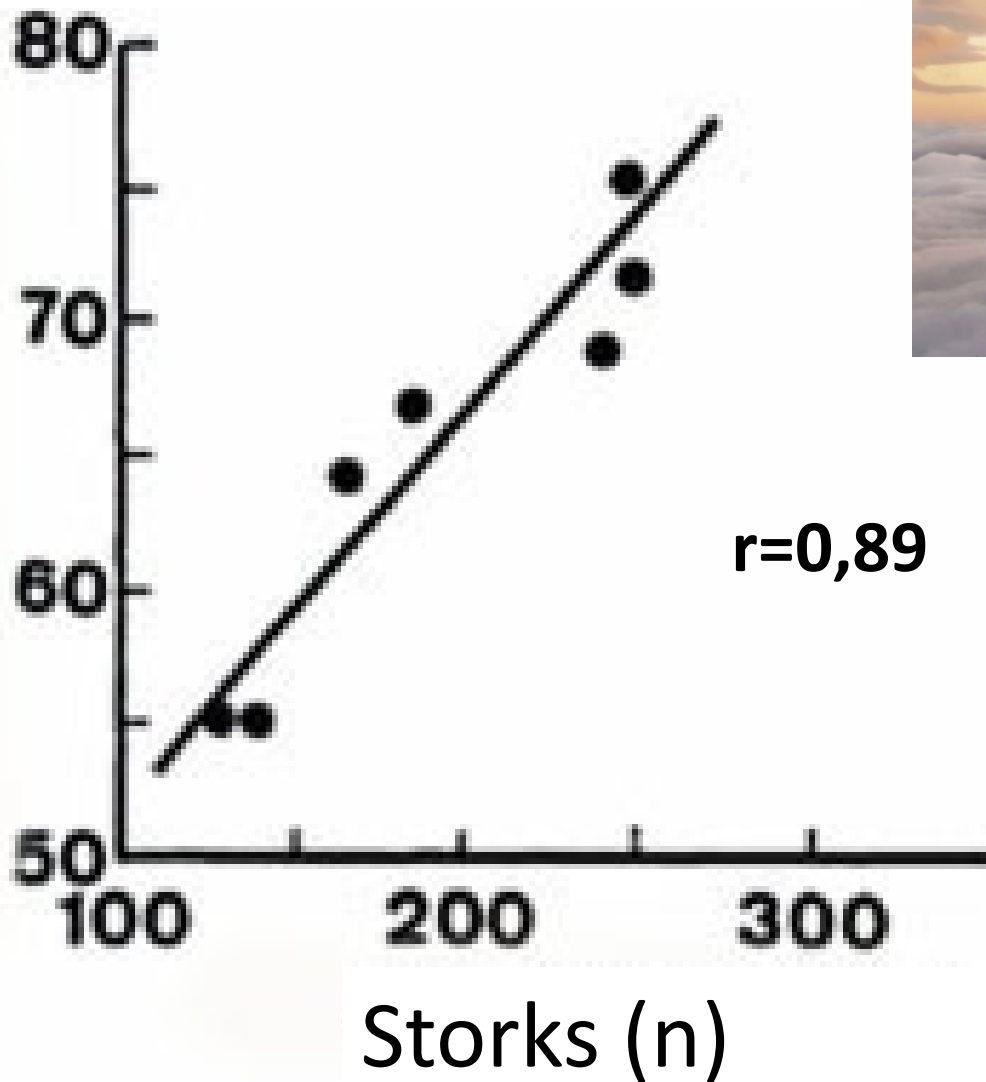- adherence to treatment
- Consumtion of alcohols
- Physical activity
- ....
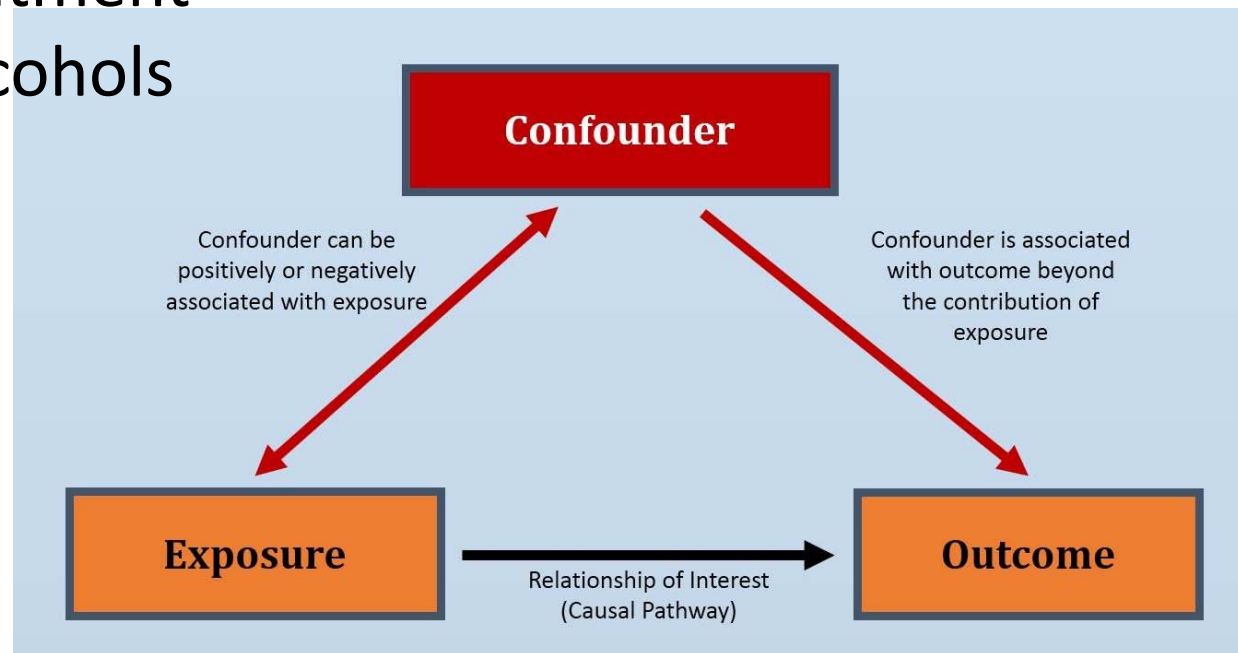
Correlation and causuality

