

Air Quality and Health Effects: a Ponzi Science Scheme?

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Incentives

1. Need p-value less than 0.05 to publish.
2. Positive results are funded.
3. Negative result stops funding.
4. Confirmation bias.
5. Technically easy to get p-value less than 0.05.
 - a. Manipulate data.
 - b. Test lots of questions, p-hacking.
 - c. Compute multiple models, p-hacking

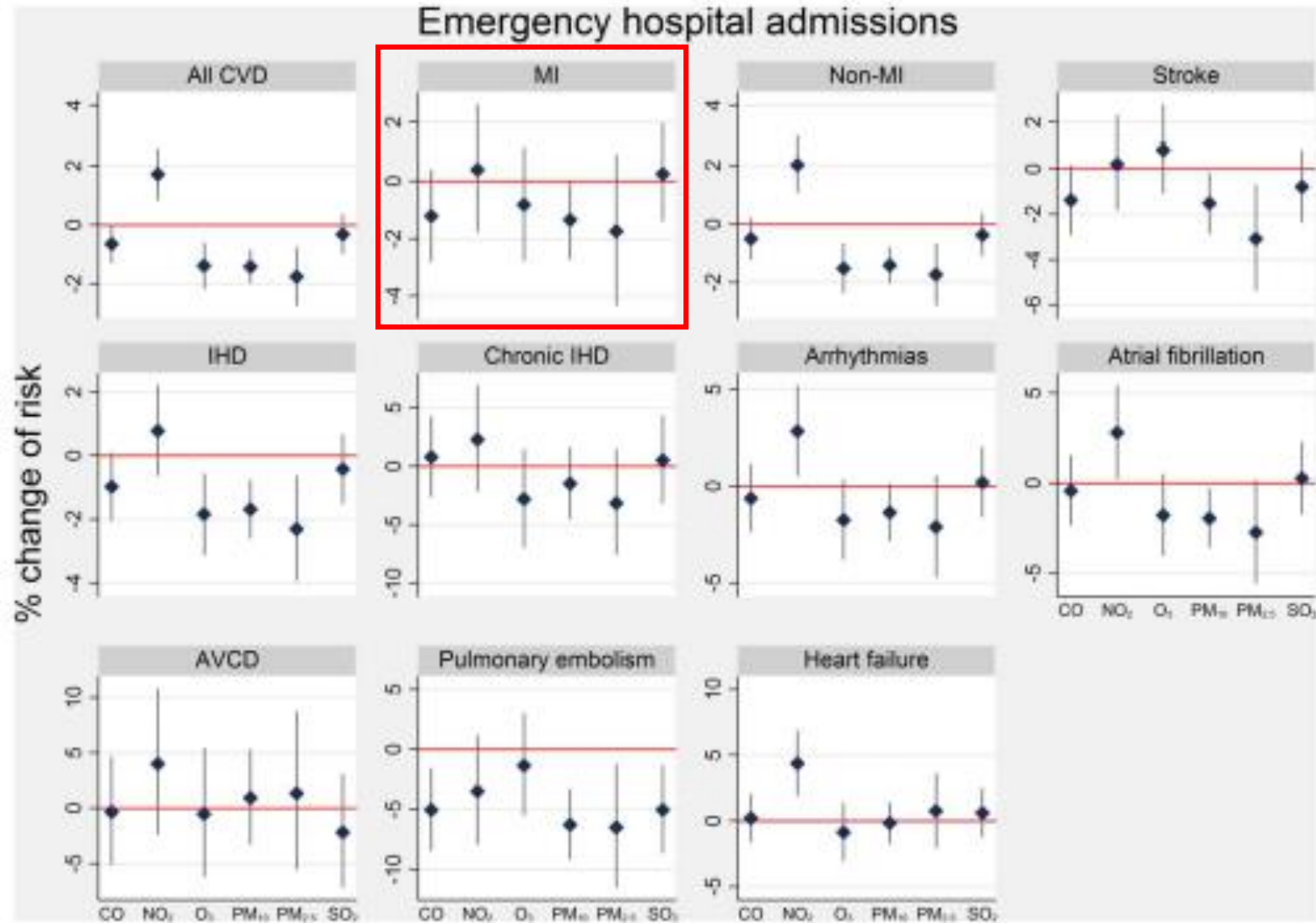
Negative paper, massive data set

Short-term effects of air pollution on a range of cardiovascular events in England and Wales: case-crossover analysis of the MINAP database, hospital admissions and mortality

