Heat-related health impact due to climate change

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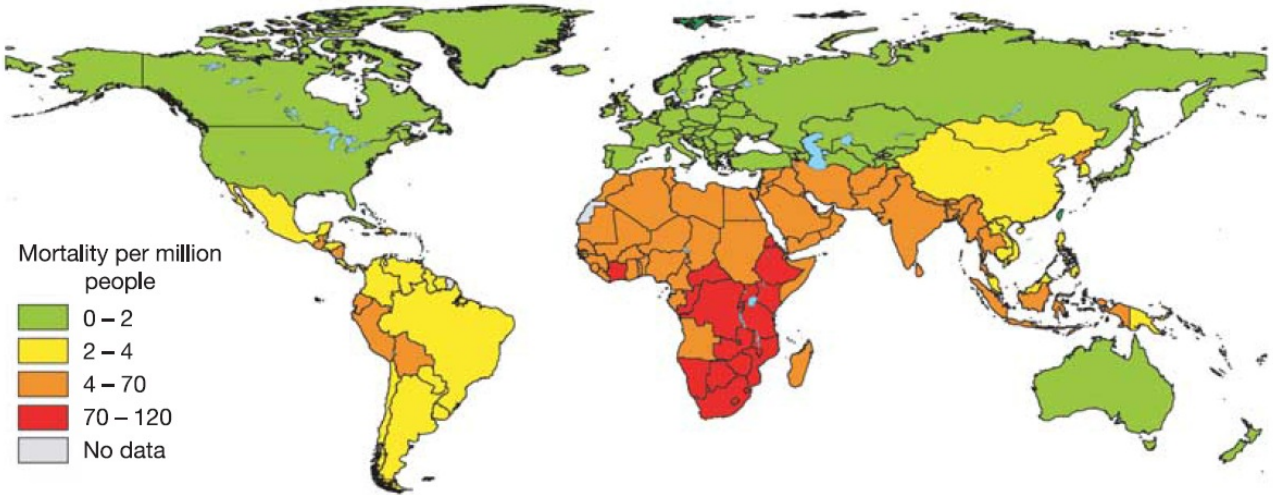
Contents

- Background
- Heat-related mortality
- Toward global projection
- Future issues

Background

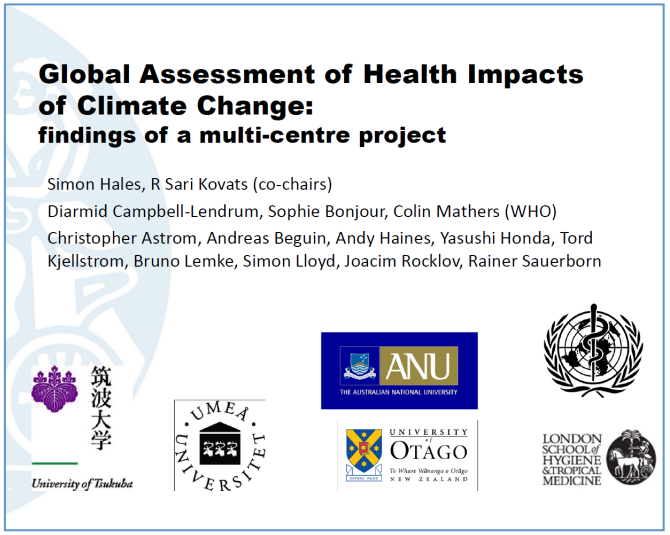
- Health: important sectors
- WHO CCRA project 2004