Consumption gasoline (l)
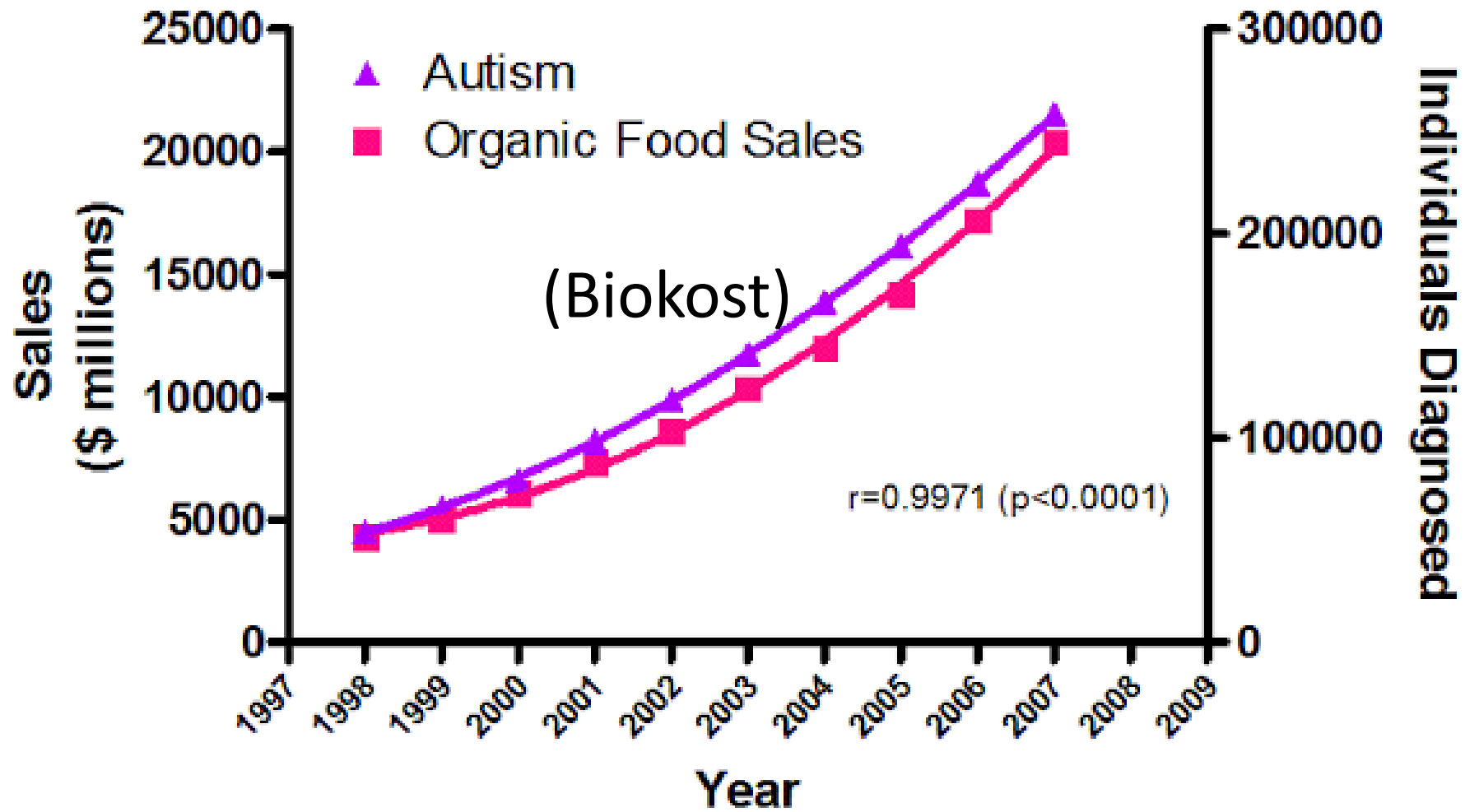

Route (km)
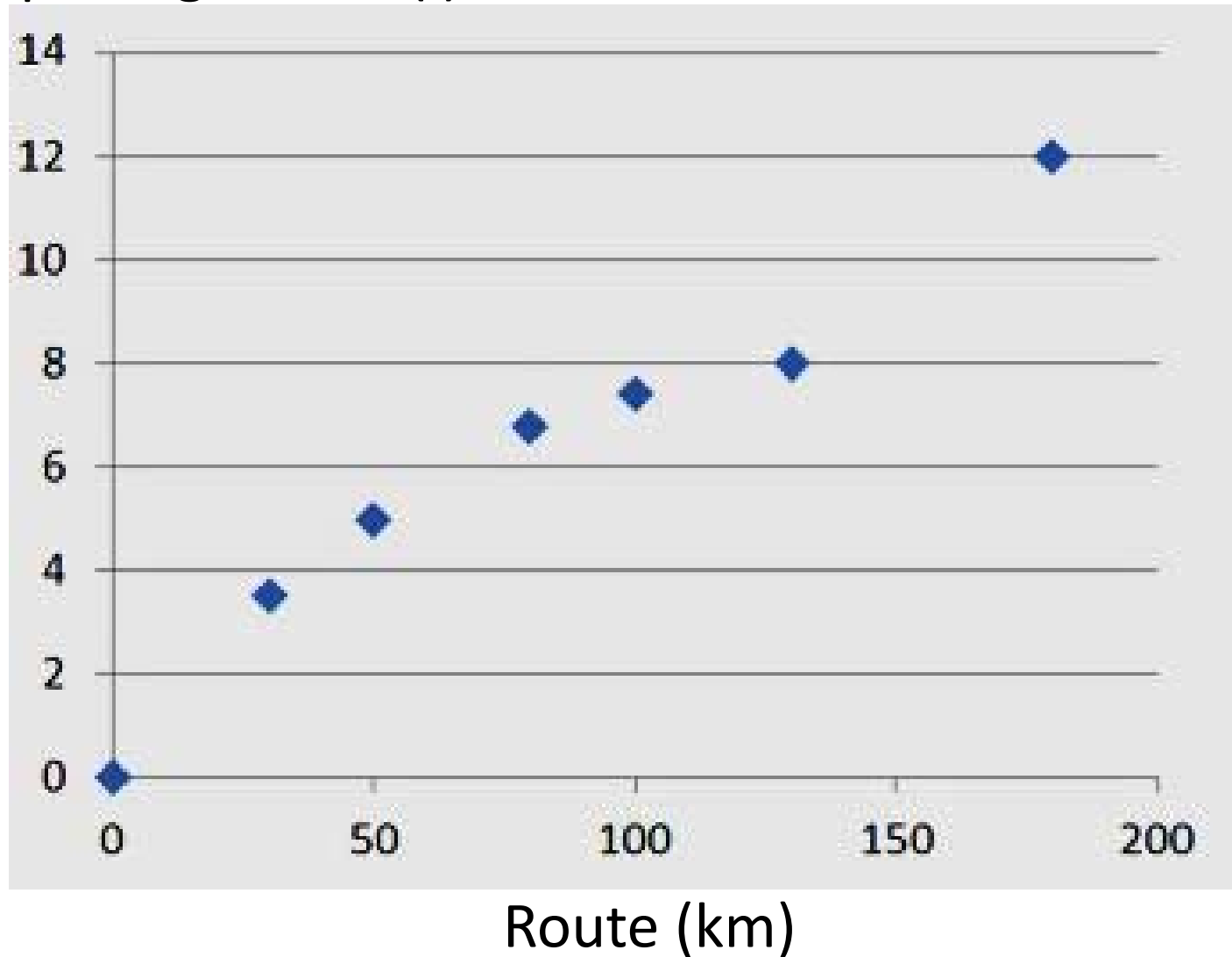
Bring storks the children?

