

# Modeling as an exposure estimation approach for use in epidemiologic studies: Guidance in choosing the appropriate model

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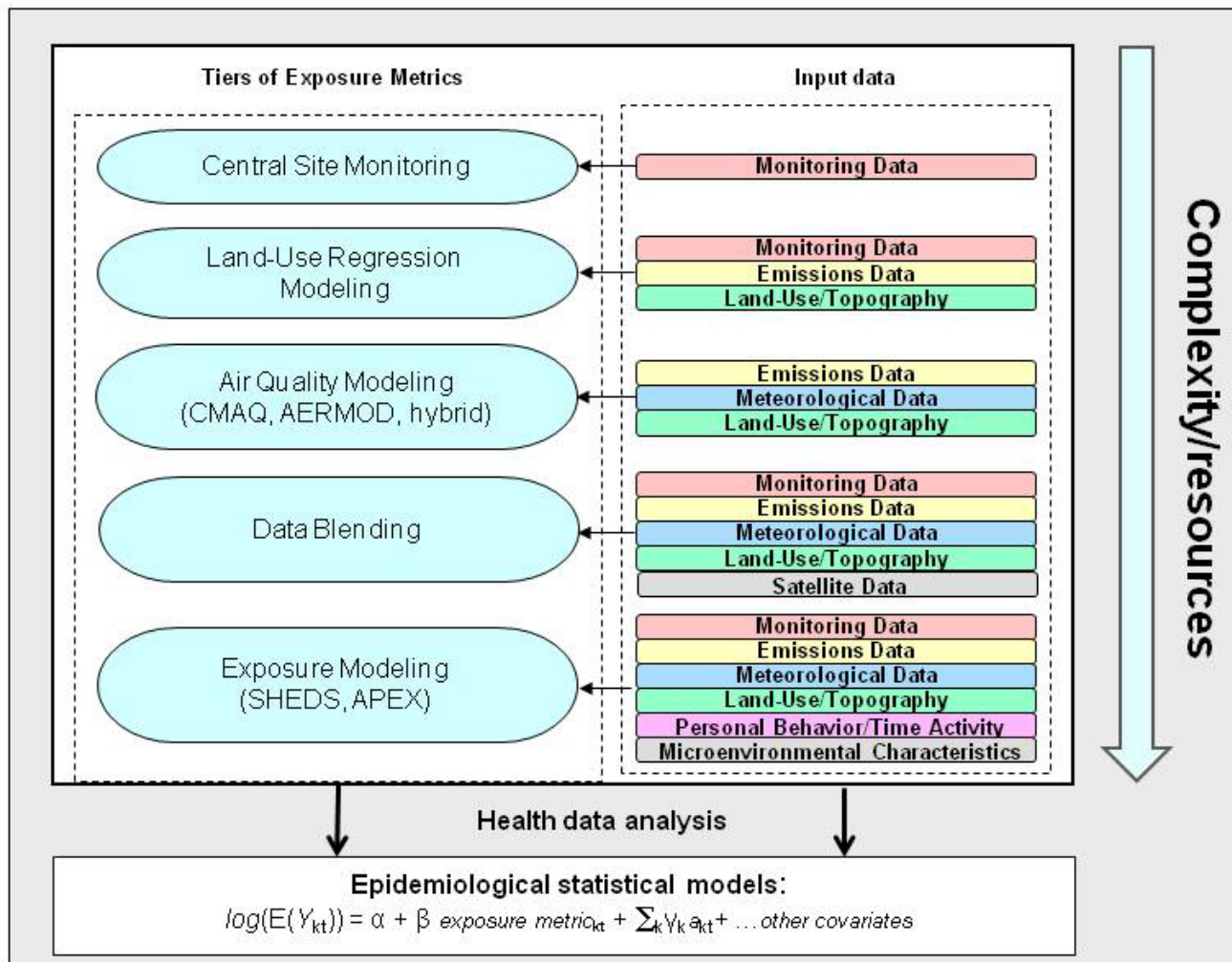
# Background

- Many epidemiological studies use measurements from central-site monitors to estimate exposures.
- Measurements from central-site monitors may lack sufficient spatial and temporal resolution.
- More sophisticated methods may provide better estimates of exposure.

