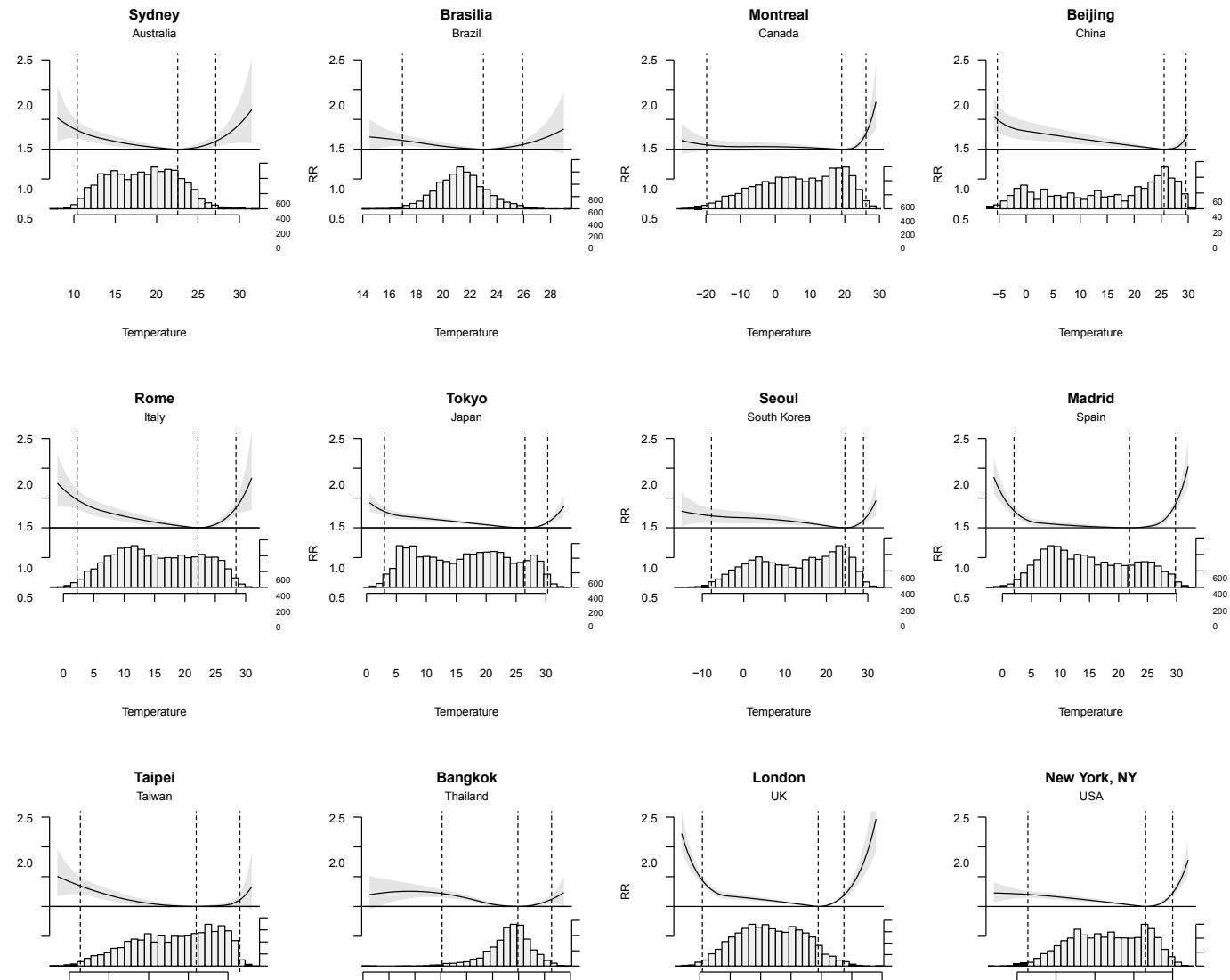


Health co-benefits of mitigation of greenhouse gases emissions: the case of ethanol

