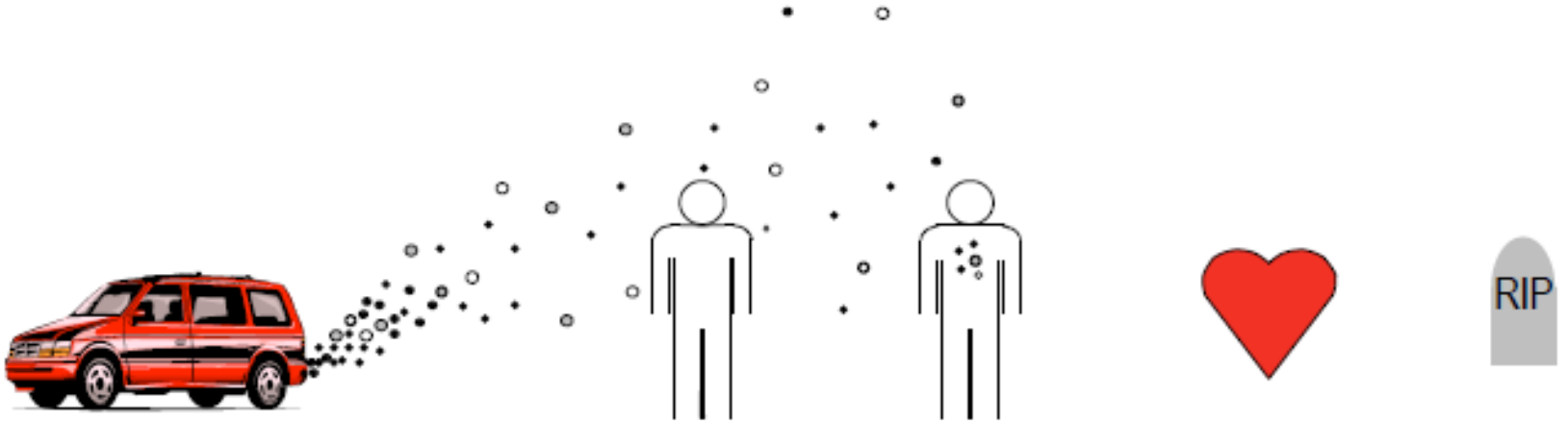
Somewhere in Lebanon today…

How do we rank these emission sources?

Vs.

Vs.

Emissions-to-health effects paradigm (Smith, 1993)



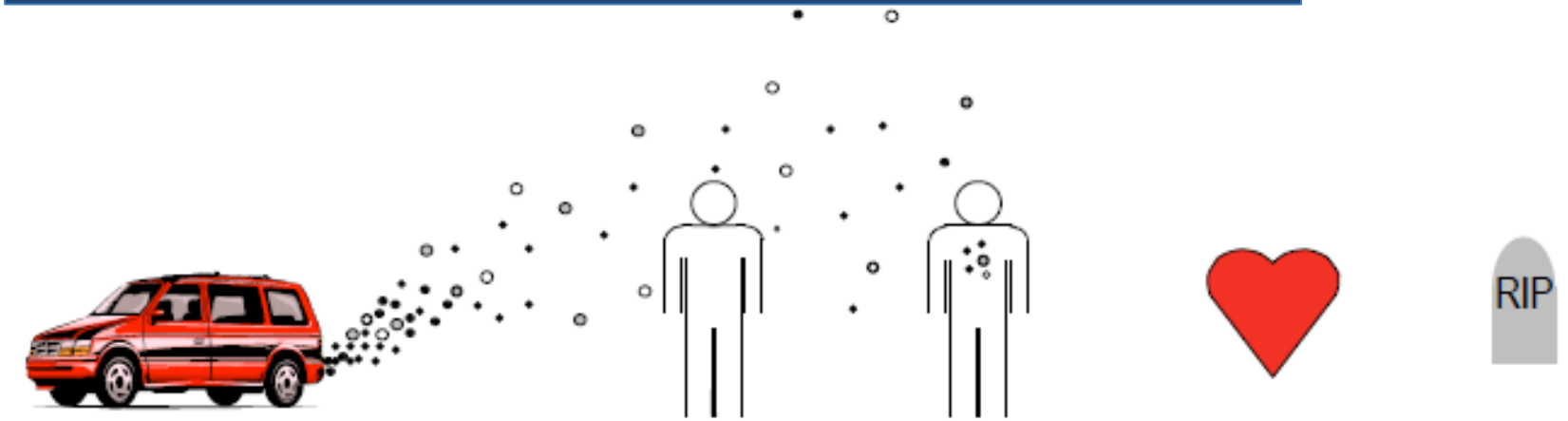
emissions → concentration → exposure → intake → dose → health effects