# Background

- Examples:
  - Employing modeling techniques to increase the spatial resolution of exposure estimates
    - Fill in counties with no measurements to get more statistical power in epidemiological studies
    - Better capture “hot spots” or roadway impacts
  - Use models to increase temporal resolution by filling in for periods of time when central site measurements are not available
    - PM speciation data only measured 1-in-3 or 1-in-6 days)
  - Exposure models which incorporate exposure factors such as time-location-activity budgets and penetration of ambient pollutants to the indoor environment

## Tiers of exposure metrics relevant to air pollution epidemiology studies

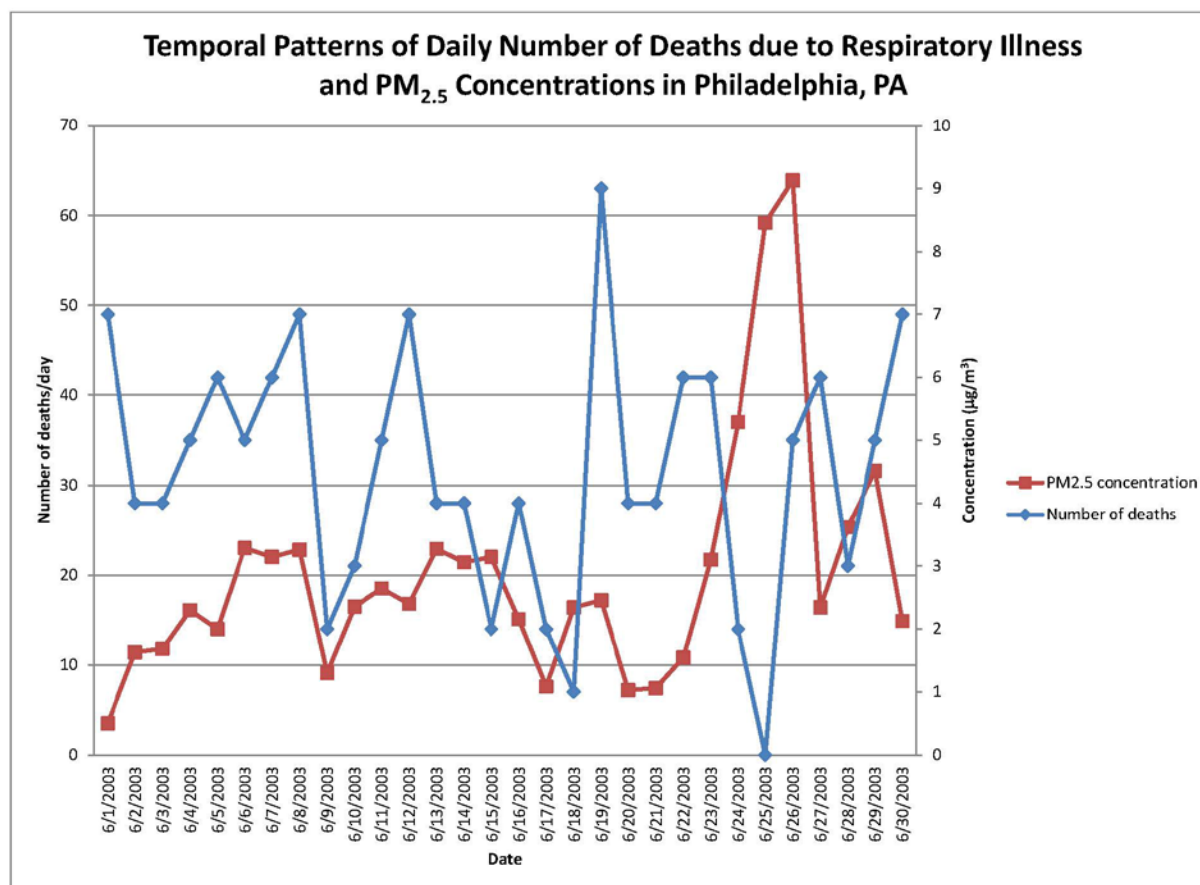


## **Factors Influencing the Selection of the Optimal Exposure Metric**

- When would exposure estimates generated from more complex methods be an improvement over those generated from central site monitoring data?
- Answer depends on:
  - Epidemiological study design
  - Pollutant(s)
  - Health outcome