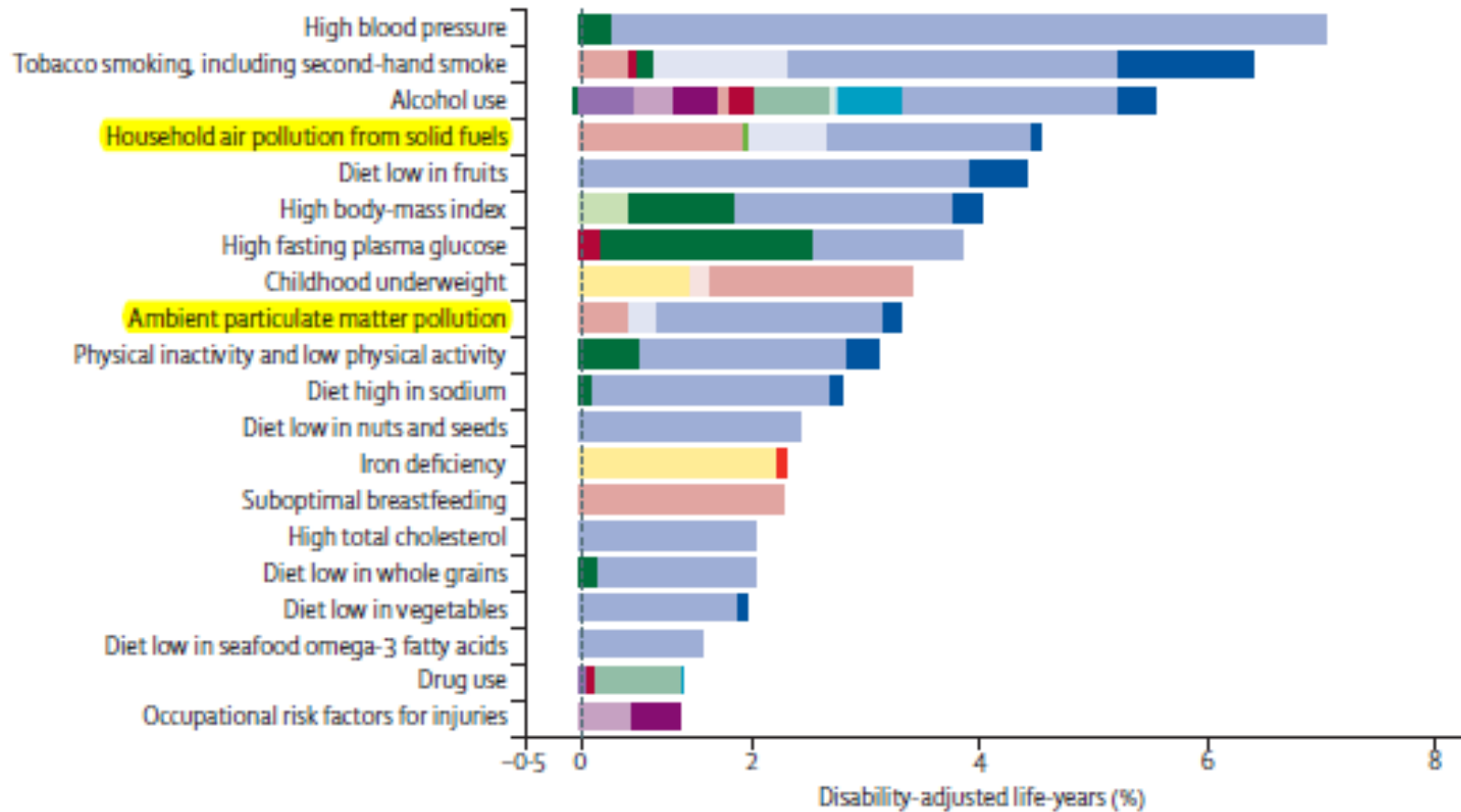
Paulo Saldiva

Faculty of Medicine – University of São Paulo

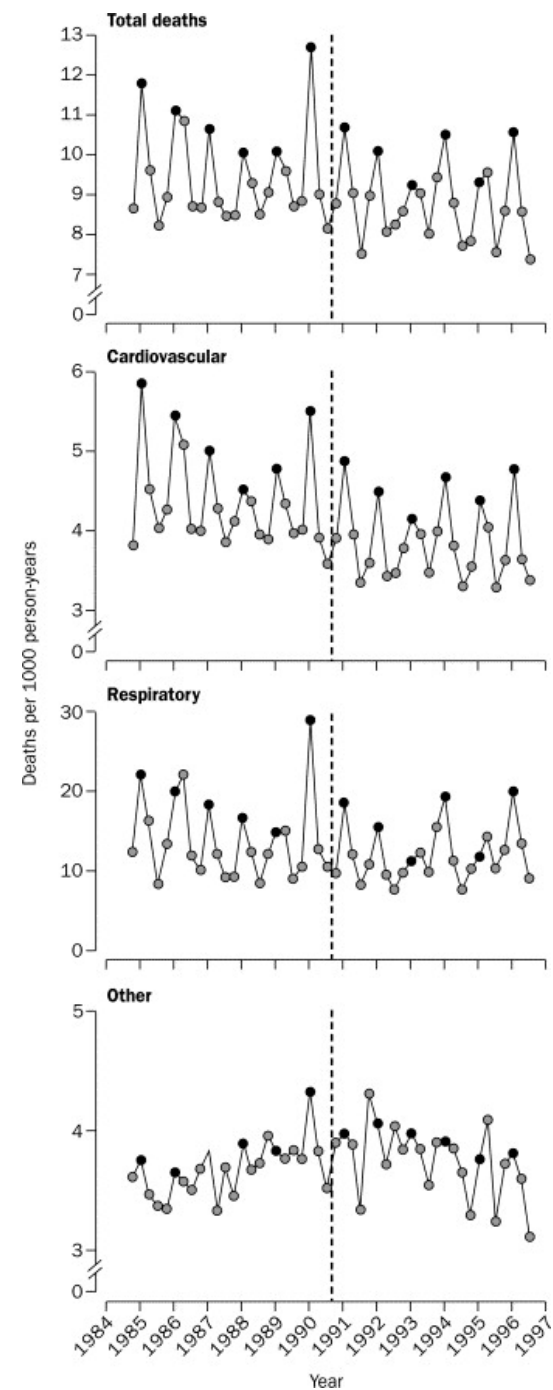
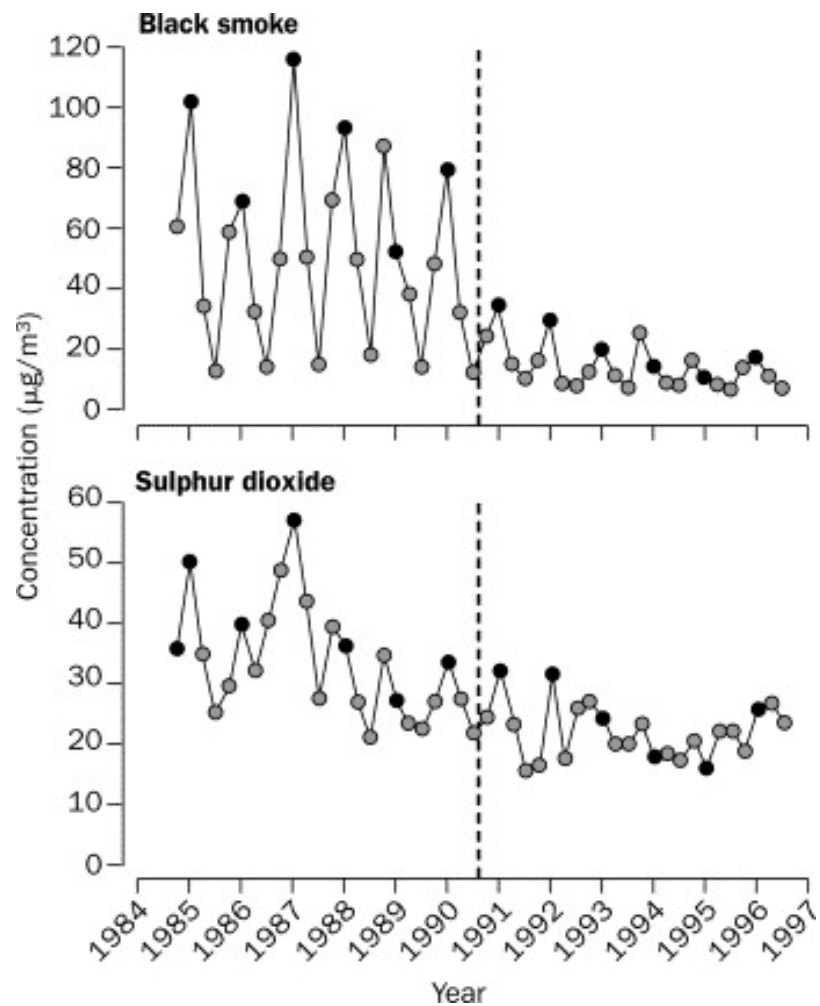
pepino@usp.br

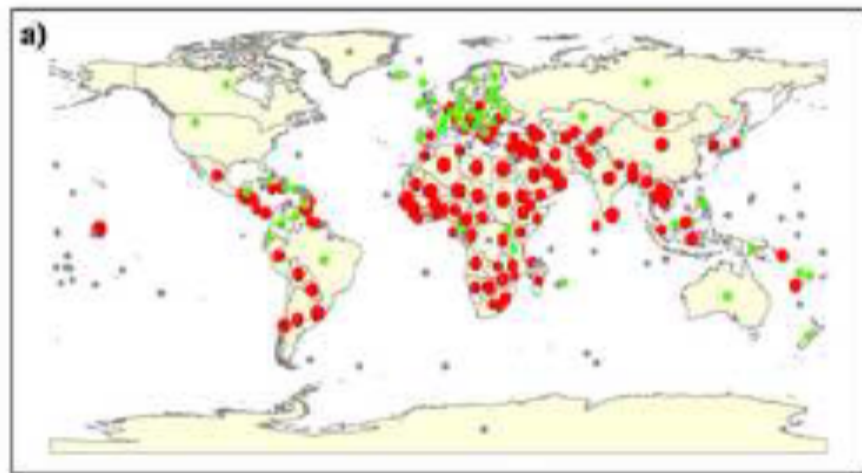


Background



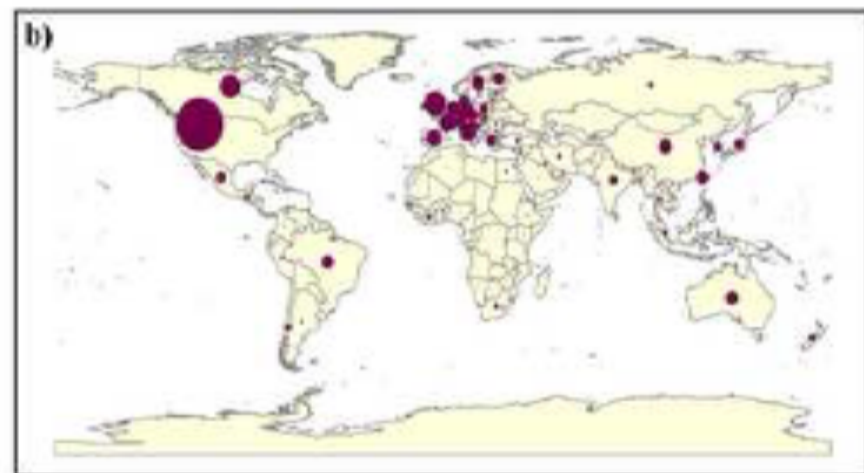
Burden of disease attributable to 20 leading risk factors in 2010, both sex





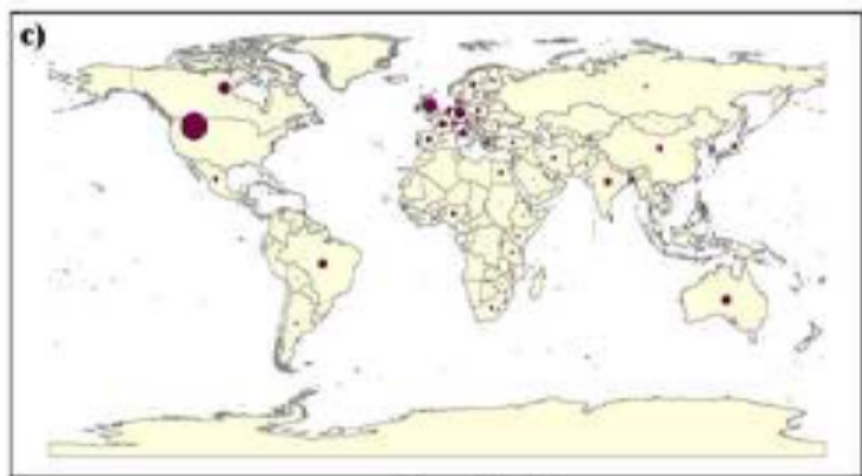
PM 10 ($\mu\text{g}/\text{m}^3$)