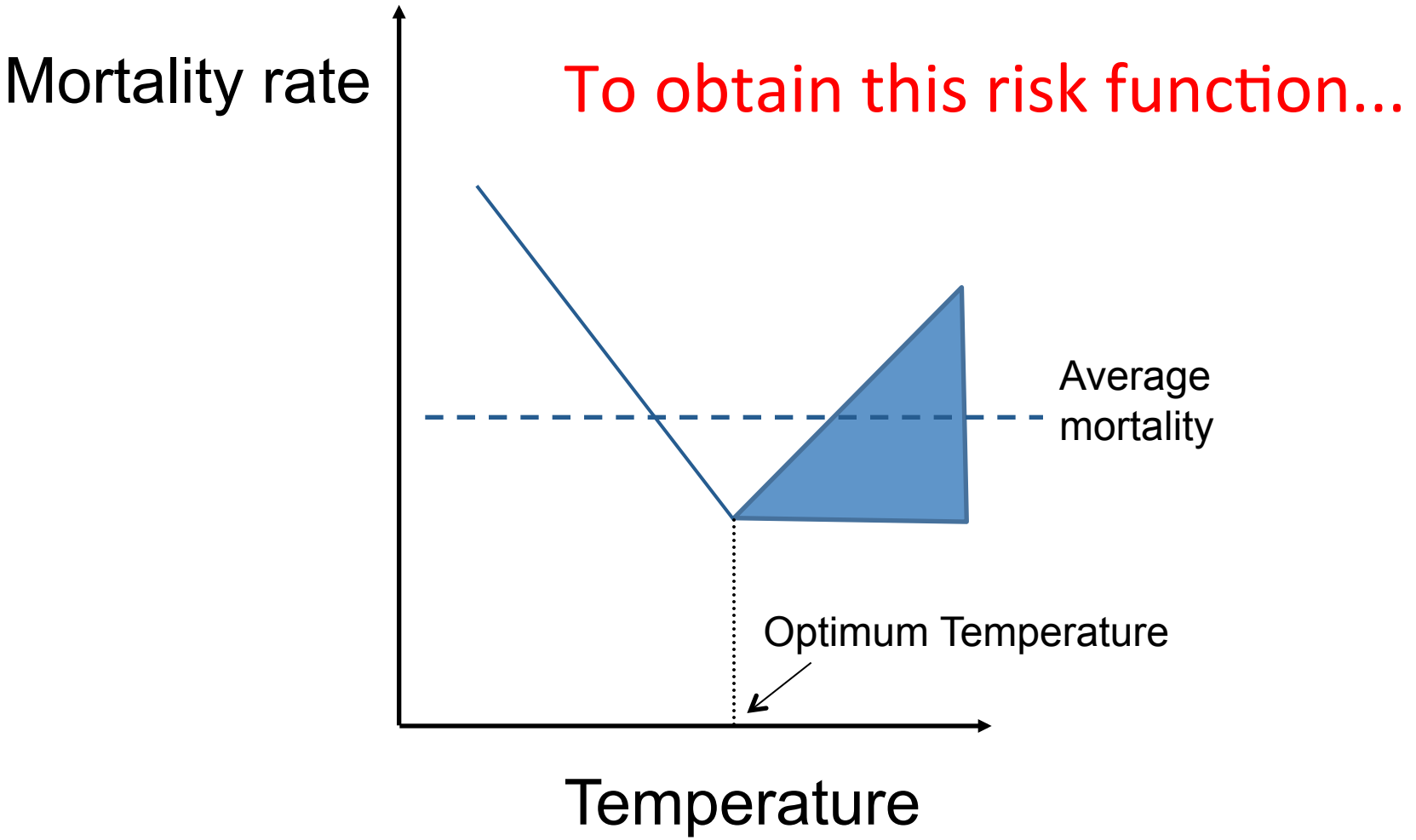
- Sequel of the above … next slide

New WHO Global burden of disease project

- **Heat and cold related mortality**: population model based on observed relationships between temperature and mortality (>65 years)
- **Occupational heat stroke**: working population (15-64 years) model based on observed relationships between heat exposure (WBGT) and clinical effects (including fatalities), and between heat exposure and work performance loss
- **Malaria, Dengue**: Empirical-statistical models of climate and GDP predictors of distribution
- **Malnutrition:** health model linked to crop models and IMPACT food trade model [IFPRI]
- **Diarrhoea:** population model based on observed temperature-mortality relationship
- **Coastal flooding:** mortality due to coastal storm surge, linked to global coastal flood model [DIVA]