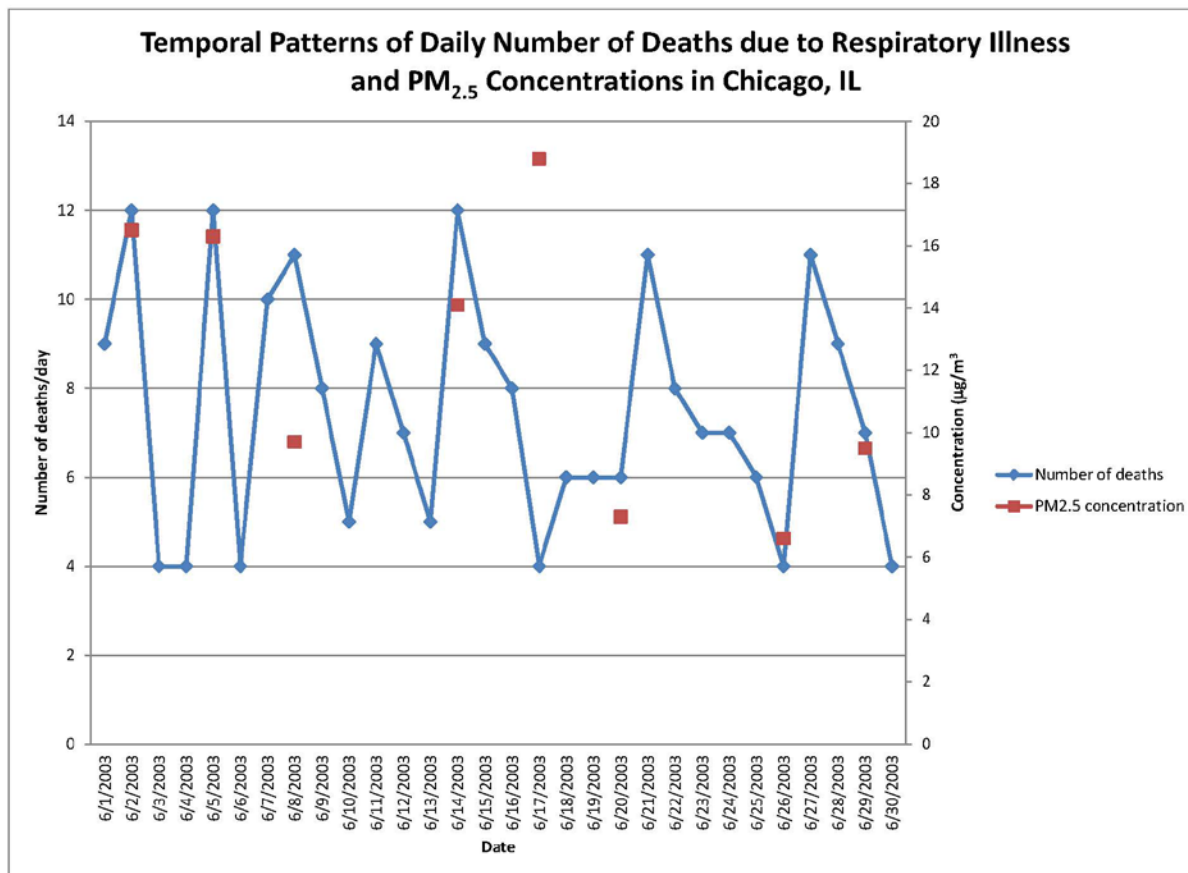
# Factors Influencing the Selection of the Optimal Exposure Metric: Epidemiological Study Design