- 0 - 5
- 6 - 20
- 21 - 30
- 31 - 50
- 51 - 70
- 71 - 142



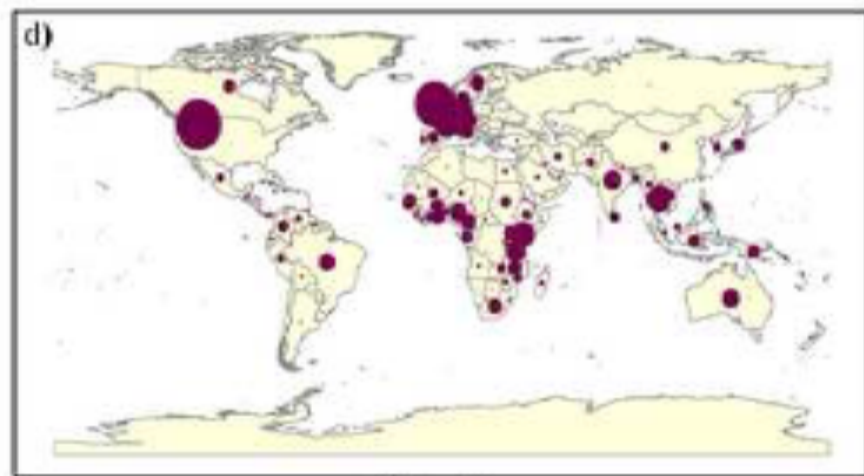
Air pollution articles

- 1
- 10
- 1,000



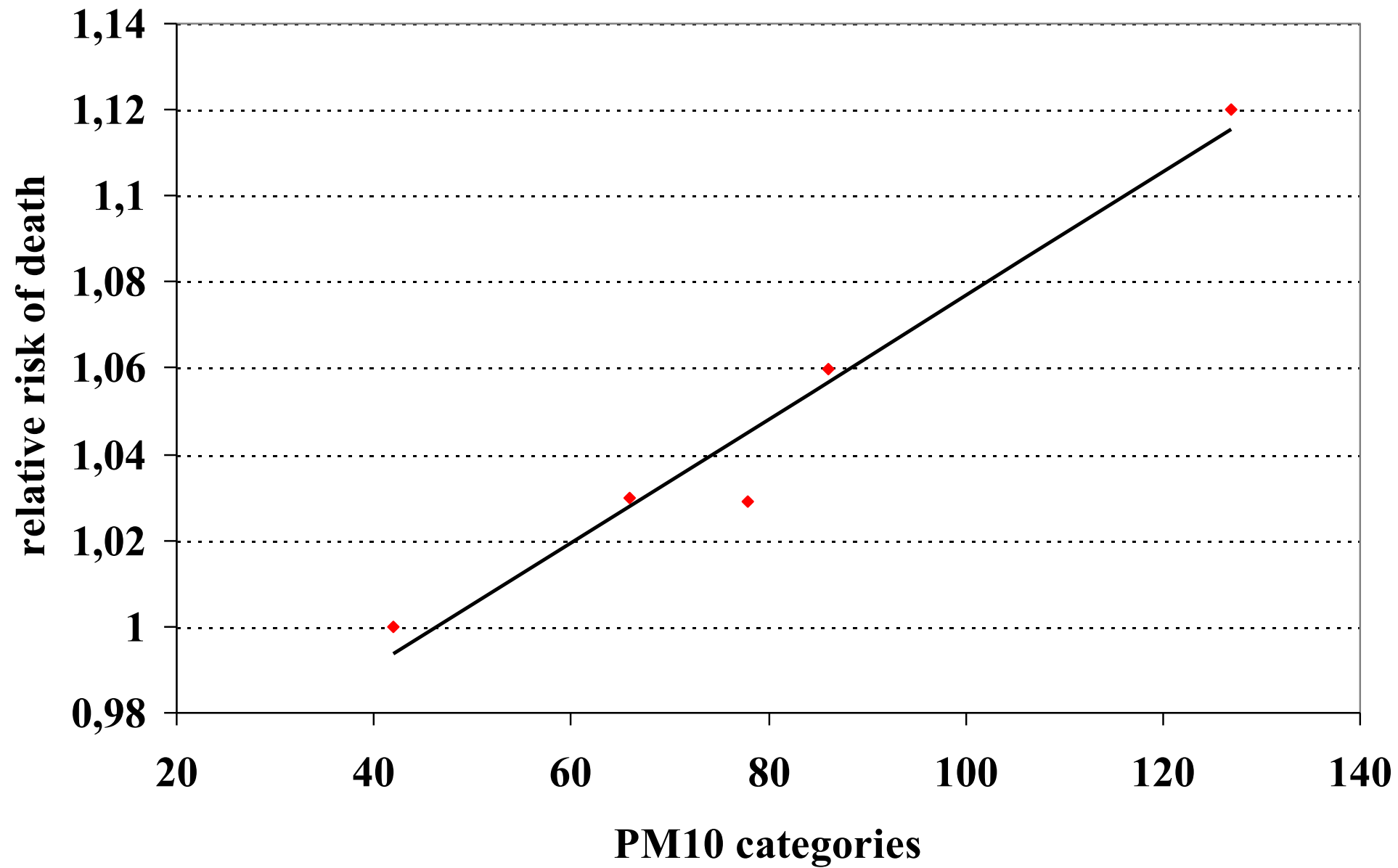
Water quality articles

- 1
- 10
- 1,000



Malaria articles

- 1
- 10
- 1,000



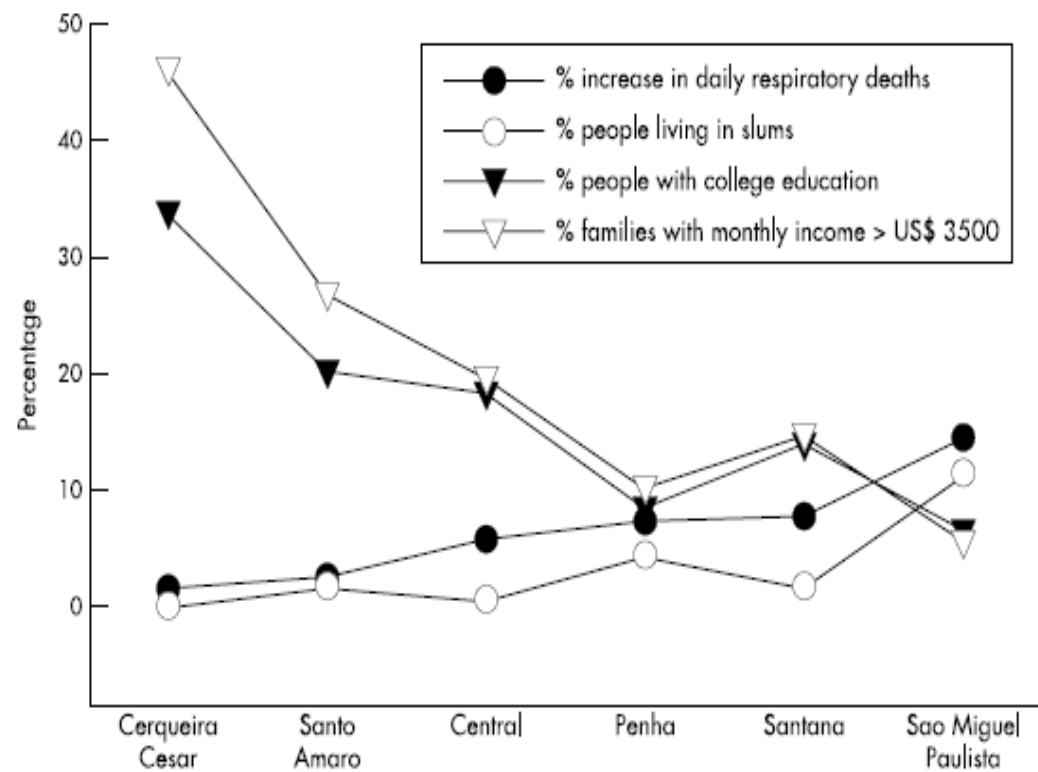
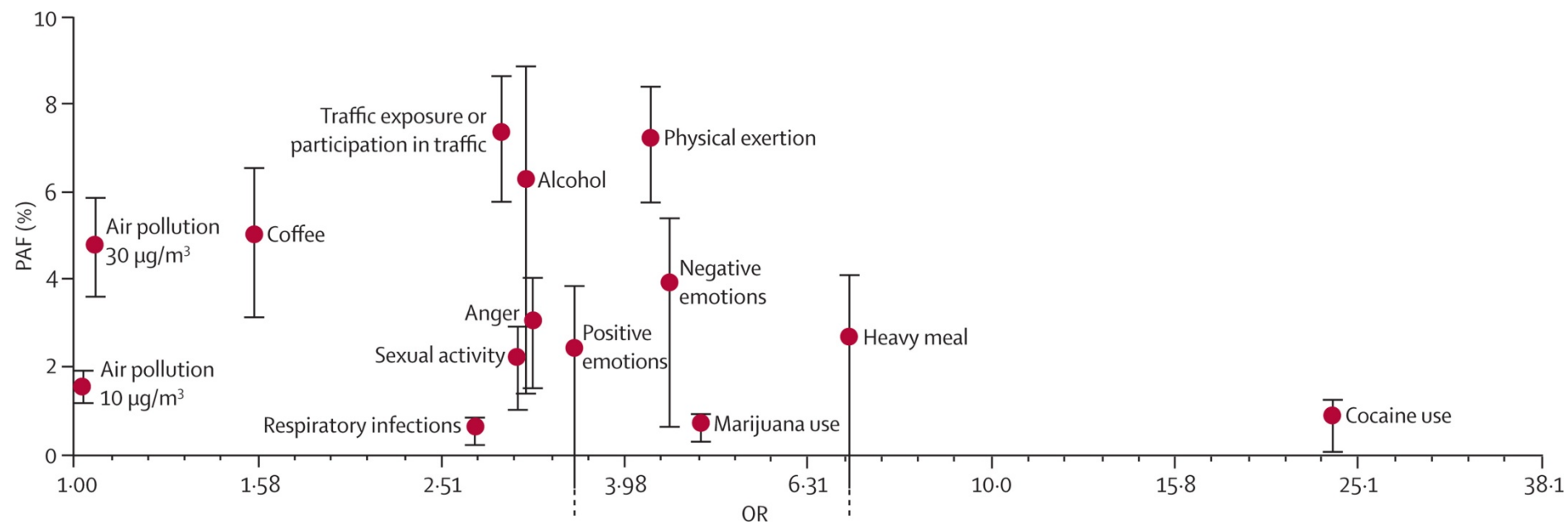
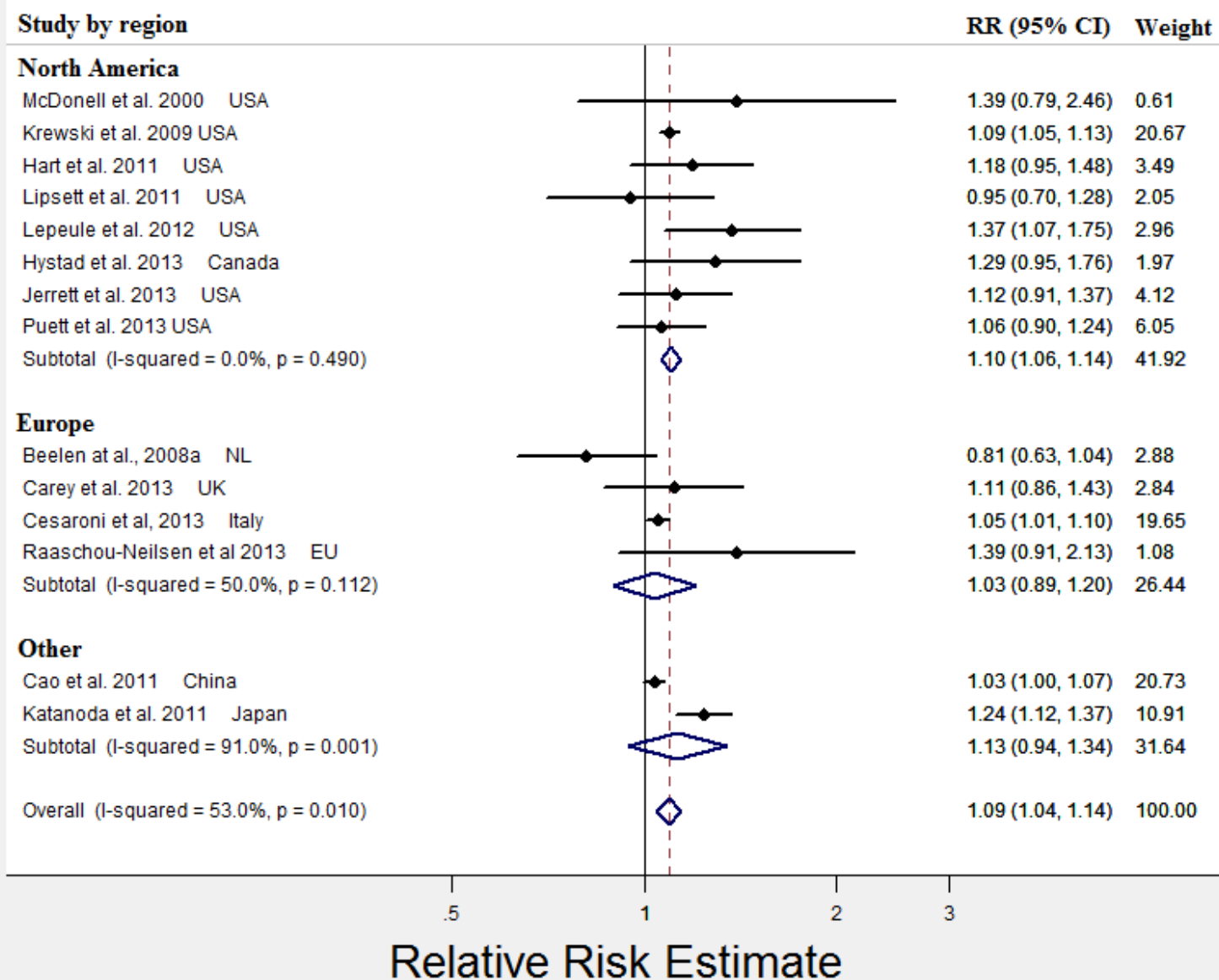


