

# Study Design of conducting epidemiological studies using hospital-based records and AS-LUNG-O data

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**Shih-Chun Candice Lung**

Chair, Science Steering Committee of the Hi-ASAP

Research Center for Environmental Changes, Academia Sinica, Taipei, Taiwan

Center for Sustainability Science, Academia Sinica, Taipei, Taiwan

# PM2.5 exposure-health relationship evaluation with hospital data

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- Objective:
  - Assessing the relationship of daily PM2.5 levels (or maximum hourly PM2.5 each day) and daily counts of hospital admission (or emergency visits) of **cardiovascular and pulmonary diseases** in this region
- This type of studies have been conducted in the US and the European countries for a long time
- **Scientific niche in this region:** (1) high ambient PM2.5, (2) seasonal variations of PM2.5 (dry vs. wet seasons), and (3) low-cost sensing devices (ex. AS-LUNG-O) in fixed locations

# Prerequisites

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- **Collaboration with local hospitals** to access their data (daily counts of hospital admission (or emergency visits) of cardiovascular and pulmonary diseases
  - It is ok with only one hospital; at least two-year of data
- Funding to support your **long-term monitoring** near the hospitals
  - With AS-LUNG-O sets, the expenses will be reduced; however, this type of study may need to collect data for at least 2 years to obtain enough sample size for data analysis to reach statistical significance

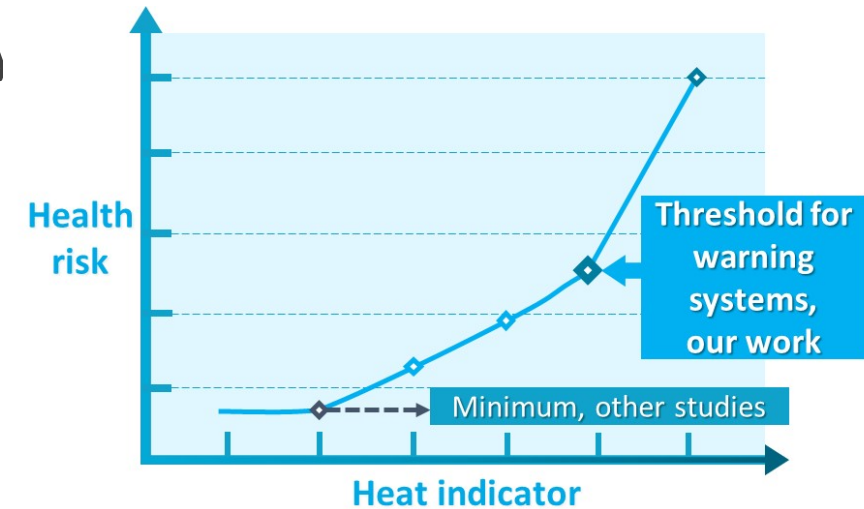
# Methodology

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- Ambient PM2.5 levels
  - Setting up one AS-LUNG-O set in one location at least 10-meter above ground without any near-by sources; this location has to be near this hospital
  - Using ambient PM2.5 levels from this AS-LUNG-O set to represent ambient levels near this hospital
  - Conduct monitoring for more than 2 years
- Daily counts of hospital admission (or emergency visits) of cardiovascular and pulmonary diseases
  - Assuming patients are residents near this hospital who are exposed to the same ambient PM2.5 levels as the PM2.5 levels monitored by AS-LUNG-O
  - Collect hospital records for more than 2 years

# Statistical models

- Y: Daily counts of hospital admission (or emergency visits) of cardiovascular and pulmonary diseases
- X: daily mean PM2.5 levels (or maximum hourly PM2.5 each day)
- Generalized additive models (GAMs) with Poisson distribution (Lung et al., 2021, IJERPH)
- To identify thresholds with steep slope since the health impacts of PM2.5 do not have a threshold
- Adjustment terms: at least age and sex from hospital records (what data are available from hospital?)