Inhabitants x10³

r=0,89

Storks (n)
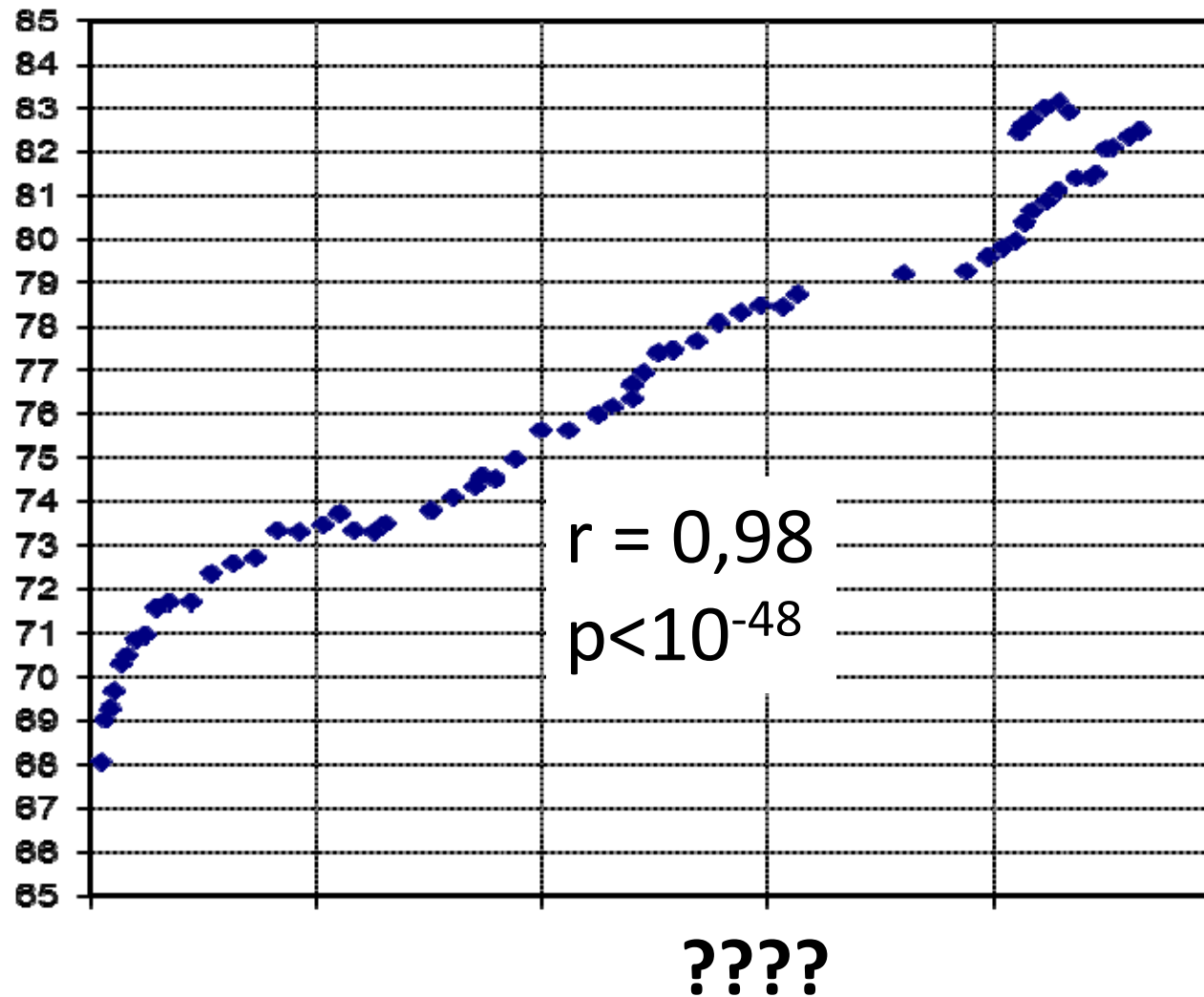
The real cause of increasing autism prevalence?

Extremly strong correlation, reason?

Life expectency (Germany) 1950-2013 (Y)

