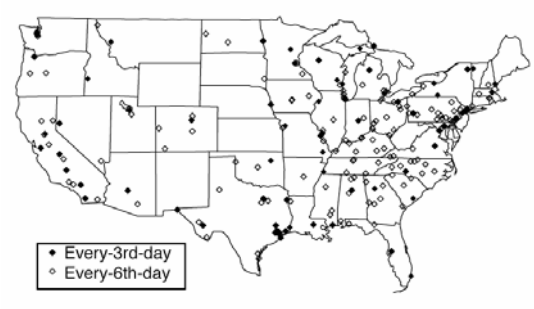
Some issues associated with the use of speciated PM data for health effects analysis

Kaz Ito

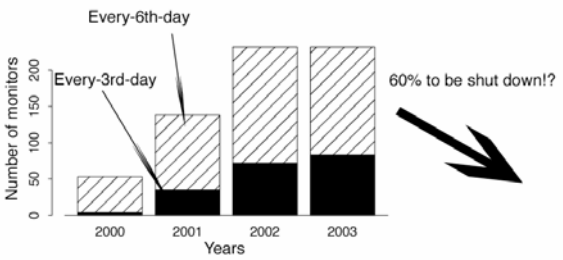
NYU School of Medicine

(1) Lots of data, but we could always use some more...

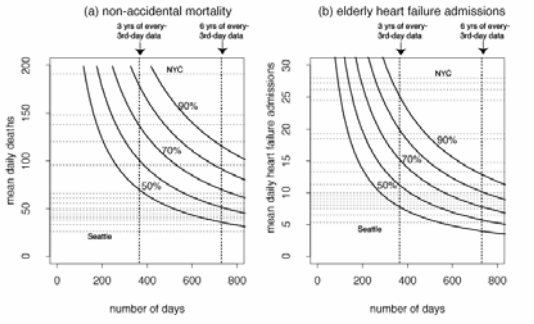
There are more every-6th-day monitors than every-3rd-day monitors



But many are being shut down



Implication of every-6th-day and every-3rd-day data: Statistical power for time-series studies



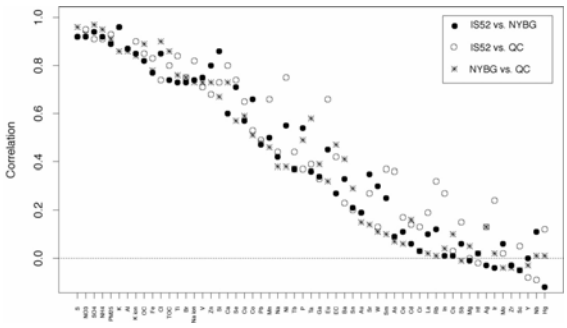
BUT, what's not considered here is PM components' variation

(2) Spatial resolution of speciation data for time-series studies

There are 3 monitors in NYC that are collecting PM chemical species

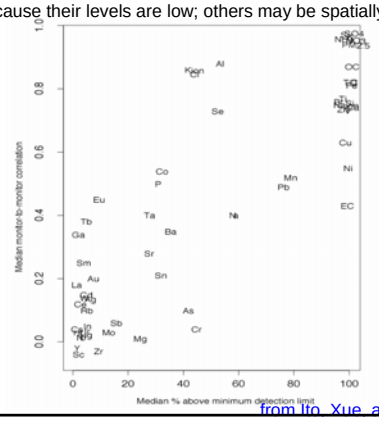
from Ito, Xue, and Thurston, 2004

Temporal correlation of PM components across 3 monitors sorted by the smallest of the three correlations



from Ito, Xue, and Thurston, 2004

Some elements have low monitor-to-monitor correlations because their levels are low; others may be spatially variable



from Ito, Xue, and Thurston, 2004

But do we care about all of these species?