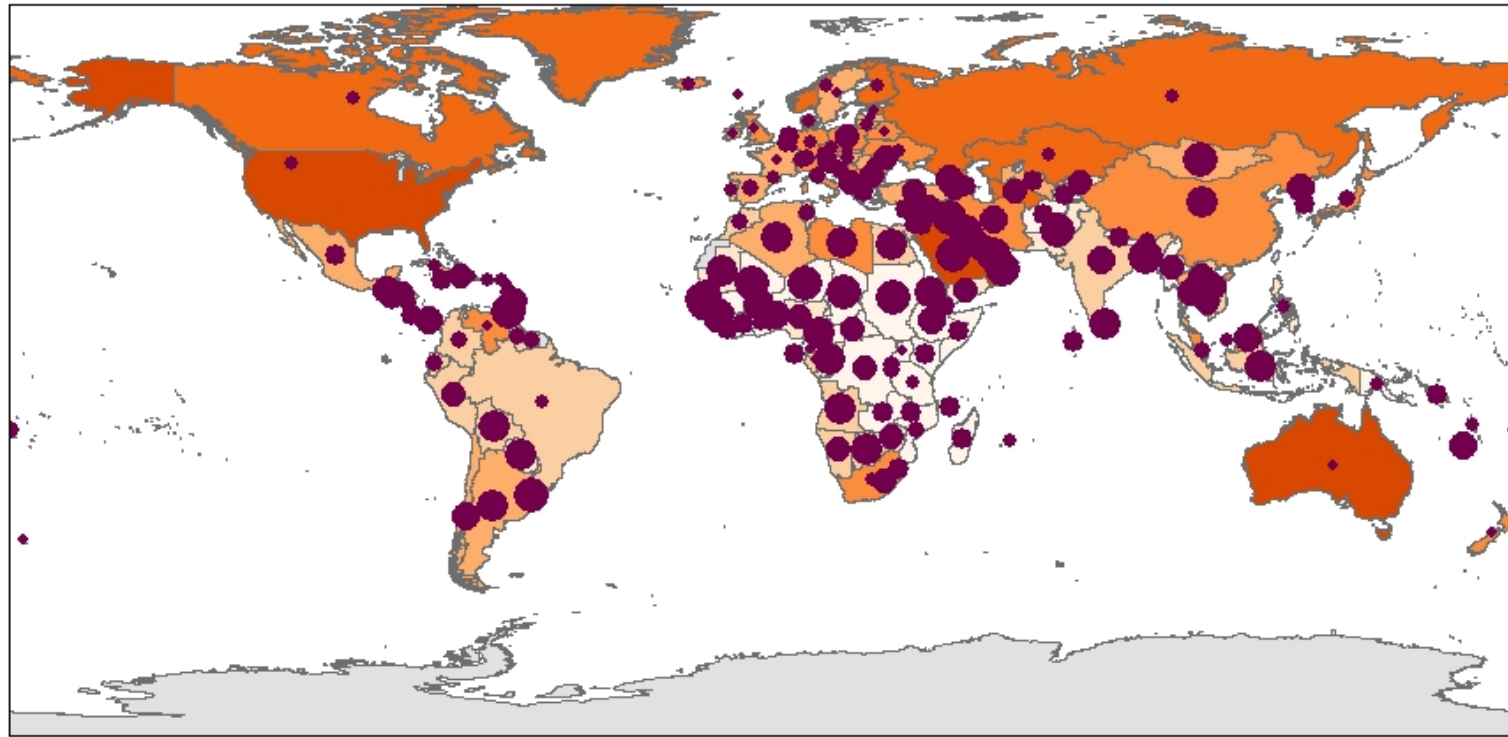
Figure 3 Percentage increase in daily respiratory deaths attributable to a $10 \mu\text{g}/\text{m}^3$ increase in three day moving average of PM_{10} and socioeconomic indicators in each region of the study.