r = 0,98

$p < 10^{-48}$

????
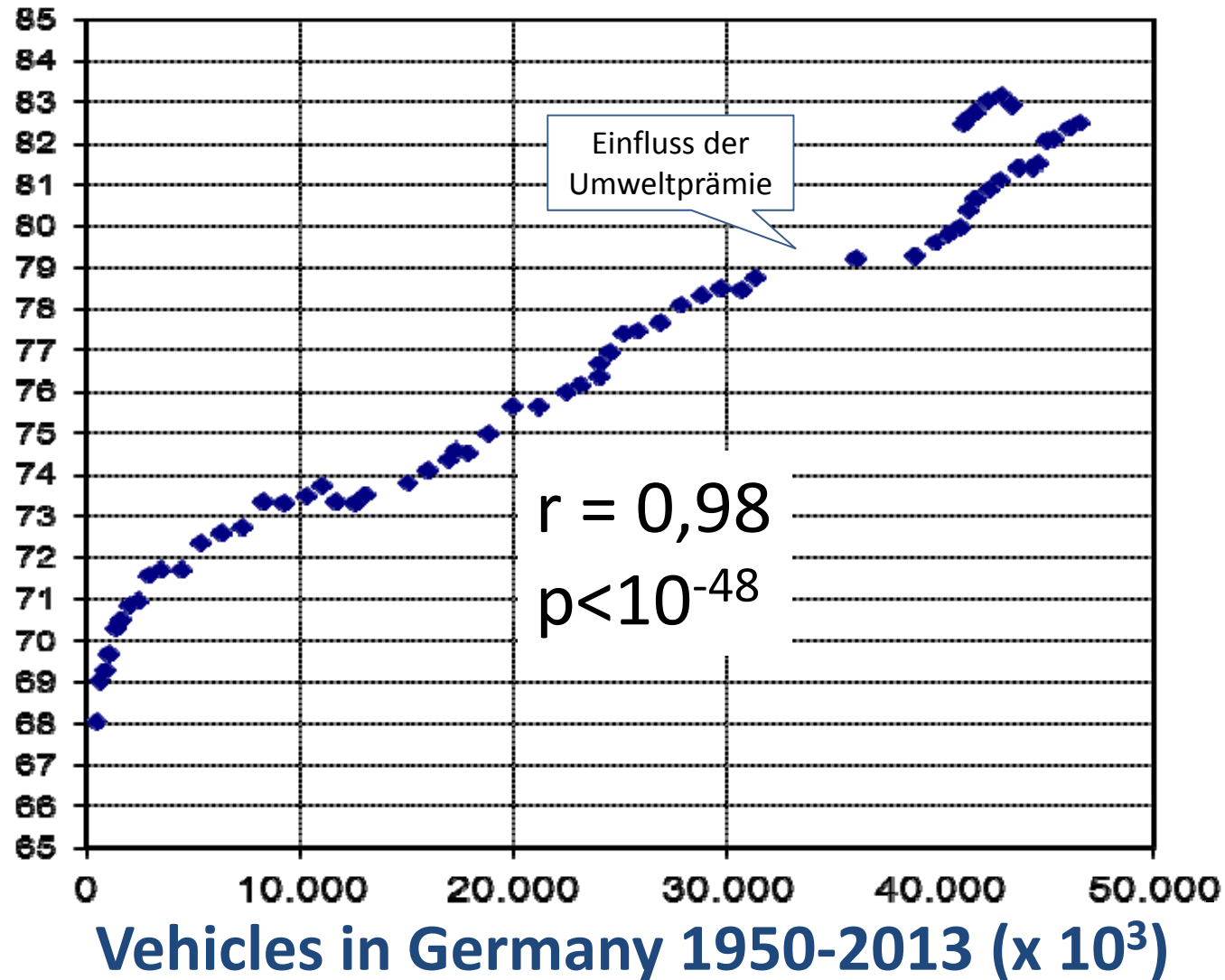
Conclusion: we need more vehicles to get older

Verification doesn't support a hypothesis, only falsification helps

Karl Popper
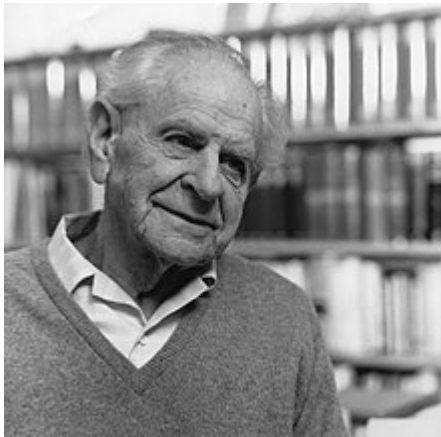
David Hume

Hypothesis: all swans are white
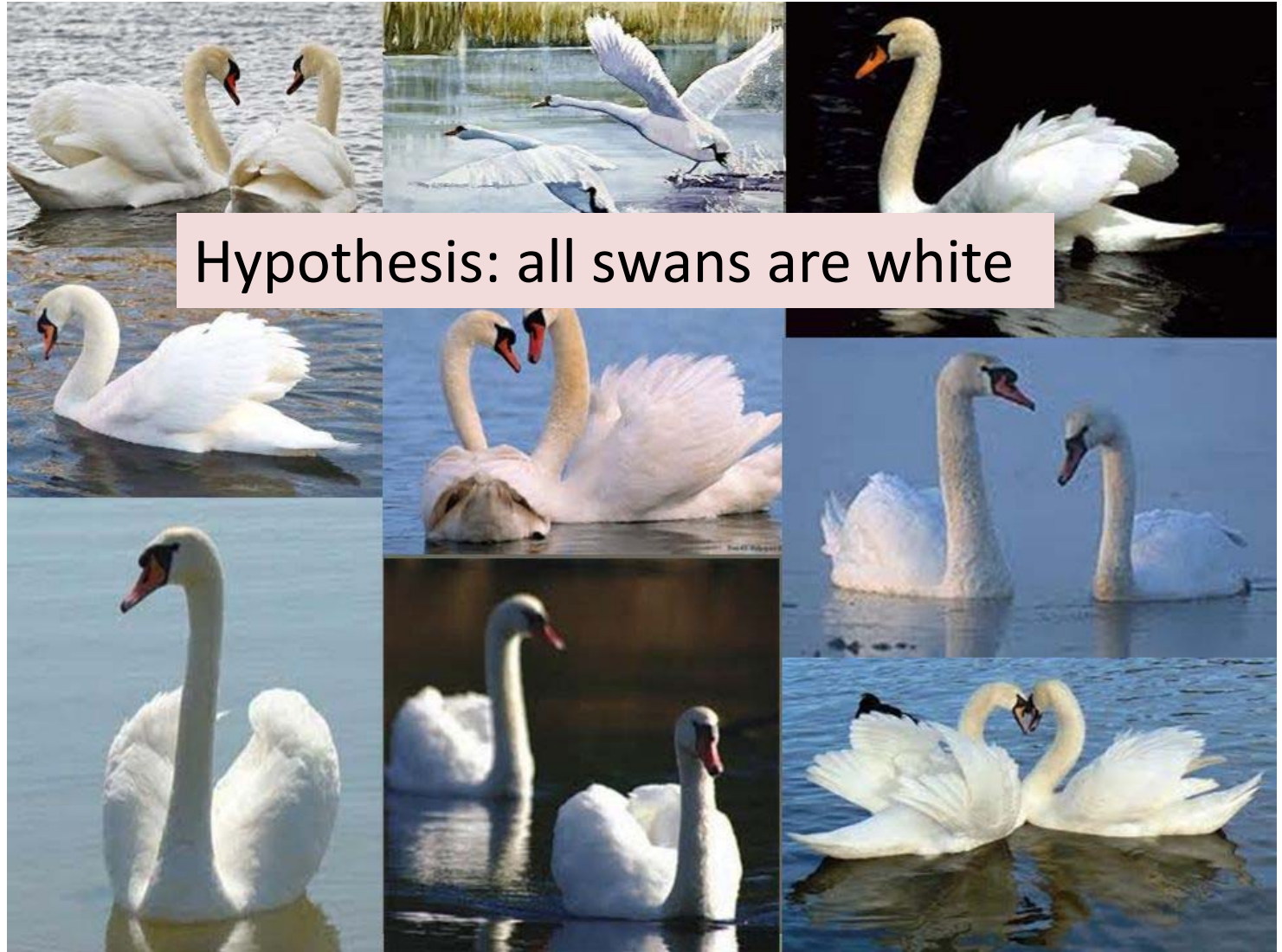
One black swan and the hypothesis is destroyed
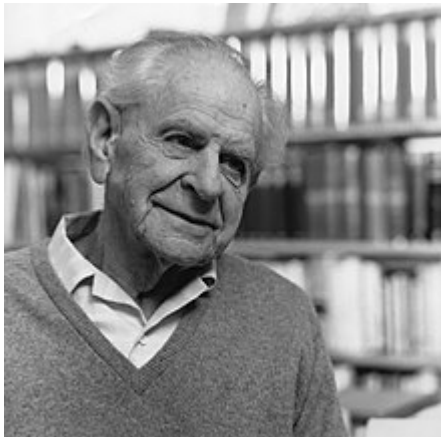
Karl Popper