## Time-Series Study



# Factors Influencing the Selection of the Optimal Exposure Metric: Epidemiological Study Design

## Time-Series

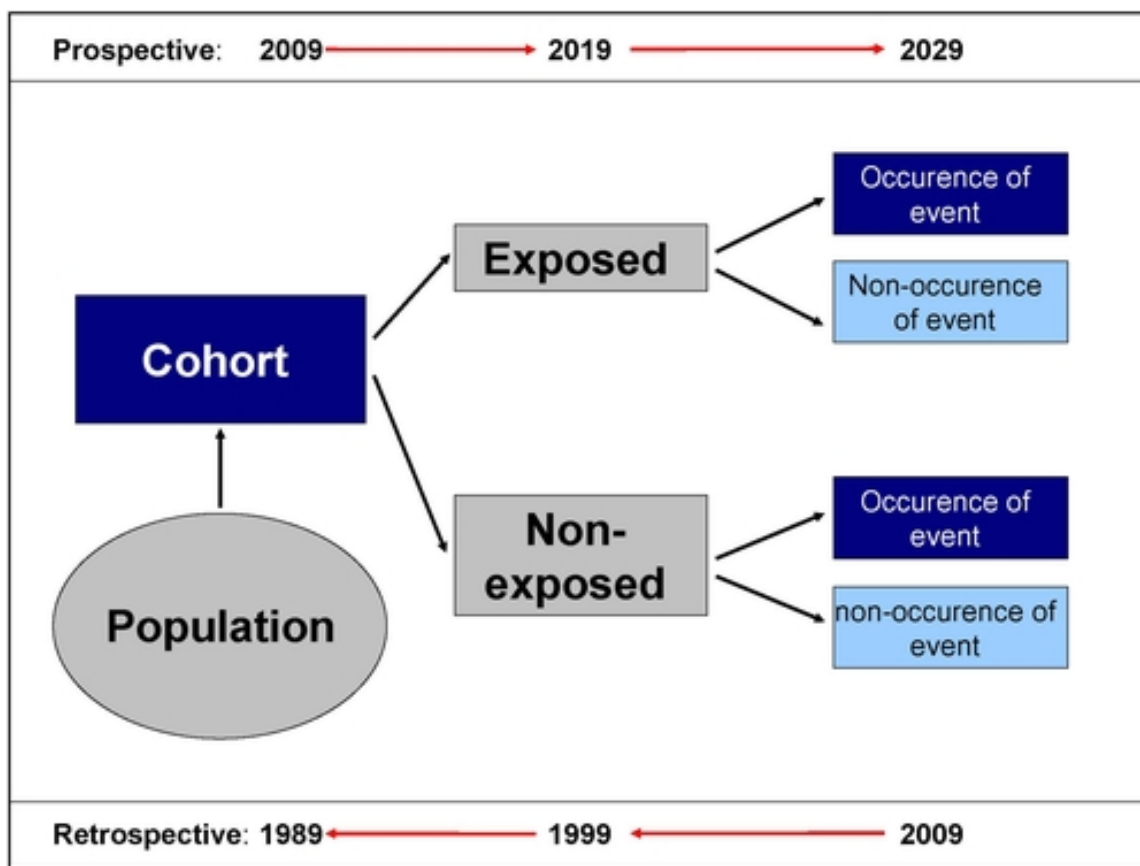


# Factors Influencing the Selection of the Optimal Exposure Metric: Epidemiological Study Design

## Cohort Study

Source:

<http://medanth.wikispaces.com/Cohort+Studies>



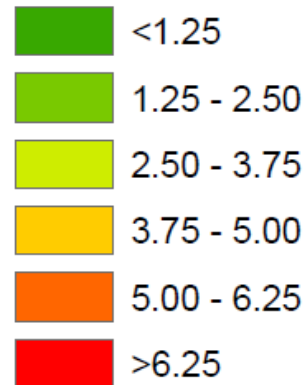


# Factors Influencing the Selection of the Optimal Exposure Metric: Pollutant

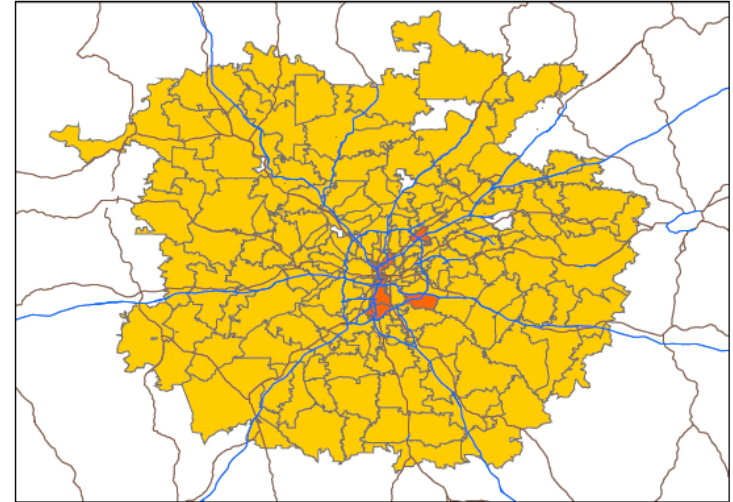
metric i: CS



SO<sub>4</sub> (µg/m<sup>3</sup>)



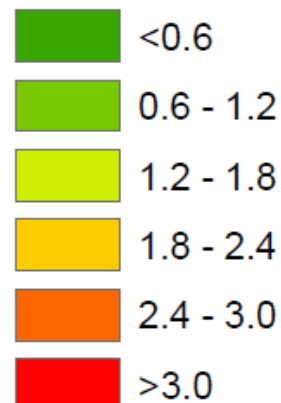
metric iv: Hybrid



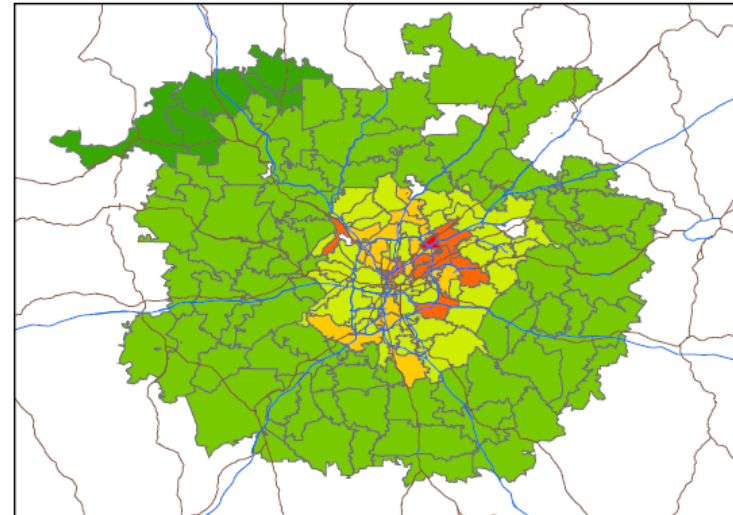
metric i: CS



EC (µg/m<sup>3</sup>)



metric iv: Hybrid



## Factors Influencing the Selection of the Optimal Exposure Metric: Health Outcome



Exposure window : years



Exposure window : days

- Some metrics may do a better job of estimating long-term exposures while others may be better estimating short-term exposures

## Take Home Message

- Exposure metric
  - There is not a one-size fits all approach
  - What is available for the study?
  - Will a modeling approach potentially improve exposure estimates in turn producing less biased health effects results?
- Need to look at the combination of epidemiological study design, pollutant, and outcome to understand whether a modeling approach would be worth the additional effort/complexity
- Modelers should be involved at the beginning to advise and decide on the approach