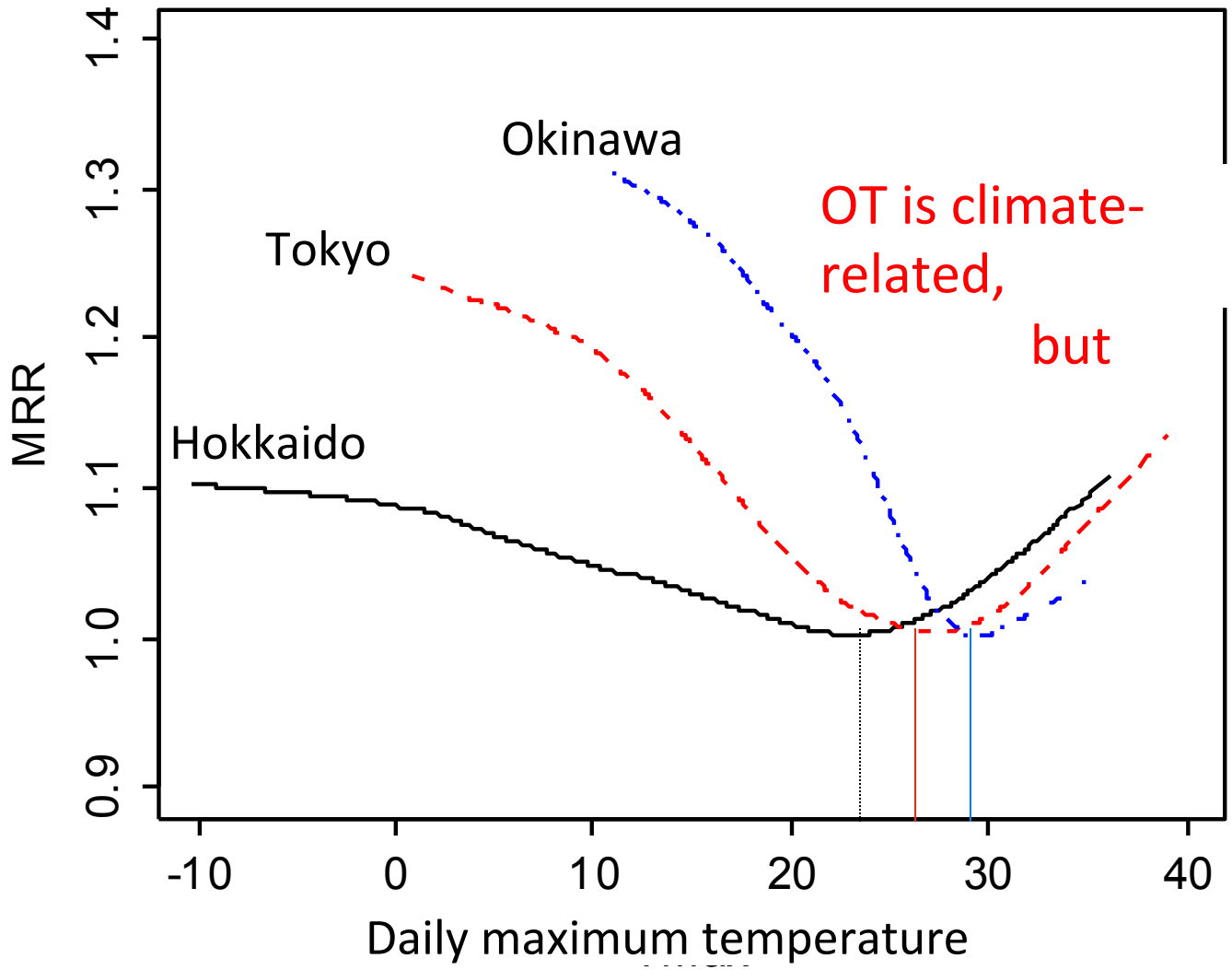
Heat-related excess mortality



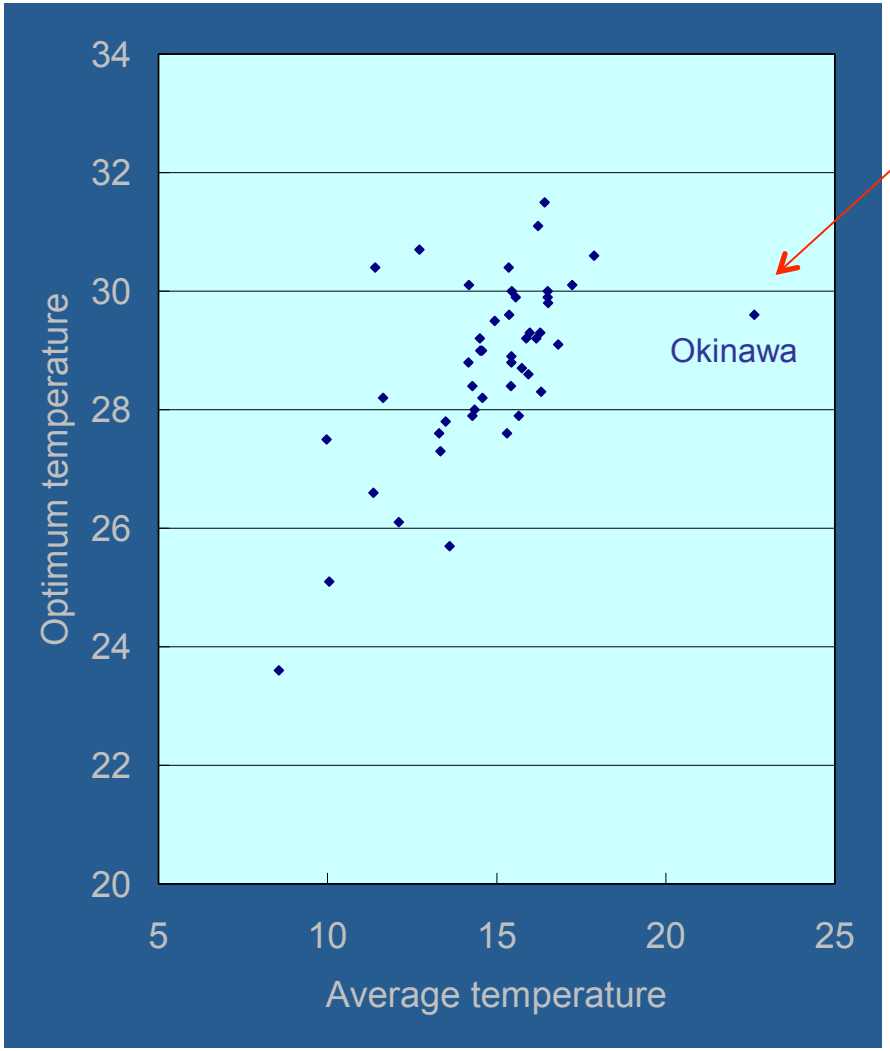
Necessary items for each area

1. OT
2. # deaths at OT
3. RR due to heat