David Hume

Hypothesis: all swans are white

Relative risk for all-cause mortality and a 10 µg/m³ increase in daily PM10 in Europe

Hints for a falsification of the hypothesis

Source: WHO 2004
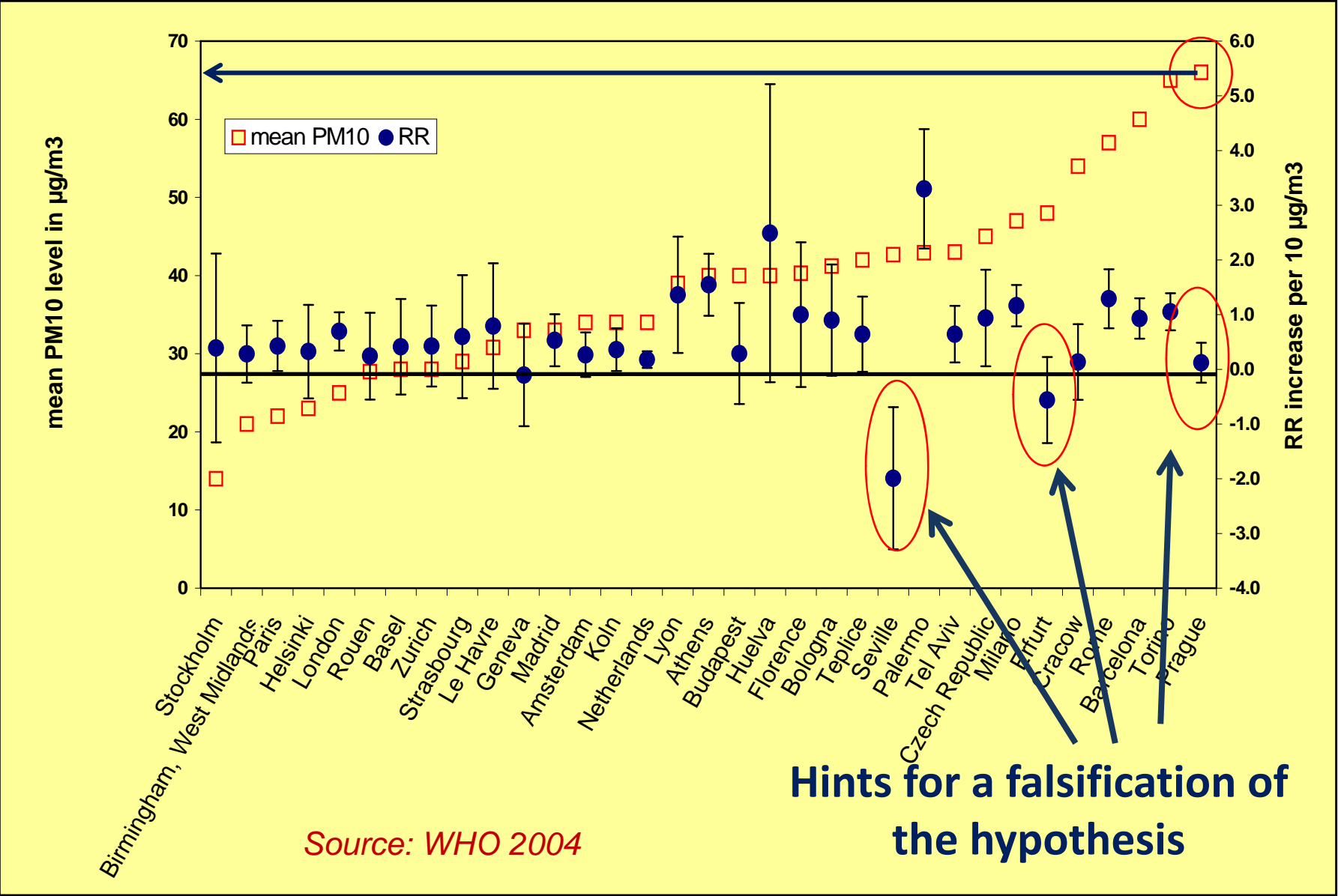
Strong hints for falsification about health risk in the low dosis range:

The relation to the the high concentration of cigarette smoke

Exhaust from a big diesel truck with a tube direct into a closed 36m³ container, compared to smoking

The exhaust pipe of two trucks powered by a diesel engine of about 13,000/14,000cc^3 were connected with a flexible hose to a hole in the window of a container of 36 m^3 volume used as a field office. With door and window closed, the air exchange per hours (ACH) was calculated to be about 0.5/0.7.

Inside the office a fan was installed to assure the highest mixing factor as possible and one gravimetrically pre-calibrated Optical Particle Counter in mass (model Aerocet 531, Metone Instruments Inc.) was used to measure PM_1, $PM_{2.5}$ and PM_{10}. The gravimetric calibration of the Aerocet 531 was performed by comparison with a Beta Attenuation Monitor model BAM-1020 of Metone Instruments Inc. with US EPA EQPM-0798-122 and German T.Ü.V. 936/21205333/A certification for $PM_{2.5}$ and PM_{10} [12]. Gravimetric calibration of PM_1 was not performed and the factory default gravimetric factor was used.

The heavy duty truck engines were supplied with common low sulphur diesel fuel oil purchased normally by the drivers on gas stations.