Discussion point: (1) are you interested and able to conduct this type of research & (2) is it worthy of doing this

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- Which research groups have connections to collaborate with hospitals?
  - How many hospitals? Or only one hospital?
    - It is better to have one AS-LUNG-O set for monitoring ambient PM2.5 levels near one hospital unless these hospitals are really close to each other
  - Data availability?
    - At least two years of daily counts of **hospital admission (or emergency visits)** of cardiovascular and pulmonary diseases; may be extended to other diseases in the future
    - other patient data (at least age and sex)
  - Data quality?
  - This requires ethical clearance from institutional review board



## *Reading for October 13*

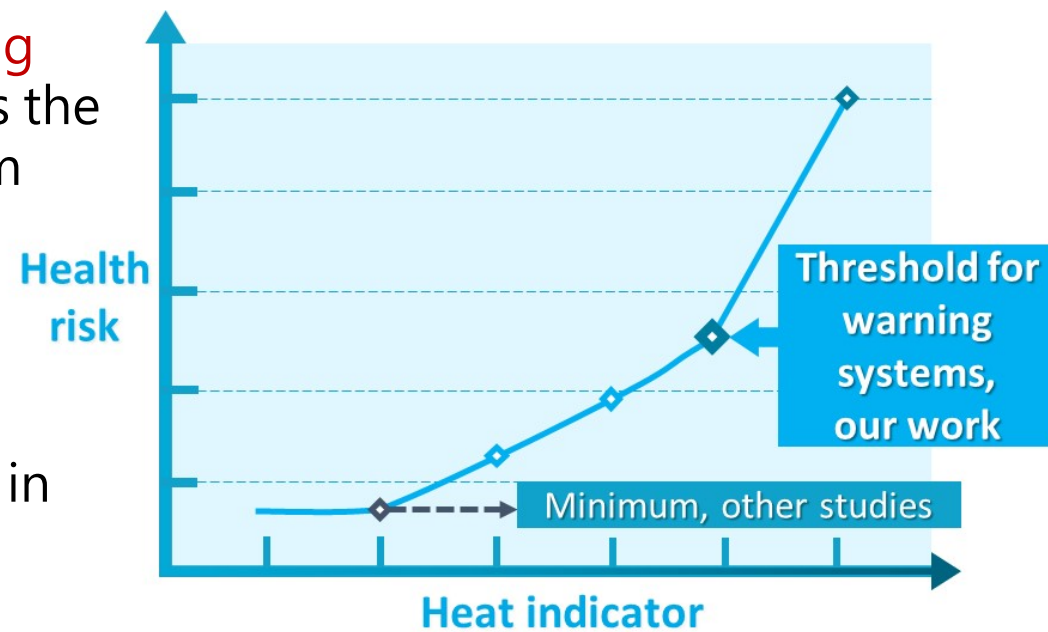
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Lung et al., "Selecting thresholds of heat-warning systems with substantial enhancement of essential population health outcomes for facilitating implementation", Int. J. Environ. Res. Public Health 2021, 18, 9506. <https://doi.org/10.3390/ijerph18189506>

# Assessment of Thresholds of a Warning System

(Lung et al., 2021, *IJERPH*)

- Objective:
  - (1) revise statistical methods to assess the starting point of the rapid increase of heat-health risks as the appropriate thresholds for a heat warning system
  - (2) compare WBGT and temperature
- Data data:
  - Daily meteorological data for 2000-2017
  - Daily heat-related hospital and emergency visits in 2000-2017 and daily mortality counts (excluding accidents and suicides) in 2008-2014
- Statistical analysis (collaborate with a statistician) :
  - Revised generalized additive models (GAMs) with Poisson distribution



1. Replace WBGT or temperature with PM2.5 (X)
2. Replace health database with hospital data (Y)
3. Apply the same methodology to evaluate PM2.5 exposure-health relationships with AS-LUNG-O and hospital data



# Health Investigation and Air Sensing for Asian Pollution (Hi-ASAP)

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- Developed under the umbrella of IGAC - Monsoon Asia and Oceania Networking Group (**IGAC-MANGO**), met in May 2019 to write the Science Plan; **endorsed by Regional Centre for Future Earth in Asia** in November 2019
- Goal
  - To **provide scientific evidence to support effective policy actions** to reduce air pollution levels, in particular  $PM_{2.5}$ , in this region by applying newly developed low-cost sensing (LCS) devices
- Current status
  - Research groups comprised of atmospheric chemists and public health professionals from **12 different areas in the Asia and the Pacific region** have joined this Hi-ASAP project