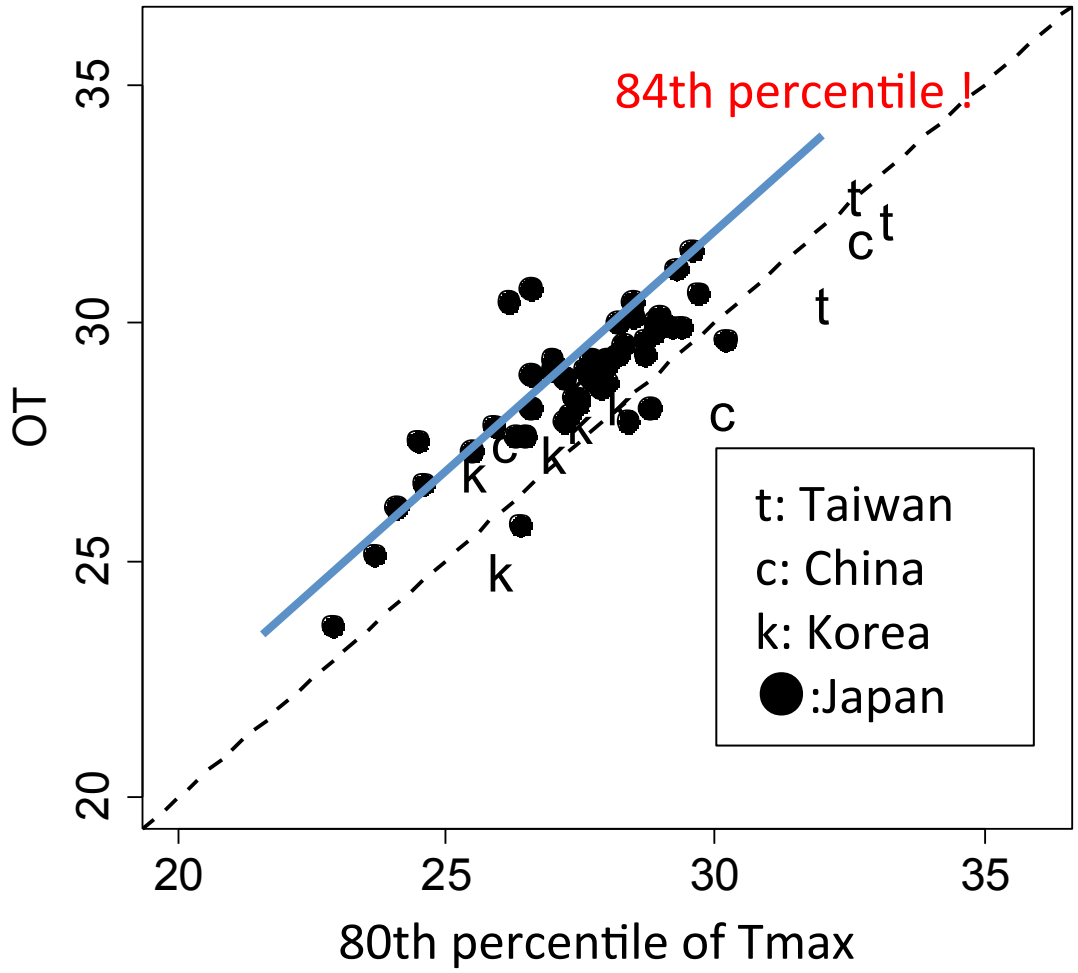
Problem with OT determination



Long-term average temperature



Best climate index



What the relation implies