De Marco C et al. 2016
Multidiscip Respir Med

Closed container 8min

Smoking 2 cigarettes

Exhaust diesel

11 liter truck

De Marco C et al. 2016 Multidiscip Respir Med

Total exhaust from a big truck contains less amount of PM1, PM10, PM2.5 than smoking of 2 cigarretes

Heavy duty trucks and cigarettes PM1, PM2.5 and PM10 pollution comparison in confined environment (mean of two tests background subtracted)

PM1 trucks, 125.0
PM1 cigarettes, 231.7
PM2.5 trucks, 250.8
PM2.5 cigarettes, 591.8
PM10 trucks, 255.8
PM10 cigarettes, 624.0

Test t of Student p= 0.002   0.006   0.002
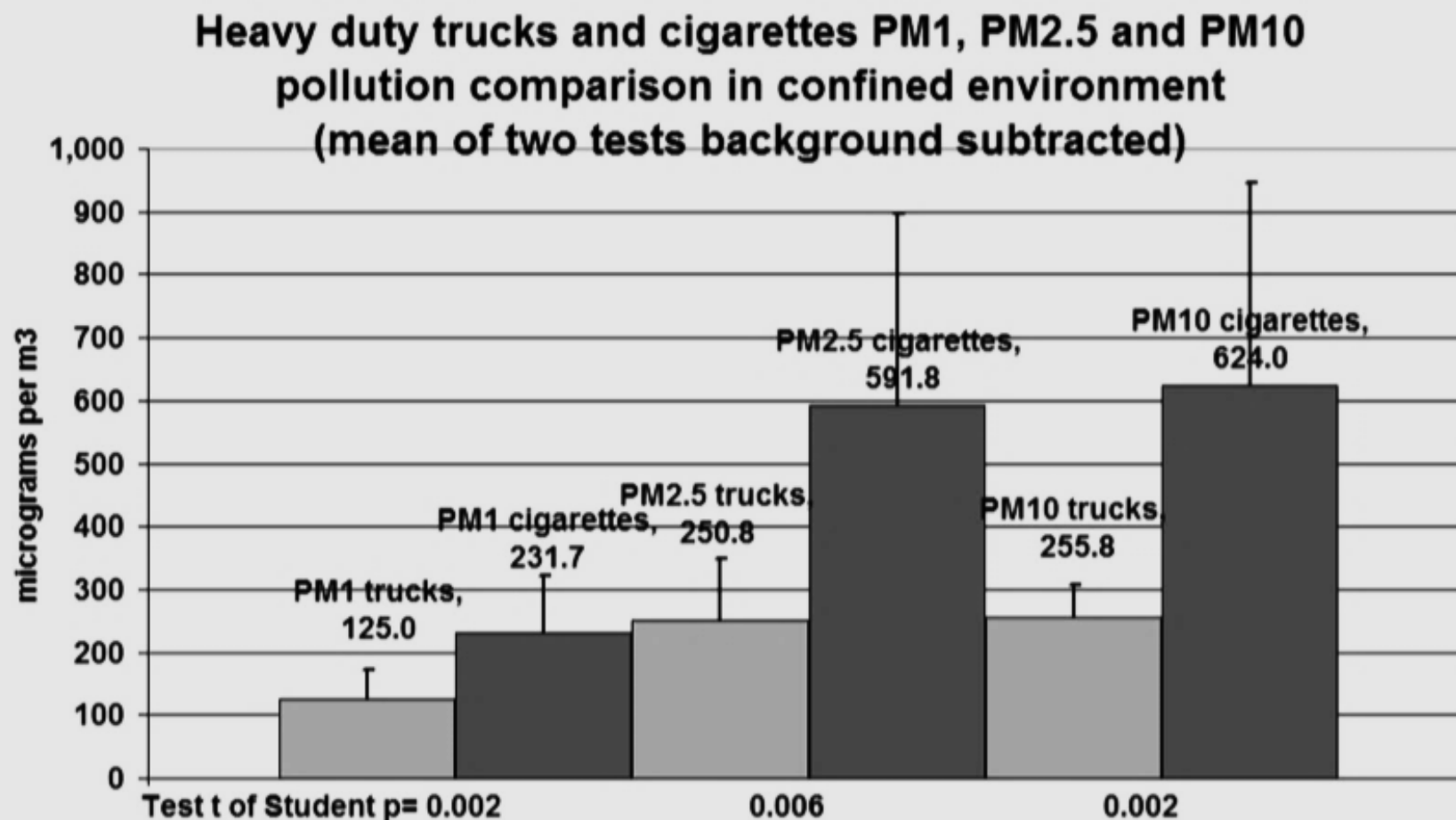
PM1, PM2.5 and PM10 means of the two tests background subtracted

De Marco C et al. Multidiscip Respir Med 2016

PM (µg/m³)

1.000

750

500

250

0

Comparison PM in different places

limit fine dust

Big cities (3. World)

Pollution Workplace till 70th (mining, foundry, Stone pit...)