Nazaroff, AAAR 2010

Smith, K.R., 1993. Fuel combustion, air pollution exposure, and health: The situation in developing countries. Annual Review of Energy and the Environment 18, 529-566.

Emissions-to-health effects paradigm (Smith, 1993)

Exposure – intersection in space & time between pollutants & people



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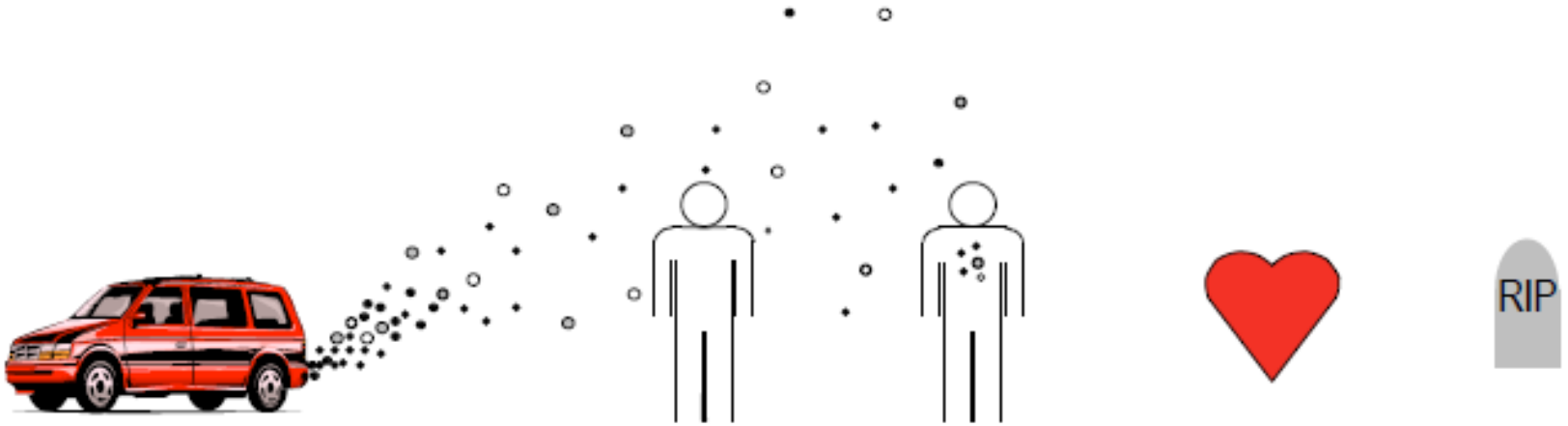
Inhaled fraction, *iF*

$$iF = \frac{\sum_{\text{people, time}} \text{intake of pollutant by an individual } (mass)}{\text{mass released into the environment } (mass)}$$

emissions → [ ] → intake → dose → health effects



emissions → concentration → exposure → intake → dose → health effects

Inhaled fraction, *iF*

$$iF = \frac{\sum_{\text{people, time}} \text{intake of pollutant by an individual } (mass)}{\text{mass released into the environment } (mass)}$$