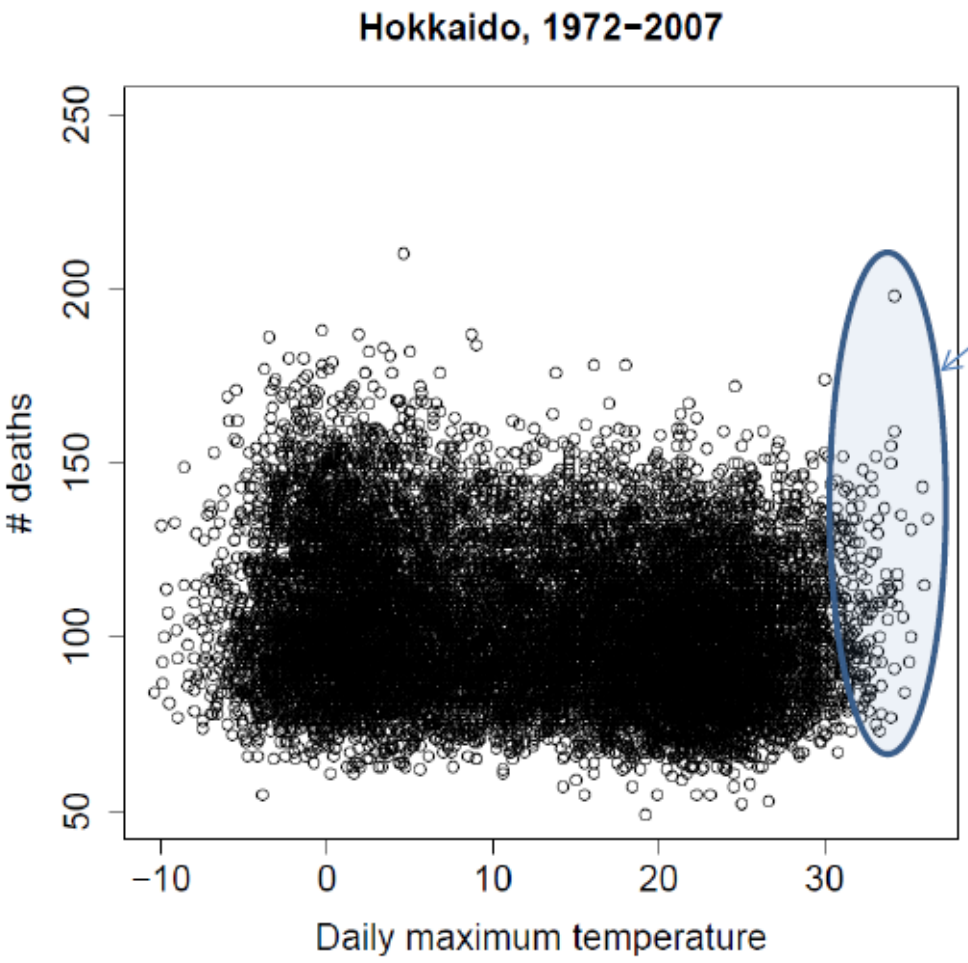
OT can be estimated using Tmax distribution

Can be used for global projection

(Tmax - OT) as a temperature index

Then, how can we estimate the risk?