50µg/m³   200-600µg/m³   2-5mg/m³
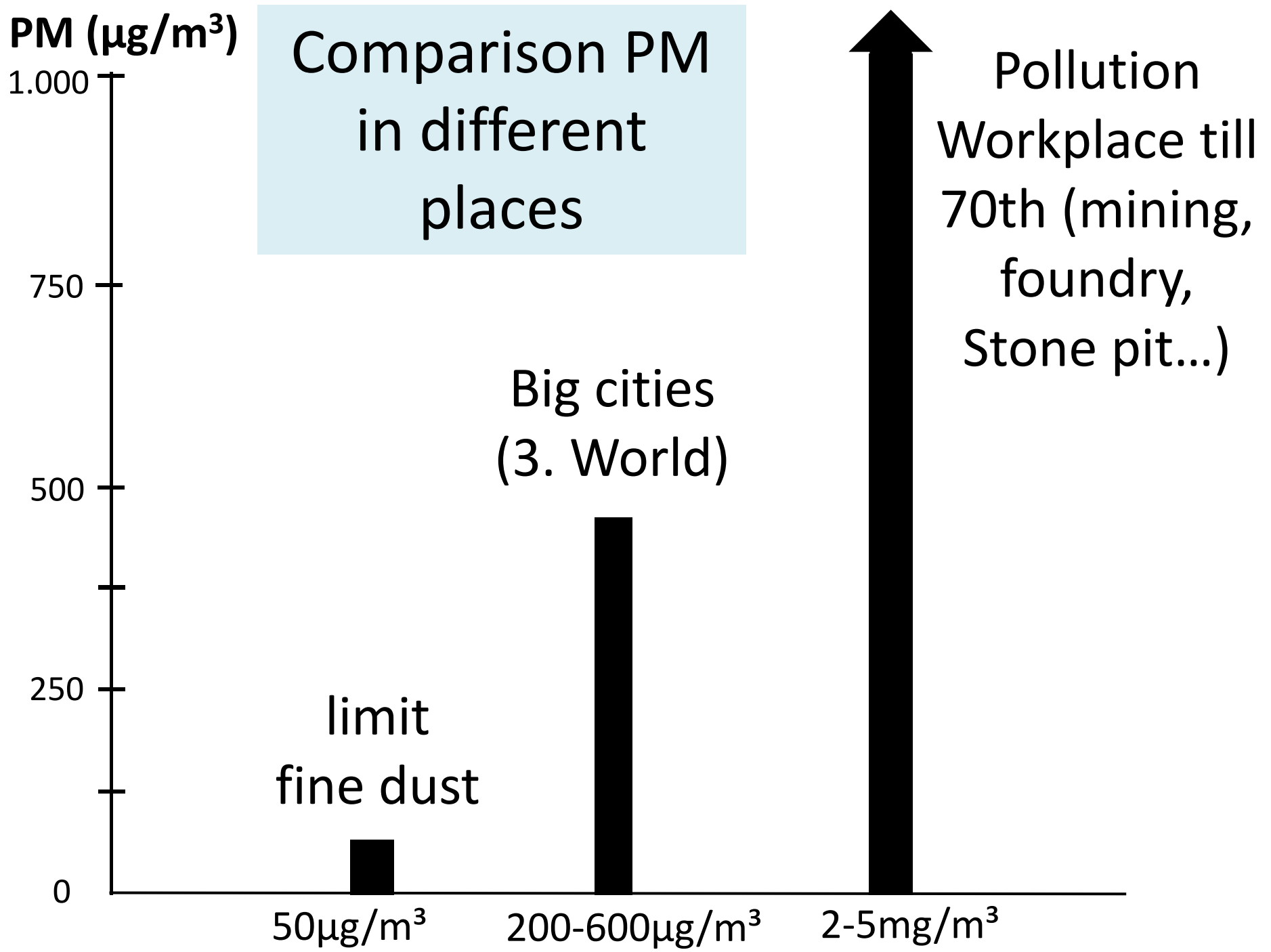
Exampel: coal worker pneumoconiosis after 30 years of working

Healthy   Silicosis
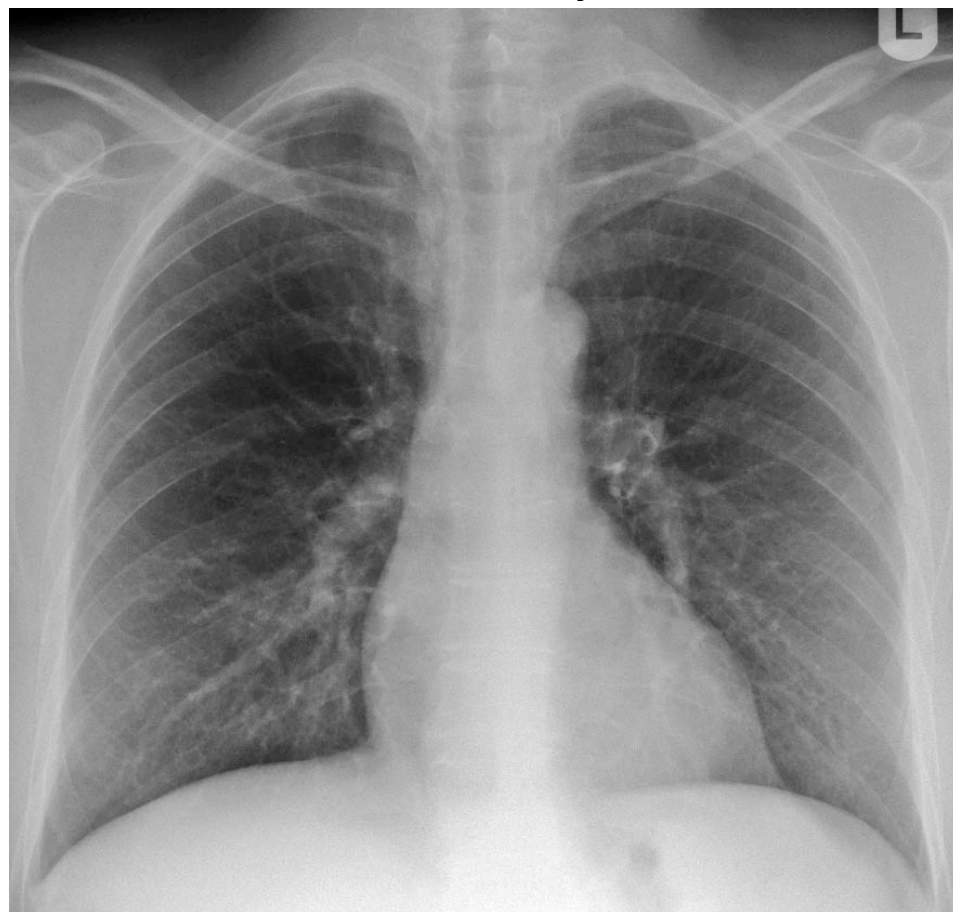
PM (g/m³)

PM of the Mainstream of cigarette smoke is 10Mio higher than the limit of fine dust

Cigarette smoke

1.000

750

500

250

0

fine dust limit

Big cities (3. World)

Pollution Workplace (mining, foundry...)

50μg/m³   2-400μg/m³   2-4mg/m³   **0,5-1kg/m³**

Comparison PM „fine dust" (5µg/m³) to PM cigarette smoke for kidney cancer, a study where a high risk was found

Outdoor air pollution and risk for kidney parenchyma cancer in 14 European cohorts.

Raaschou-Nielsen O[1,2], Pedersen M[1,3], Stafoggia M[4,5], Weinmayr G[6], Andersen ZJ[3], Galassi C[7], Sommar J[8], Forsberg B[8], Olsson D[8], Oftedal B[9], Krog NH[9], Aasvang GM[9], Pyko A[5], Pershagen G[5], Korek M[5], De Faire U[5], Pedersen NL[10], Östenson CG[11], Fratiglioni L[12], Sørensen M[1], Eriksen KT[1], Tjønneland A[1], Peeters PH[13,14], Bueno-de-Mesquita HB[14,15,16], Plusquin M[14], Key TJ[17], Jaensch A[6], Nagel G[6,18], Föger B[18], Wang M[19], Tsai MY[19,20,21], Grioni S[22], Marcon A[23], Krogh V[22], Ricceri F[7,24], Sacerdote C[7], Migliore E[7], Tamayo I[25,26,27], Amiano P[26,28], Dorronsoro M[26,28], Sokhi R[29], Kooter I[30], de Hoogh K[20,21], Beelen R[31,32], Eeftens M[20,21], Vermeulen R[14,31,33], Vineis P[14,34], Brunekreef B[31,33], Hoek G[31].