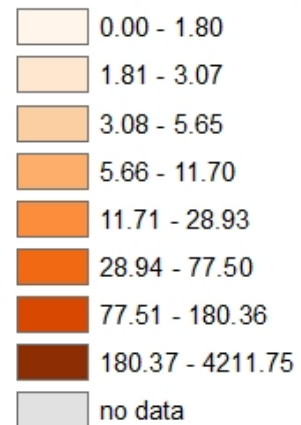
Lancet. 2011 Feb 26;377(9767):732-40

Lung Cancer and PM2.5 Meta-Analysis

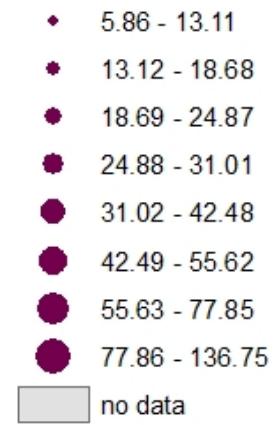


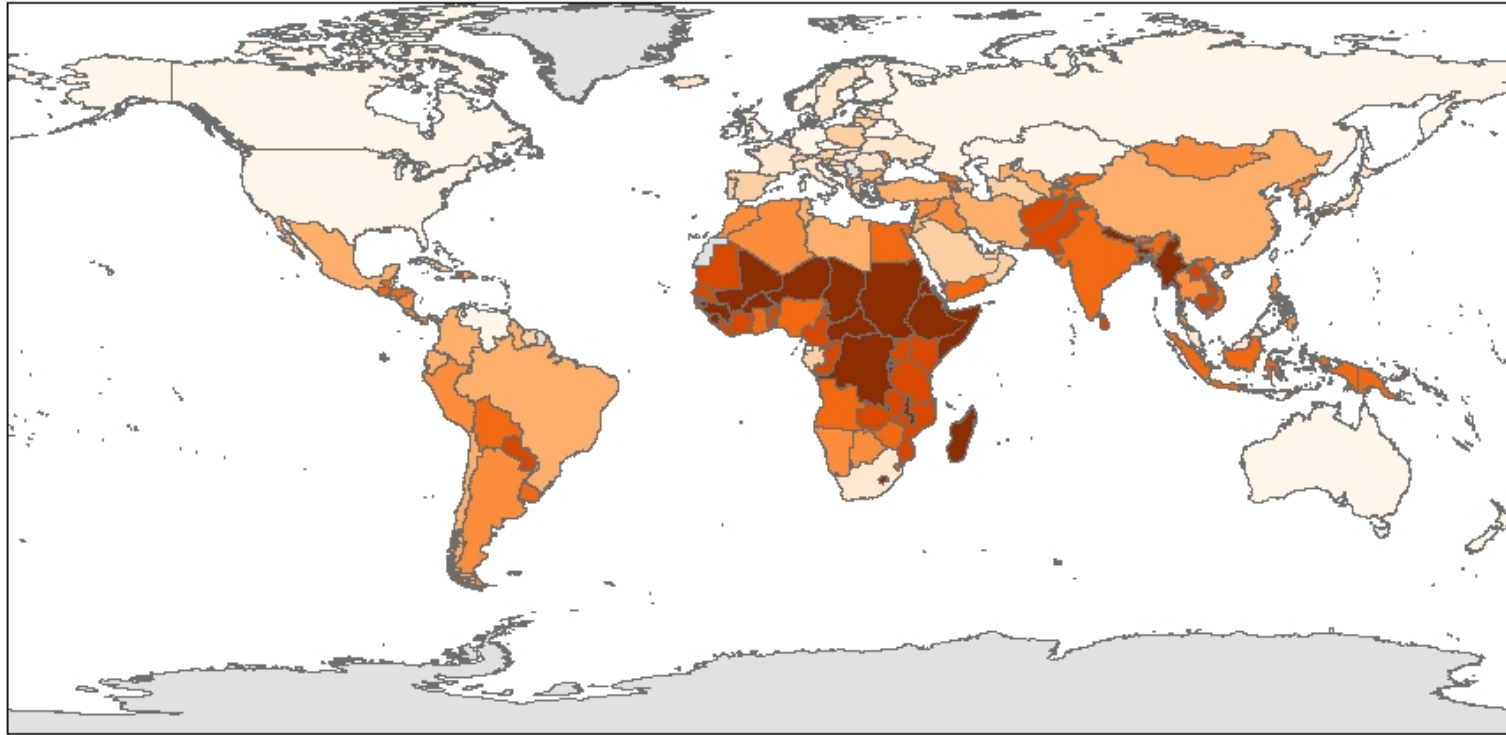


CO2 emissions
(metric tons per capita)

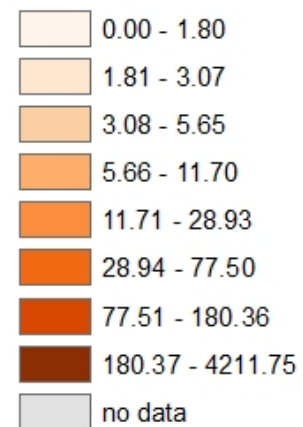


PM10
(micrograms per cubic meter)