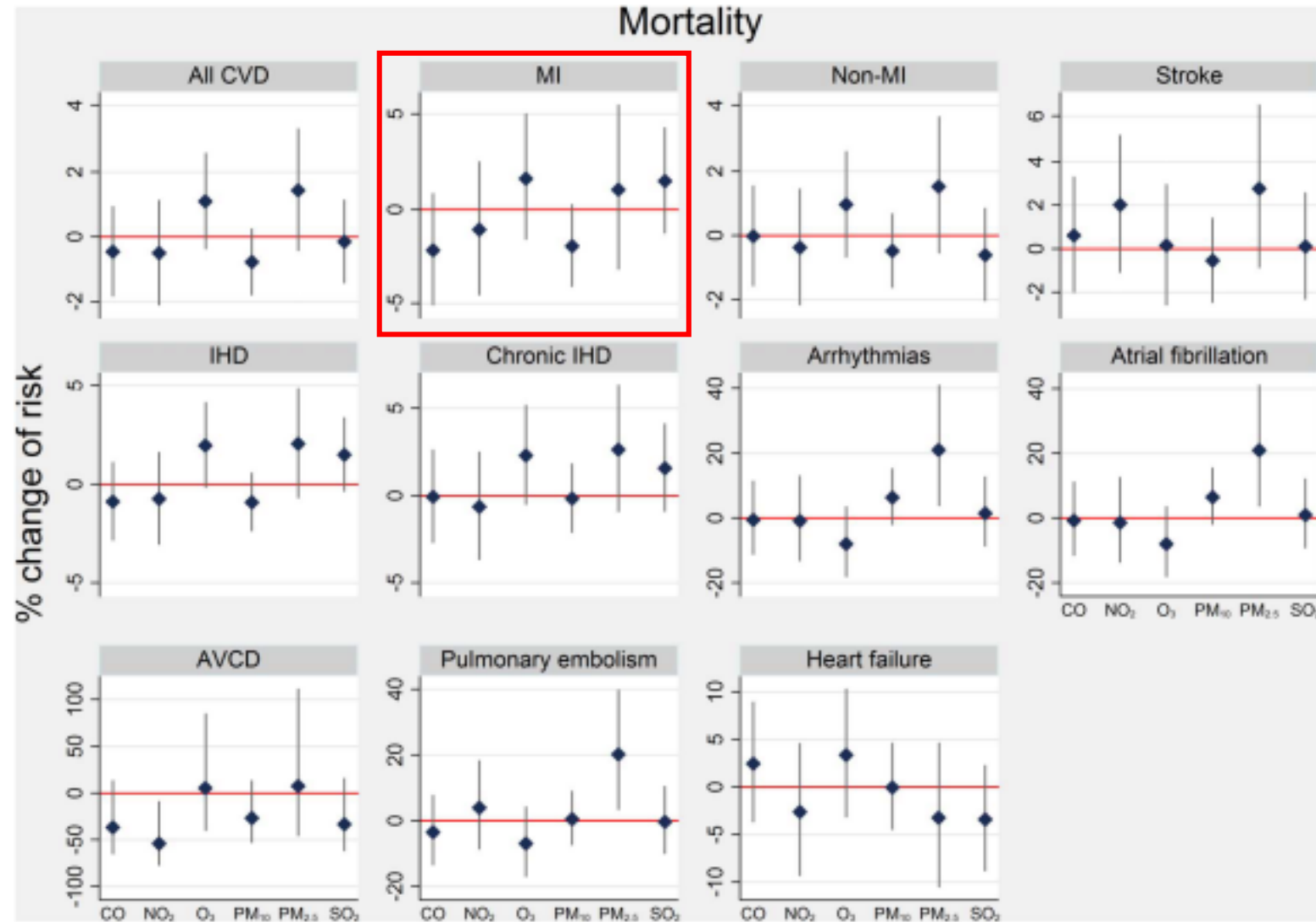
Ai Milojevic,¹ Paul Wilkinson,¹ Ben Armstrong,¹ Krishnan Bhaskaran,² Liam Smeeth,² Shakoor Hajat¹

Milojevic A, et al. Heart 2014;100:1093–1098.