⊕ Author information

Abstract

Several studies ... higher PM concentration, e.g. HR = 1.57 (95%CI: 0.81-3.01) per 5 µg/m³ ... in the general population. We u... ...dy. We geocoded and assessed air pollution concentrations at baseline a... ...by land-use regression models for particulate matter (PM_{10}, $PM_{2.5}$, PM_{coarse}, $PM_{2.5}$ absorbance (soot)) and nitrogen oxides (NO_2, NO_x), and collected data on traffic. We used Cox regression models with adjustment for potential confounders for cohort-specific analyses and random effects models for meta-analyses to calculate summary hazard ratios (HRs). The 289,002 cohort members contributed 4,111,908 person-years at risk. During follow-up (mean 14.2 years) 697 incident cancers of the kidney parenchyma were diagnosed. The meta-analyses showed higher HRs in association with higher PM concentration, e.g. HR = 1.57 (95%CI: 0.81-3.01) per 5 µg/m³ $PM_{2.5}$ and HR = 1.36 (95%CI: 0.84-2.19) per 10^{-5} m^{-1} $PM_{2.5}$ absorbance, albeit never statistically significant. The HRs in association with nitrogen oxides and traffic density on the nearest street were slightly above one. Sensitivity analyses among participants who did not change residence during follow-up showed stronger associations, but none were statistically significant. Our study provides suggestive evidence that exposure to outdoor PM at the residence may be associated with higher risk for kidney parenchyma cancer; the results should be interpreted cautiously as associations may be due to chance.

PM 5µg/m³ during life in relation to smoking

A human is breathing 9m³ air/day or
ca. 250.000m³ air/life.
5µg/m³ Particle Matter (PM) inhaled: <u>1.25g/life</u>

Smoker: 1 cigarette contains 0.7g tobacco;
inhaled PM ca. 25mg (and gases).
After 50 cigaretts: <u>1,25g is reached</u>

**A method for measuring respiratory deposition of cigarette smoke during smoking.**

Hinds W, First MW, Huber GL, Shea JW.

Abstract
An understanding of the factors influencing respiratory deposition of cigarette smoke in smokers is needed to accurately control this important source of respiratory exposure in epidemiological studies of workers. Only a few studies have characterized the deposition of cigarette smoke in smokers and these involve methods that interfere with normal smoking. A technique for measuring puff volume, inhaled amount, and respiratory deposition of cigarette smoke particulate phase has been developed. It provides satisfactory accuracy (+/- 10%) and causes minimal disruption of normal smoking pattern. The technique captures exhaled smoke with an exhaust hood and establishes the amount of

A lot of smoker should develop kidney cancer after smoking of 3 packages??
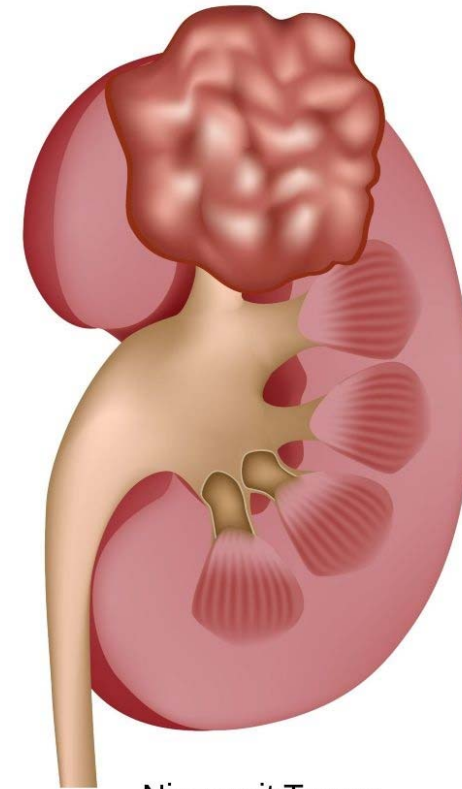
Niere mit Tumor

What is the basis for these calculations?

WHO: Weltweit jährlich drei Millionen Todes-
fälle durch Feinstaub in der Außenluft

Dienstag, 27. September 2016

Nachrichten > Auto > News > Abgas-Skandal > Diesel-Abgase: Rund 38.000 Tote durch mehr Diesel-Abgase

"Diesel-Todesliste" offenbart
Studie behauptet: Rund 38.000 Tote durch steigende Diesel-Abgase

ZEIT ONLINE

Politik   Gesellschaft   Wirtschaft   Kultur ▾   **Wissen**   Digital   Campus ▾ | Arbeit |

/dpa

Abgase

So tödlich könnte der Dieselskandal gewesen sein

Rund 38.000 Todesfälle wären Forschern zufolge vermeidbar gewesen,
hätten Autobauer Abgasgrenzwerte für Dieselmotoren eingehalten.
Besonders gefährdet seien EU-Bürger.

Von **Simone Gaul**

15. Mai 2017, 17:34 Uhr / Quelle: ZEIT ONLINE, dpa / 232 Kommentare

Estimates of health impacts of anthropogenic PM in EU

Health end-point	Units (per year)	EU25	Germany
Mortality – life expectancy reduction	Months	8,6	10,2
Mortality – long term exposure	Life years lost x1,000	3001	657
Mortality – long term exposure	Number of premature deaths x1,000	288	65
Infant mortality	Cases x1,000	0,6	0,09
Chronic bronchitis	Cases x 1000	136	31
Respiratory hospital admissions	cases x 1000	51	11
Cardiac hospital admissions	Cases x 1000	32	7
Restricted activity days	Days x 1000	288292	63832
Respiratory medication use (children)	Days x 1000	3510	781
Respiratory medication use (adults)	Days x 1000	22990	5166
Lower respir. symptoms (children)	Days x 1000	160349	32291
Lower respir. symptoms in adults with chronic disease	Days x 1000	236498	52636

Source: CAFE 2005

The ongoing program Clean Air for Europe (CAFE) is an initiative from the EU Commission t

After this data: smoker should all <u>die</u> after some packages!
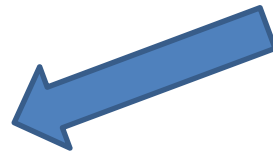
The right tool is not enough

Many thanks for your attention