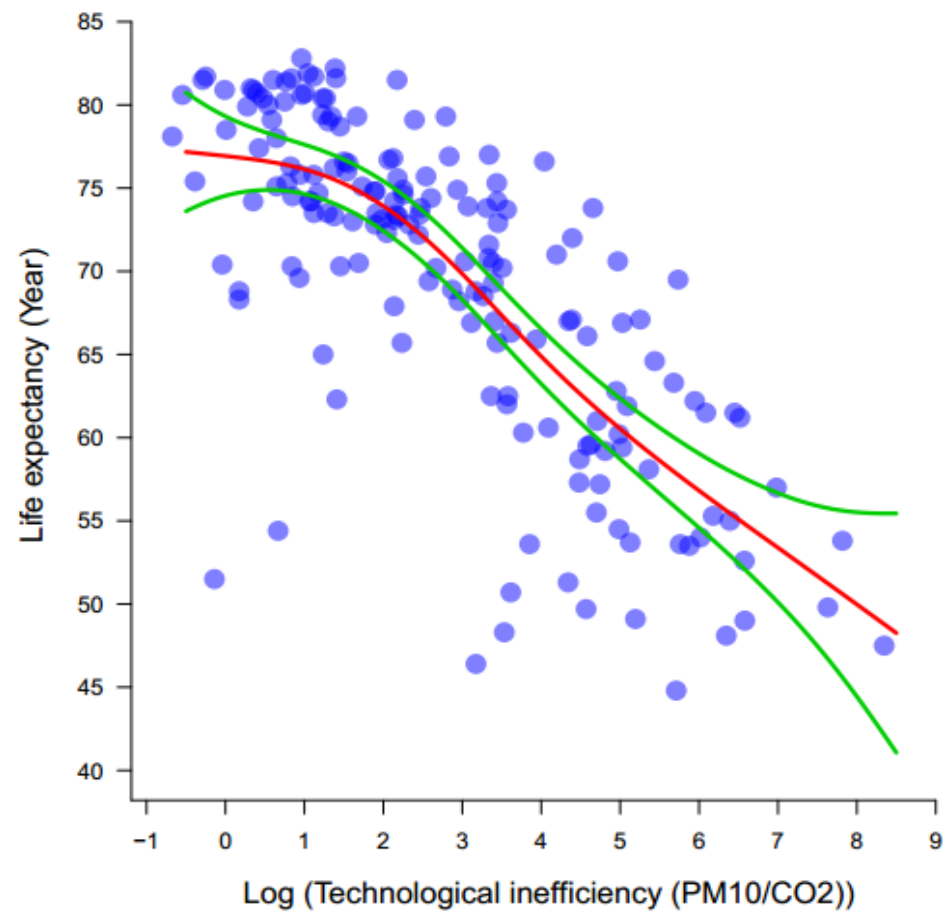


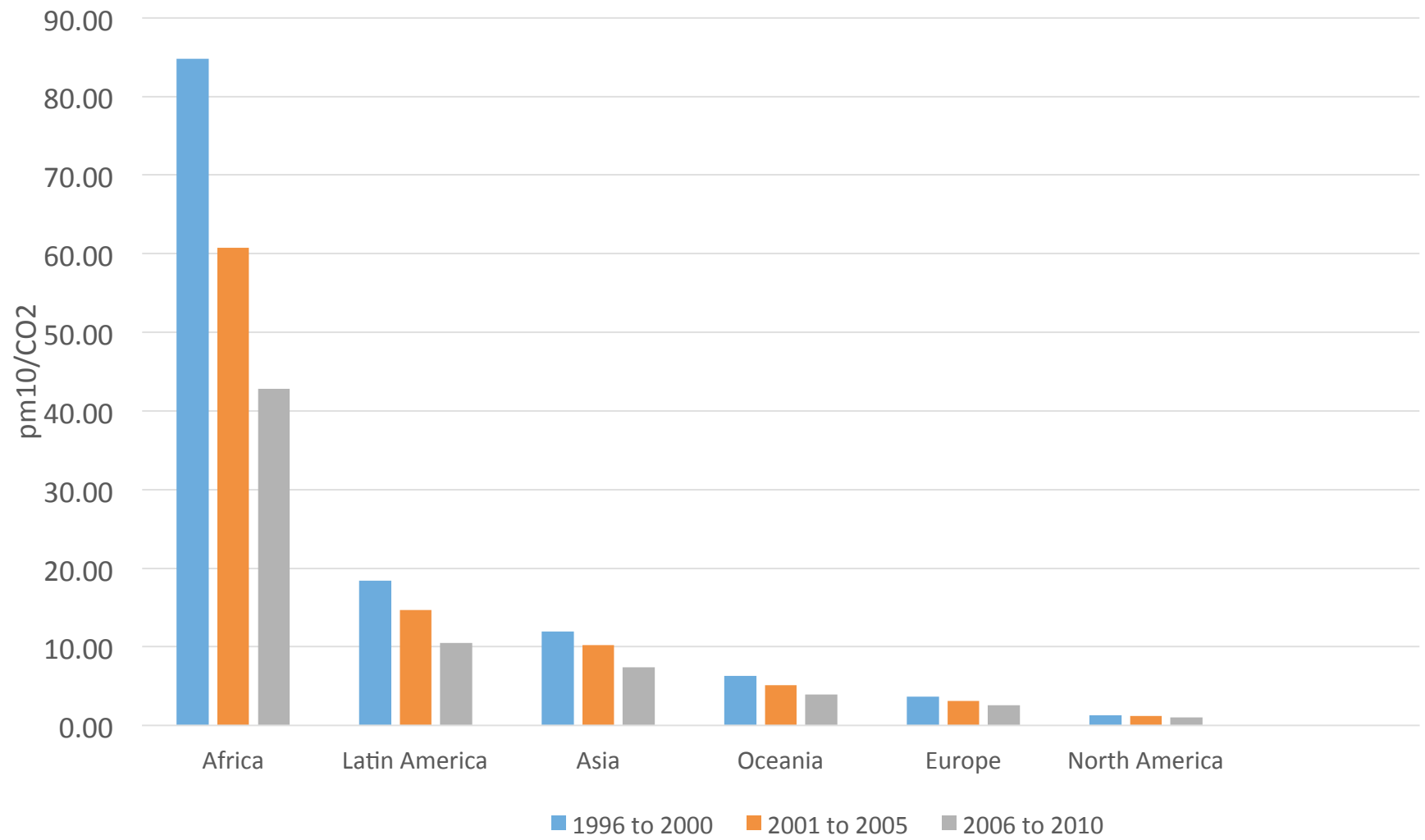


**Energetic Inefficiency Index
(PM10/CO2)**

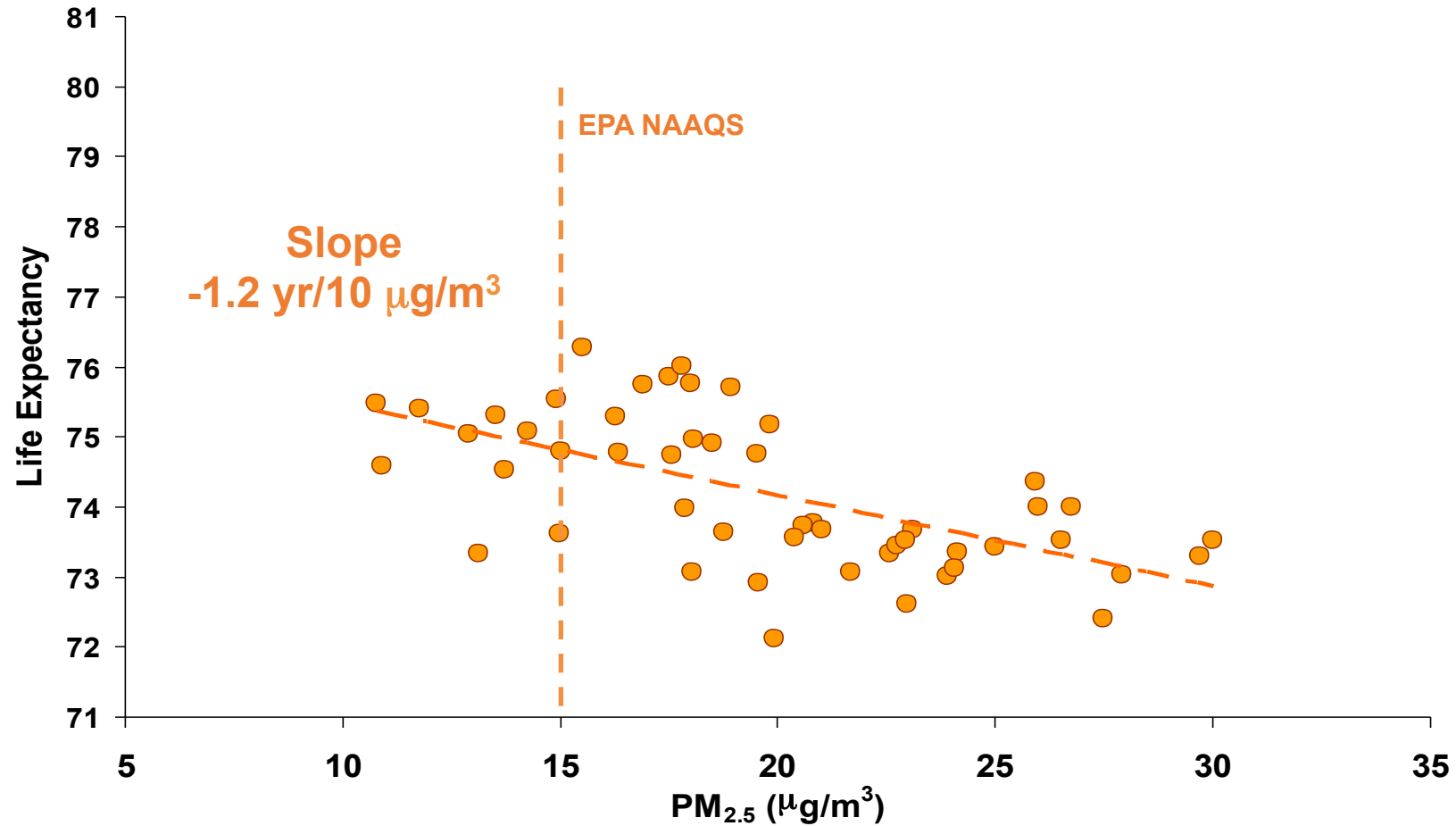


2010 data , source: the World Bank



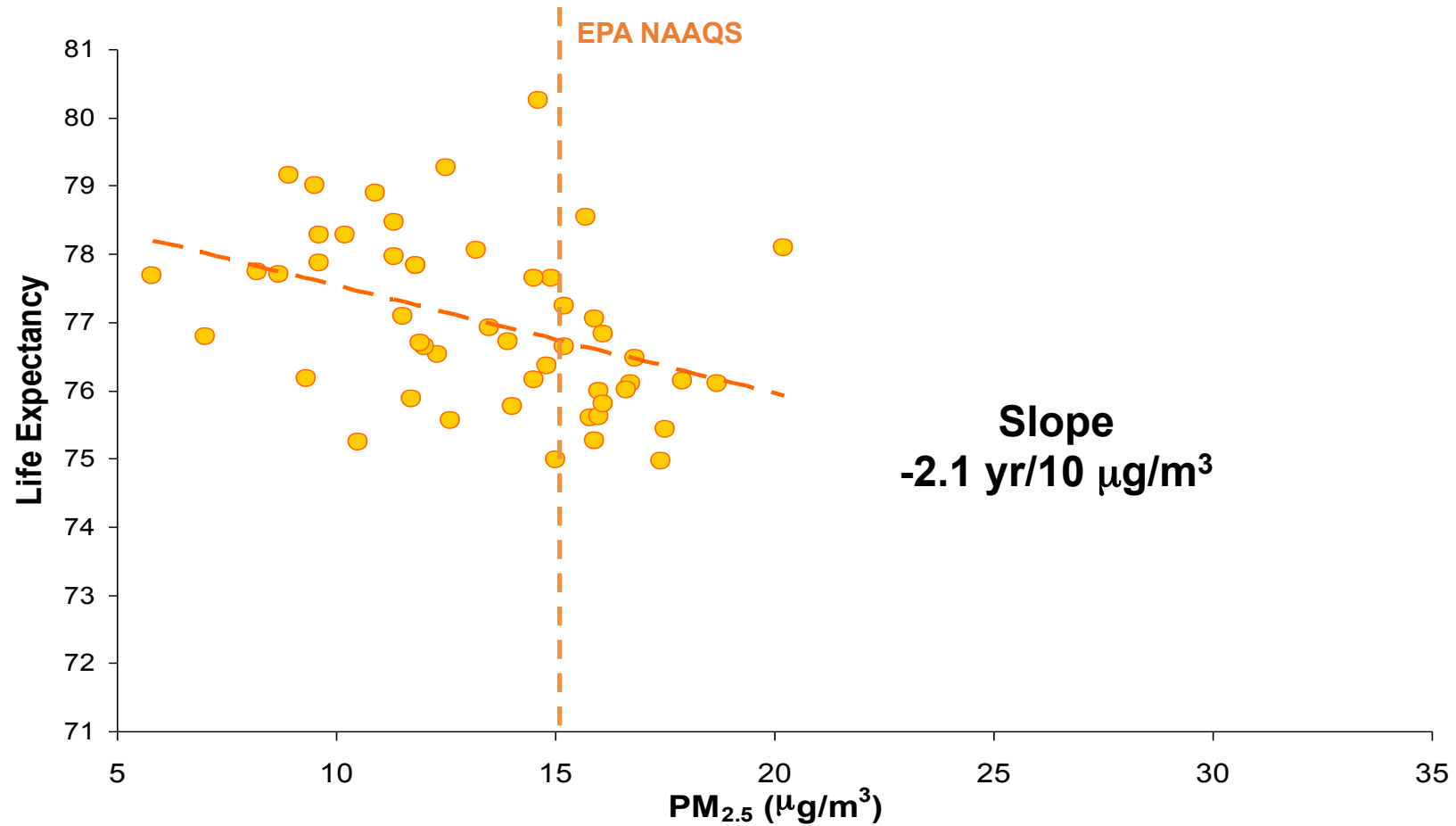