Hospital admissions



Mortality



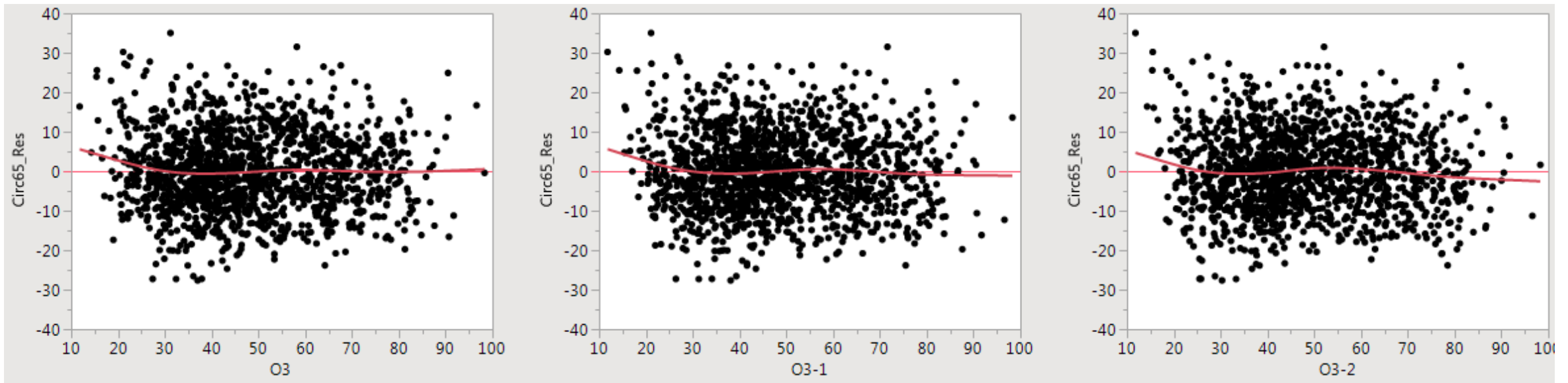
California 2000-2012 study

Air quality and acute deaths in California, 2000–2012

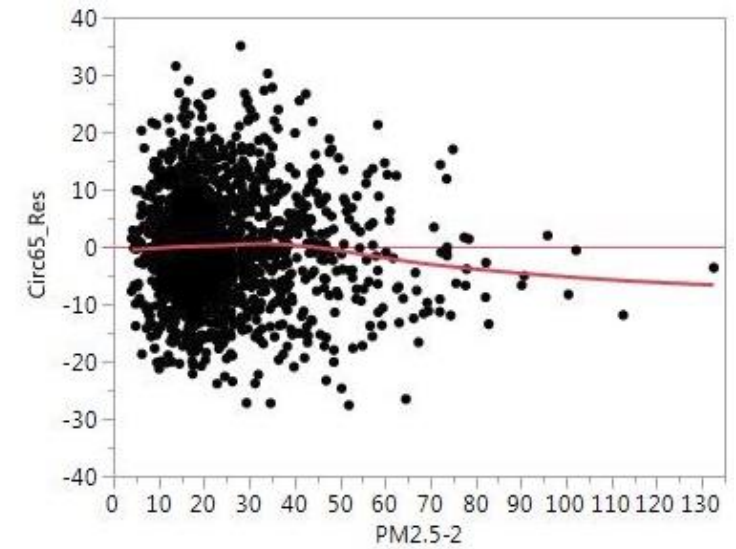
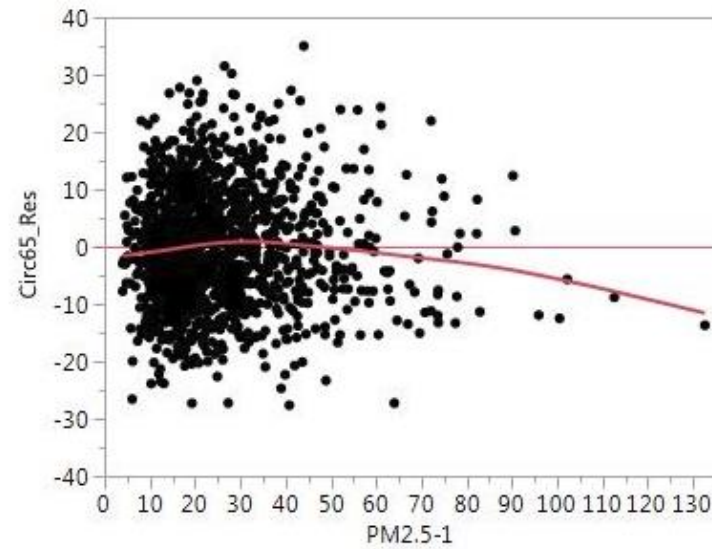
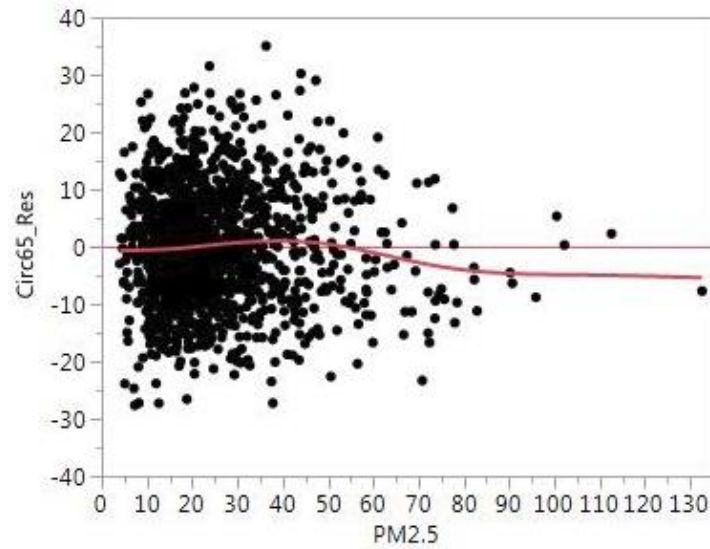
S. Stanley Young ^{a, *}, Richard L. Smith ^b, Kenneth K. Lopiano ^c