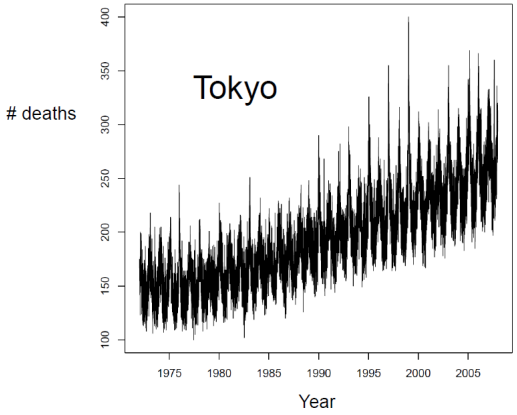
Problem with the risk estimation #1



Sparse data

- Year-pooling
- Area-pooling

Problems with the risk estimation #2



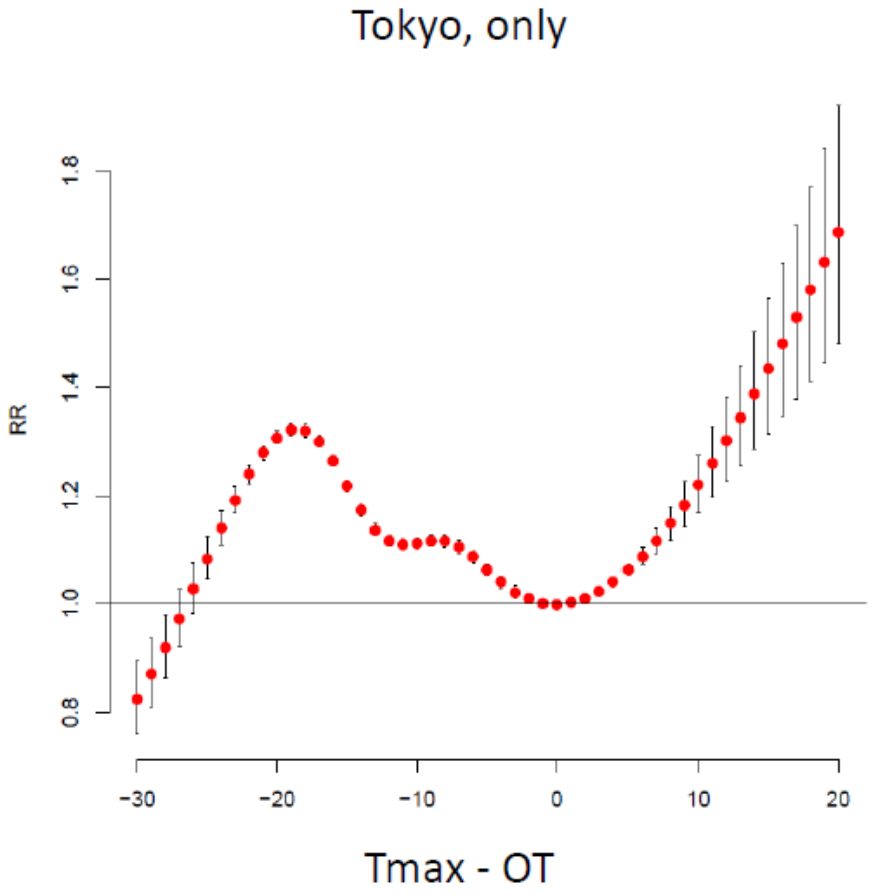
2. Time trend
3. Area difference - dealt with by (Tmax-OT)
4. Possible disturbance by influenza