Life Expectancy vs PM_{2.5} 1978-82



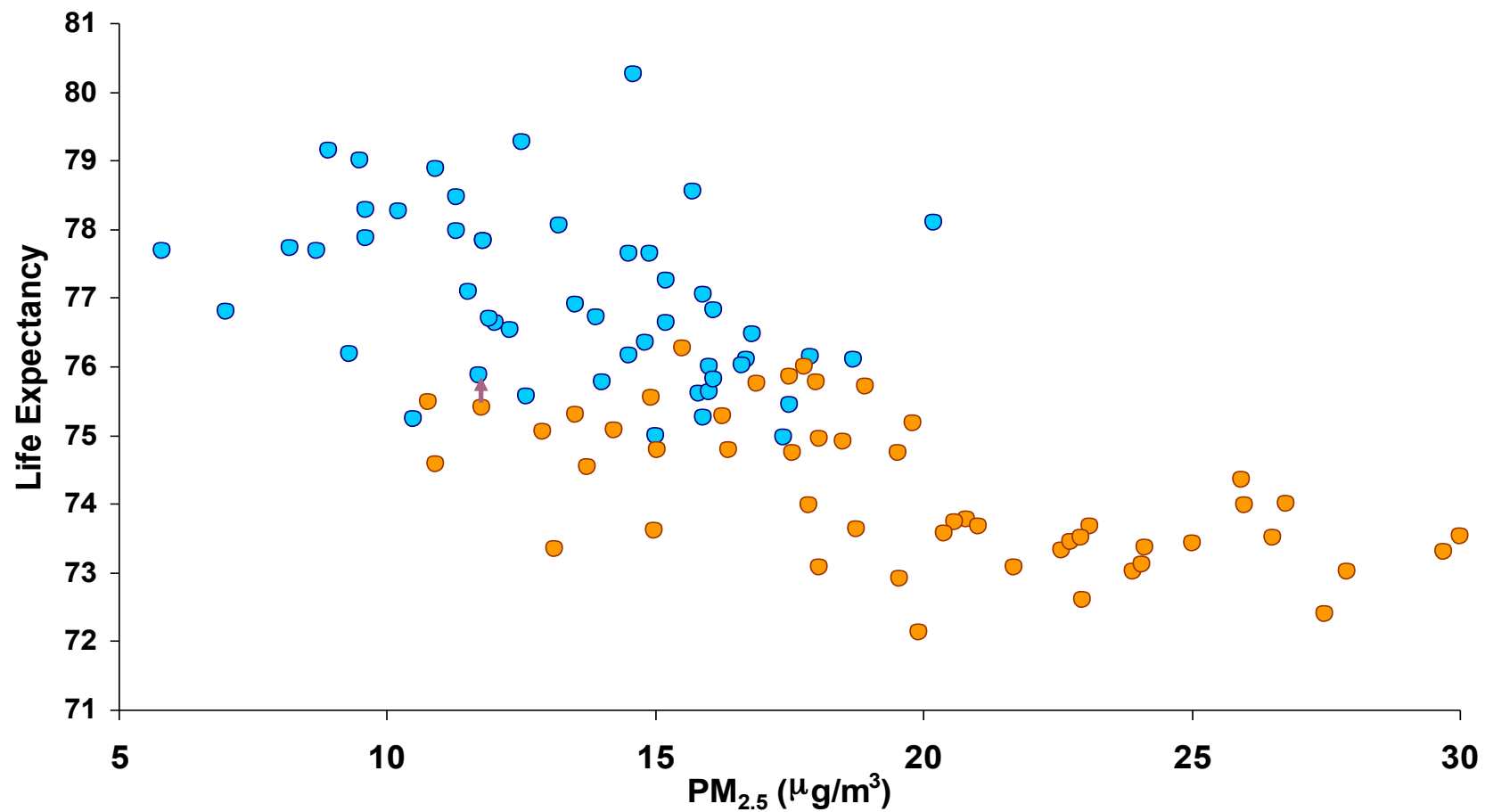
Pope, Ezzati, Dockery (NEJM 2009)

Life Expectancy vs PM_{2.5} 1997-2001



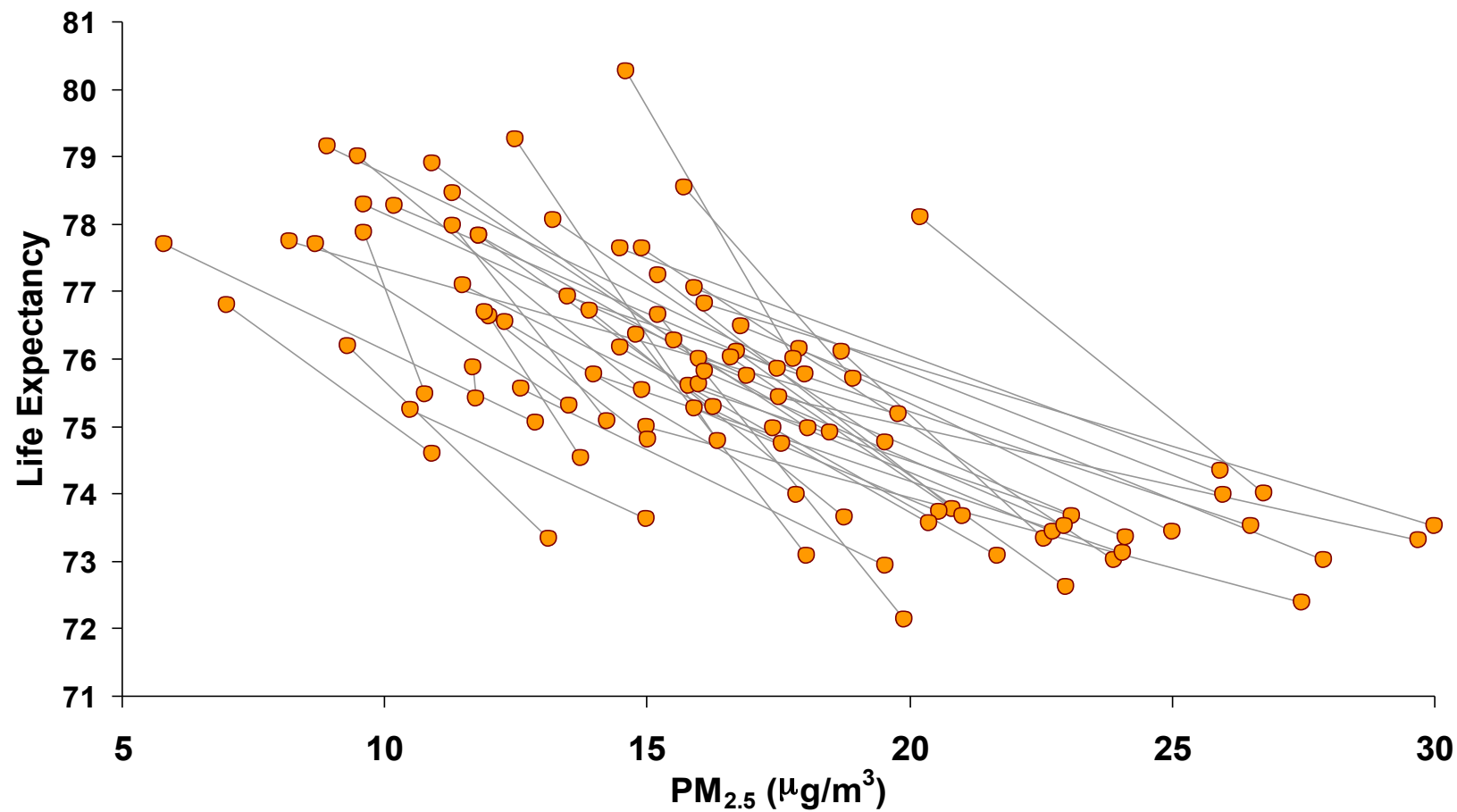
Pope, Ezzati, Dockery (NEJM 2009)