....No

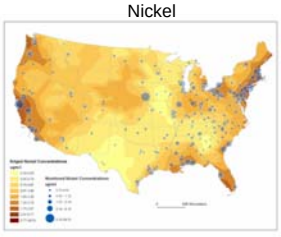
Some of the candidate PM components of interest

PM Components	Main sources[1]	High concentration region[2] / areas	Within-city uniformity[3] (temporal correlation)
Ni	Oil, metal	NE, SC, near coastal ports, point source	Moderate to high
V	Oil	NE, SC, near coastal ports	Moderate to high
Pb	Metal, incinerator	IM, point source	Moderate to low
Zn	Metal, incinerator	IM, point source	Moderate
Cr	Metal	IM, SC	Moderate to low
Mn	Metal	IM, SC	Moderate
Fe	Soil, steel mill	IM, SW, NW, SC	Moderate
Si	Soil	SW	Moderate
As	Coal, smelter	IM, SE	Moderate to low
Se	Coal	IM, NE	Moderate
Sulfate	Secondary (coal)	NE, IM, SE	High
Nitrate	Secondary (NO_x)	SC	High
Elemental carbon	Traffic, combustion	SC, NW, near traffic	Moderate to low
Organic carbon	Traffic, combustion	SC, near traffic	High to moderate

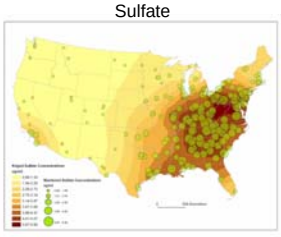
1: Main sources: Oil=residual oil combustion; Metal=metal processing/smelter.
2: Regions of US: NE=Northeast; IM=Industrial Midwest; SE=Southeast; UM=Upper Midwest; SW=Southwest; NW=Northwest; SC=Southern California.
3: Within-city uniformity is based on our current evaluation and the NYC results (Ito et al., 2004)

The PM components of interest are geographically distributed differently

Nickel



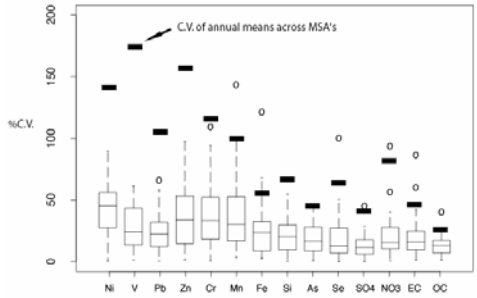
Sulfate



Kriged geographic distribution of Ni and sulfate from the $PM_{2.5}$ speciation database

ZevRoss Spatial Analysis

Spatial/temporal correlation of PM components varies across species and in the U.S. cities.

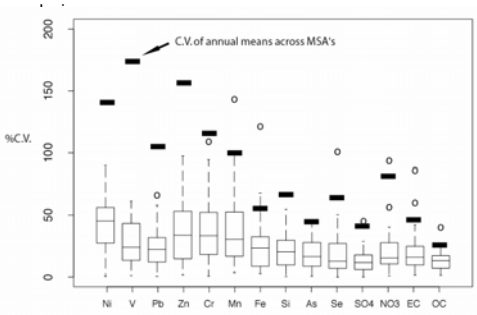


Distribution of median monitor-to-monitor correlation from 28 MSA's where multiple speciation monitors were available

Discussion

- We will have just about enough power to analyze the PM2.5 mass concentration data in time-series health effects studies in large individual cities. But, the power to detect certain PM components does vary across cities.
- Spatial representativeness of the PM components (of interest) should be characterized/evaluated in each city.
- Interpretation of relative strength of associations with health outcomes across PM components will need to take into consideration the likely differential exposure characterization errors.

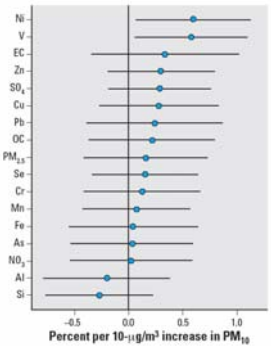
The story is a bit different for long-term effects (cross-sectional)



Comparison of coefficient of variation (C.V.) of annual (multi-year, '00-'03) means across MSA's (denoted with bold "-") and distribution of within-MSA C.V.'s of annual means in the 28 MSA's where multiple monitors were available. "o" represents extreme value.

An alternative use of speciation data:

Are PM constituents responsible for the heterogeneity of PM10 mortality risk estimates across the NMMAPS US cities?



Differences in mortality risk coefficients shown as the 5th-to–95th percentile difference in concentrations of FPM and FPM components for the 60 NMMAPS MSAs for which FPM speciation data were available. from Lippmann et al. in press 2006

Wish List:

Daily speciation monitors in large cities would be nice.

http://www.girlpower.gov/