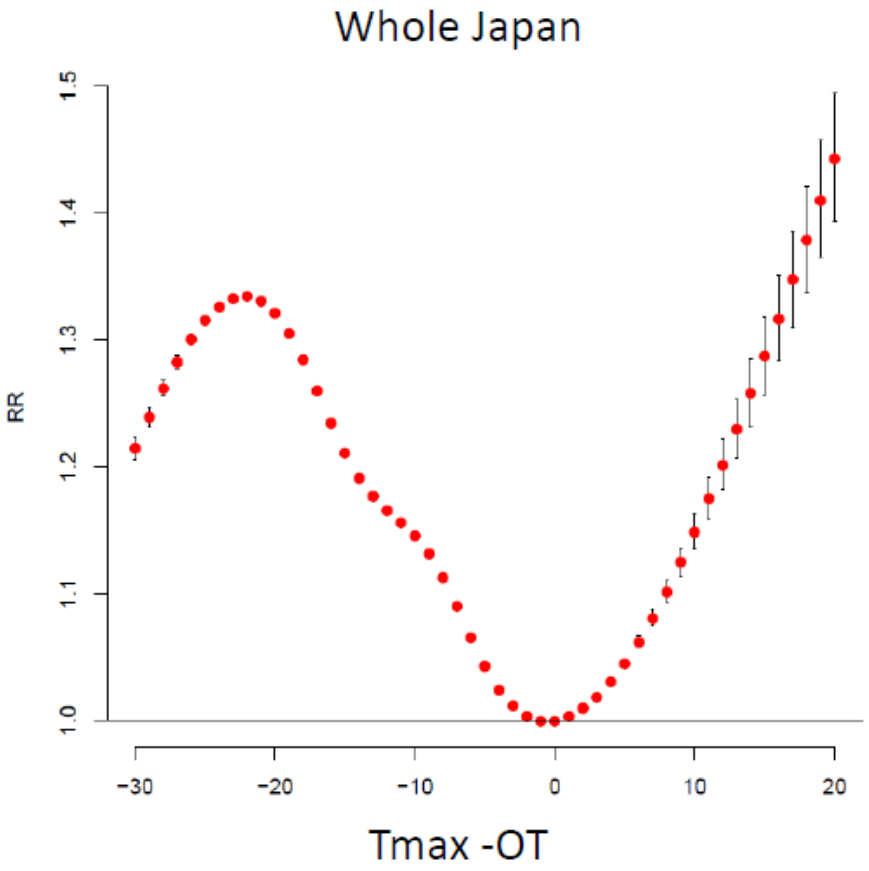
↓

Detrended relative risk

Each year's mortality on days around optimum temperature as reference

Effect of area-collapse