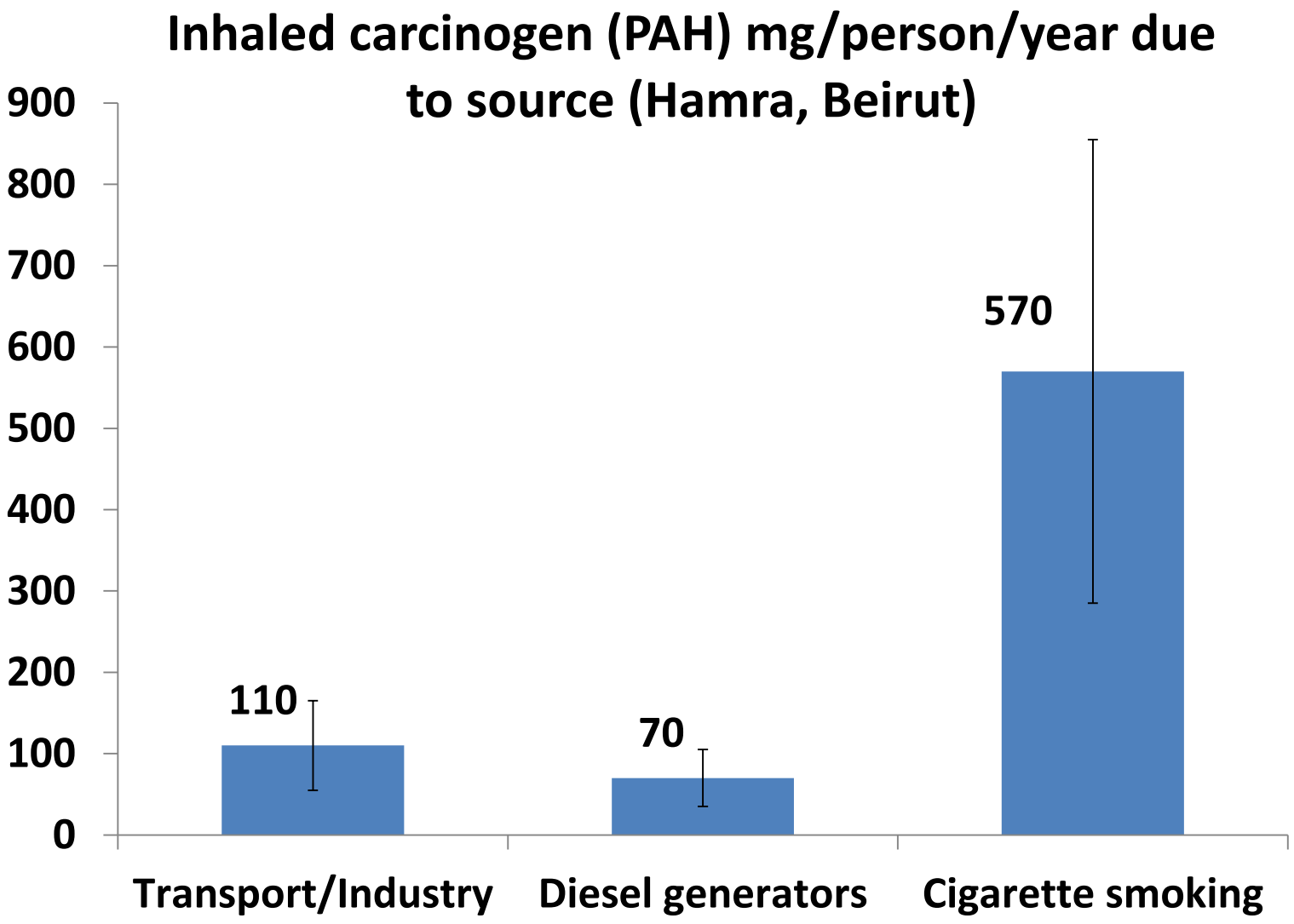
iF	outdoor emissions	~ 1/1,000,000
	indoor emissions	~ 1/1,000
	into mouth (cigarette)	~ 1

So how much PPAH do we inhale from which sources?

Assumptions

Population of Lebanon	~ 4 million	
smokers	~ 1 million	
non-smokers	~ 3 million	
Cigarettes smoked/day	25 million (2,138/capita Tob A	
First-hand PPAH/cig	0.25 ug	
Second-hand PPAH/cig	2.5 ug	
Outdoor air carcinogen concentration	PPAH ng/m3	
Background (24 hrs)	20	
Local generators (3 hrs)	73	
Other generators (9 hrs)	35	
Smoking indoor/outdoor	0.5	
iF indoor SHS	0.007	
iF outdoor SHS	0.0035	
iF first-hand	1	

Population weighted-average breathing rate 15 m3/day



1 CIG = 0.25 μg PAH