Regulatory Toxicology and Pharmacology 88 (2017) 173-184

Circulatory deaths versus ozone



Circulatory deaths versus PM2.5



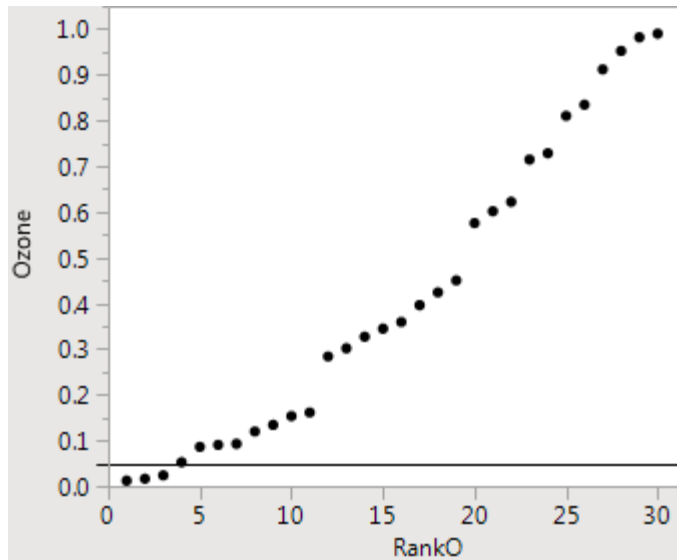
Meta-analysis : Air quality and heart attacks

- carbon monoxide: 1.05 (1.0xx-1.0xx)
 - nitrogen dioxide : 1.01 (1.0xx-1.0xx)
 - sulfur dioxide : 1.01 (1.00x-1.02x)
 - PM 10 : 1.01 (1.0xx-1.0xx)
 - PM 2.5 : 1.03 (1.0xx-1.04)
 - ozone : 1.00 (0.99x-1.01x; P= $\sim$.40)
- (Results rounded)

Conclusion: All the main air pollutants, with the exception of ozone, were significantly associated with a near-term increase in MI risk.