Life Expectancy vs PM_{2.5} 1980-2000



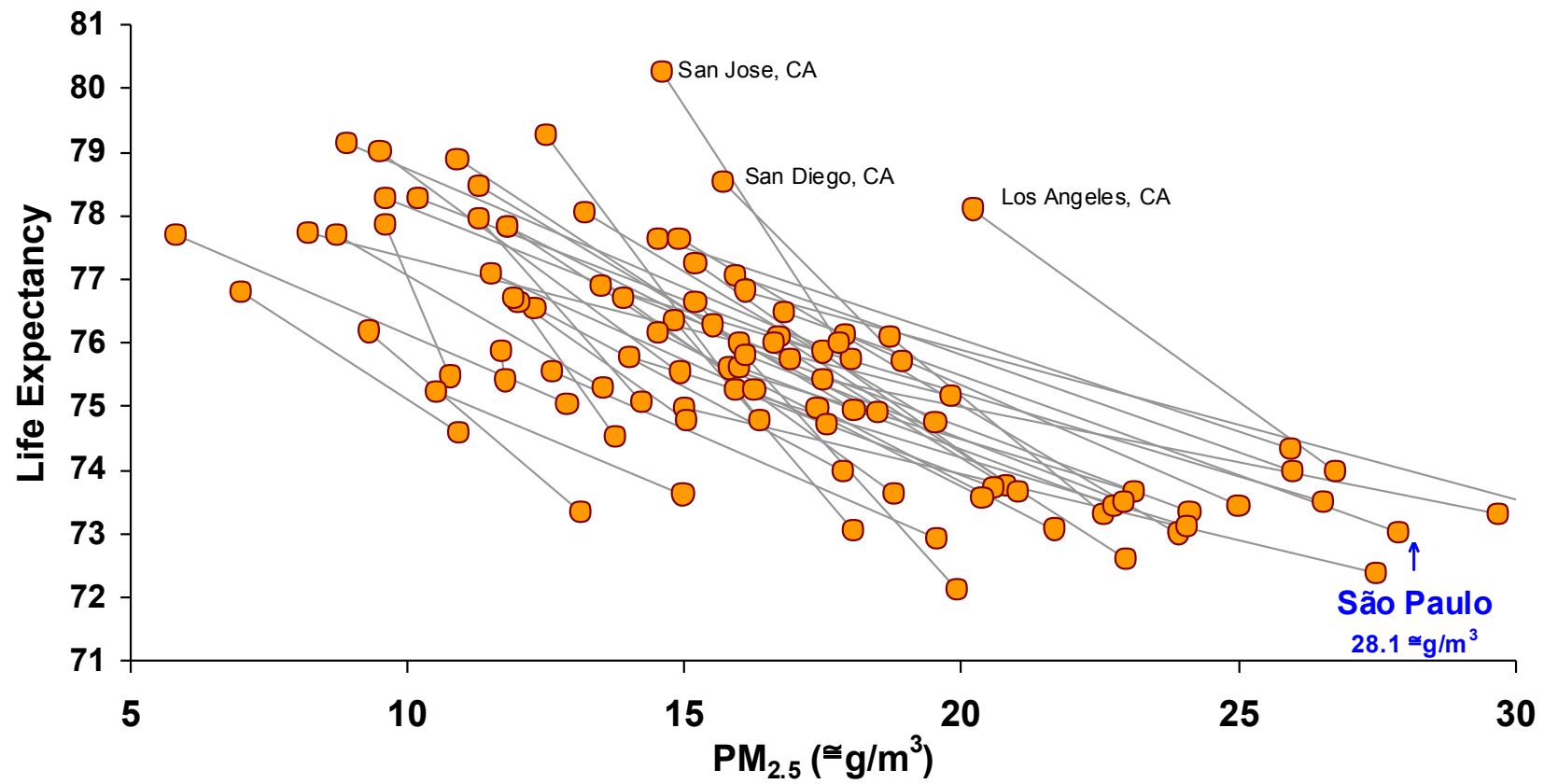
Pope, Ezzati, Dockery (NEJM 2009)

Life Expectancy vs PM_{2.5} 1980-2000

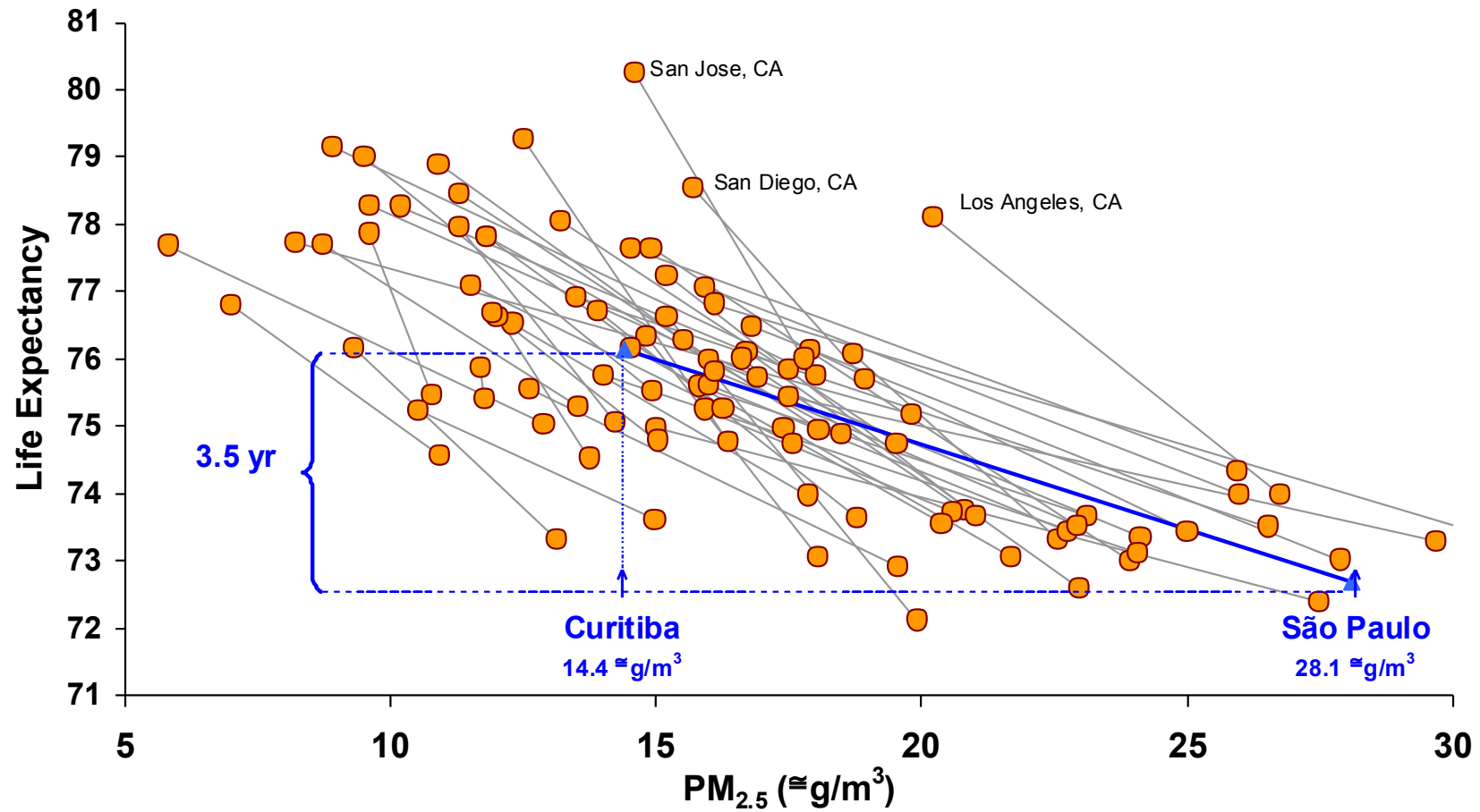


Pope, Ezzati, Dockery (NEJM 2009)

Life Expectancy vs PM_{2.5} 1980-2000



Life Expectancy vs PM_{2.5} 1980-2000



Health co-benefits of ethanol fuel.

Modelling scenarios

- #1 : Only Gasoline
- # 2: Gasool with 25% of anhydrous ethanol
- #3: Gasool + hydrous ethanol in the same proportions employed in 2009

Changes in emission factors and corresponding estimates in health outcomes

- PM2.5 (Silva, 2007)
 - Gasool = 4,351 mg/Km
 - Etanol = 1,411 mg/Km
- Ozone , Martins & Andrade (2008)
 - Scenario #1: 29 ug/m3
 - Scenario #2: 21,75 ug/m3
- Variatiion in health outcomes = $[\exp (\beta * (\Delta \text{pol}) - 1] * \text{tot}$
 - Respiratory and cardiovascular morbidity
 - Mortality

	SCENARIO		
	#1: GASOLINE	#2: GASOOL	#3: GSOOL+HIROUS.
DIAGNOSIS			
MP2,5	INCREASE	INCREASE	REDUCTION
OZONE	INCREASE	INCREASE	REDUCTION
OUTCOMES			
MORBIDITY	9.247	6.553	-505
MORTALITY	1.384	856	-226
VALUATION (US\$ X 1000)			
MORBIDITY	11.065	7715	-815
MORTALITY	160833	99475	-26263
TOTAL	171897	107190	-27078

Conclusions

- Reduction of air pollution provides short term health co-benefits of GHG emission reductions.
- This information can be used for cost-benefit analyses as well as for foster policies aimed to promote sustainable practices
- Health co-benefits of GHG reductions will be more effective in developing economies
- Ethanol represents a short term alternative to reduce GHG and improve health in the urban scenario