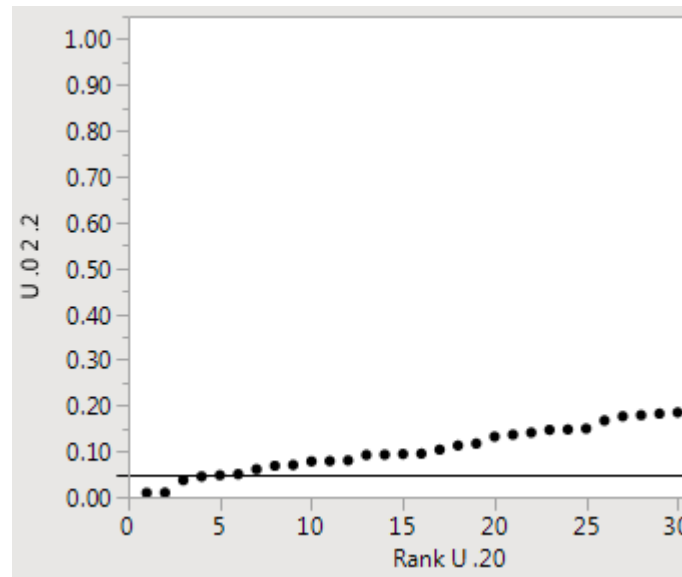
Simple statistical theory: p-value plot

No Effect

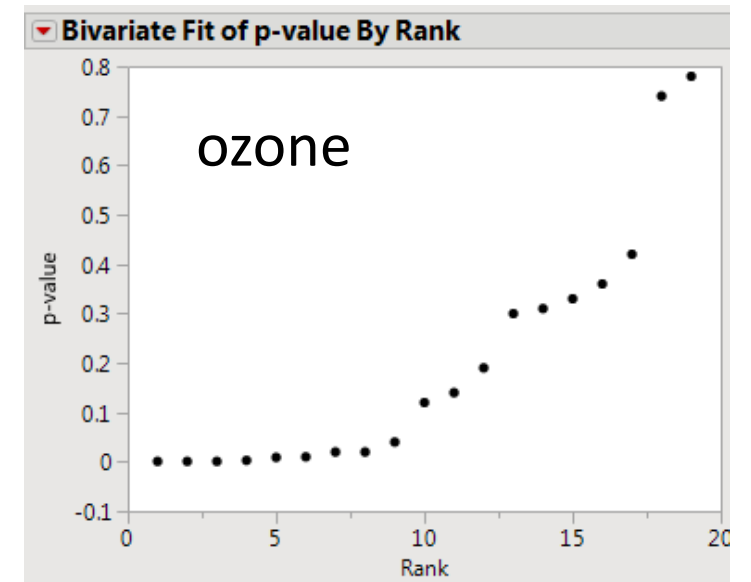


Simulated

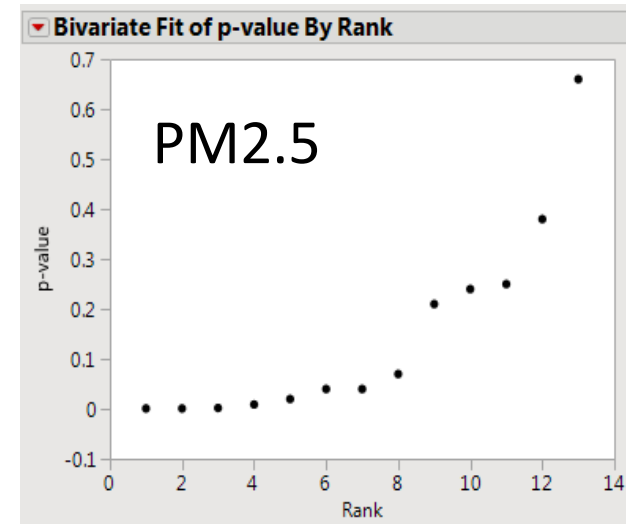
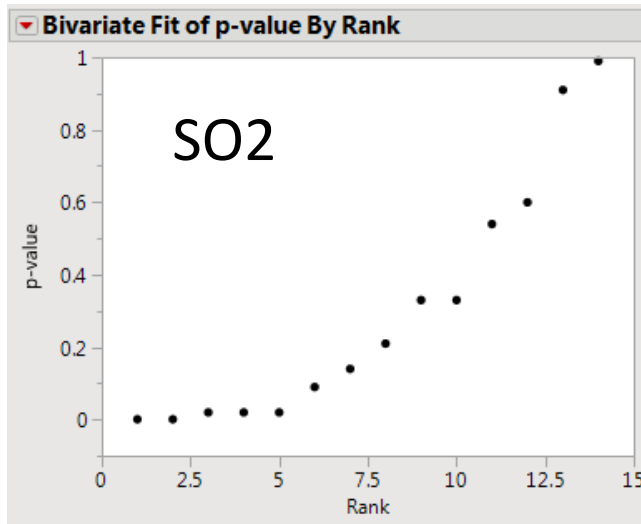
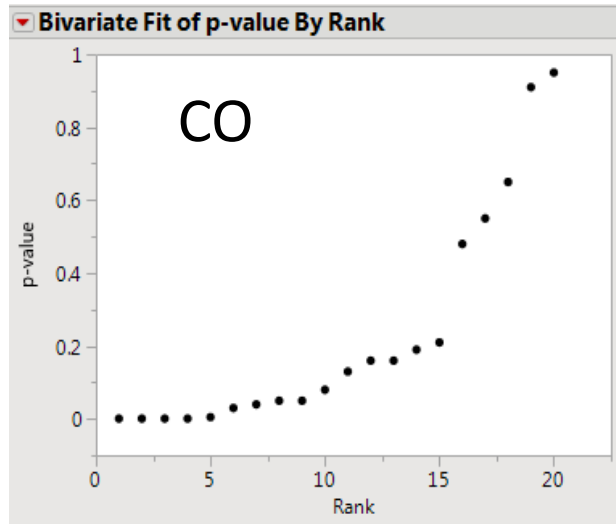
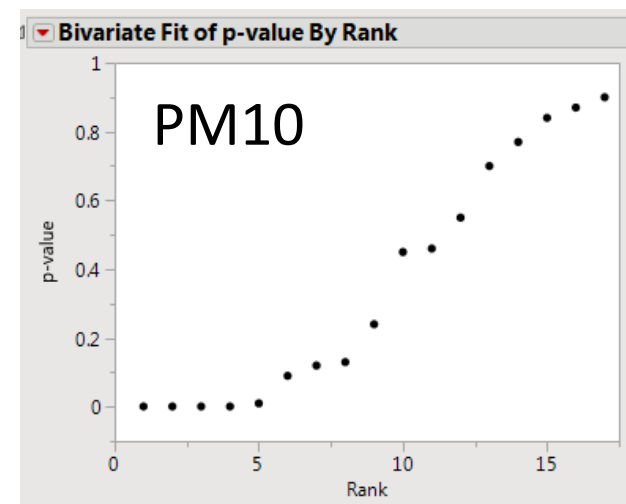
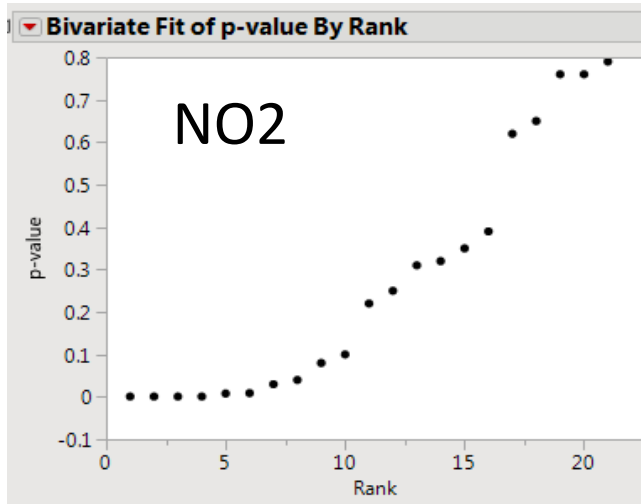
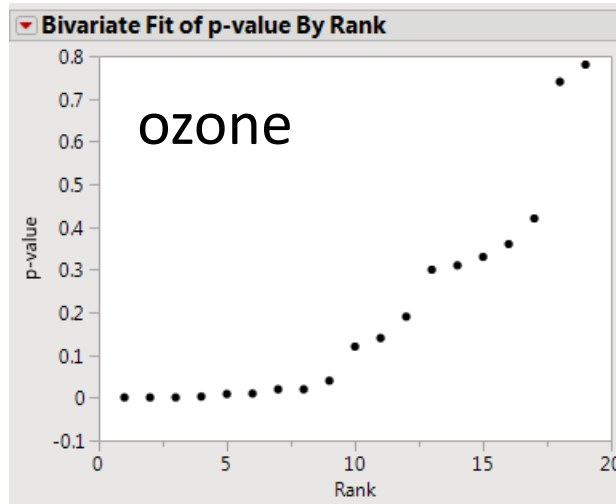
Effect



Real Experiments
Mixture



Heterogeneity



For each component there are many not significant results.

Summary

Meta-analysis conclusion: All the main air pollutants, with the exception of ozone, were significantly associated with a near-term increase in MI risk.

The meta-analysis results have the appearance of heterogeneous, **researcher generated p-values. (p-hacking)**

Those claims are contradicted by a massive studies by Milojevic et al. and Young et al.