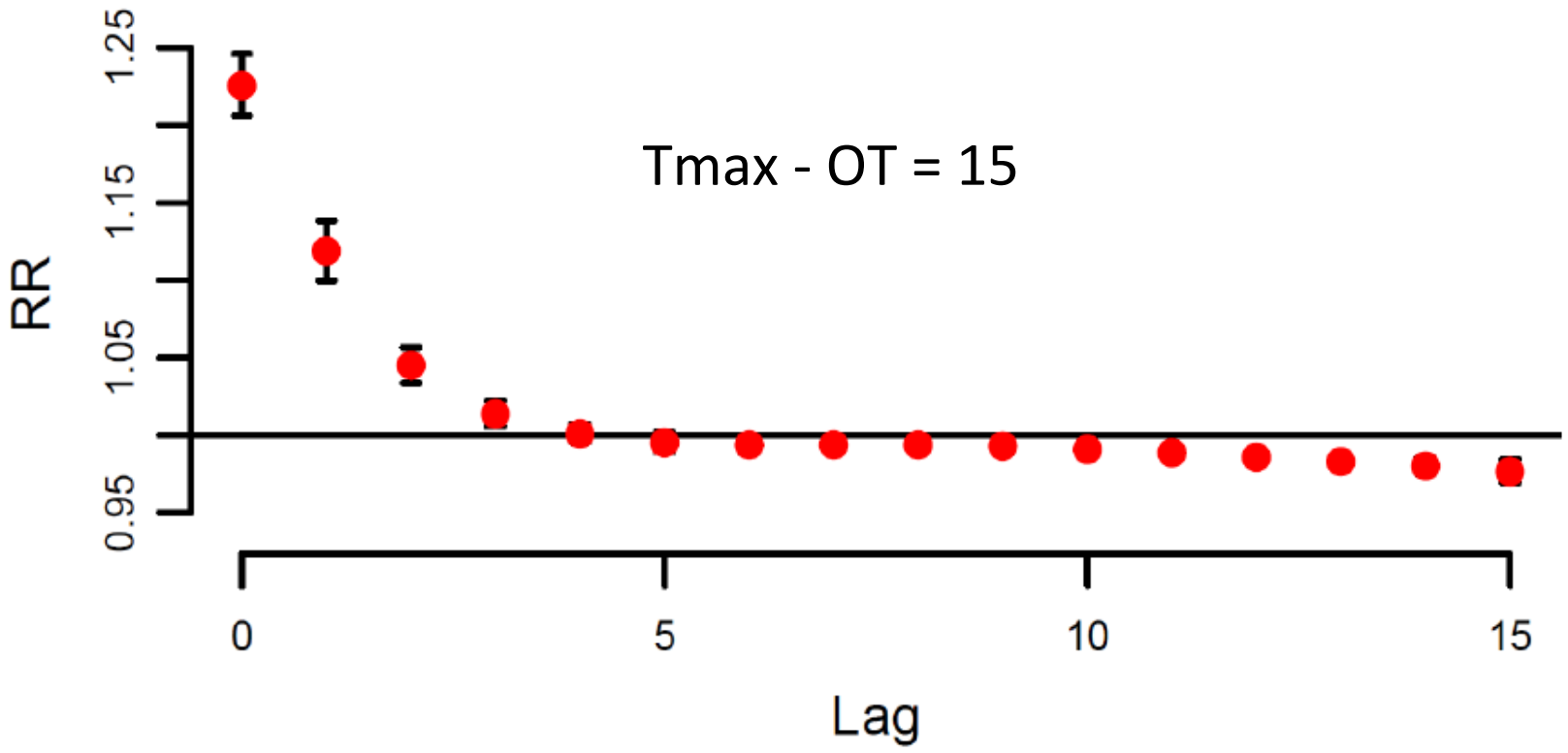




Problem with the risk estimation #3

- Need to sum up the lag effect

→ Distributed lag non-linear model



From RR to # deaths

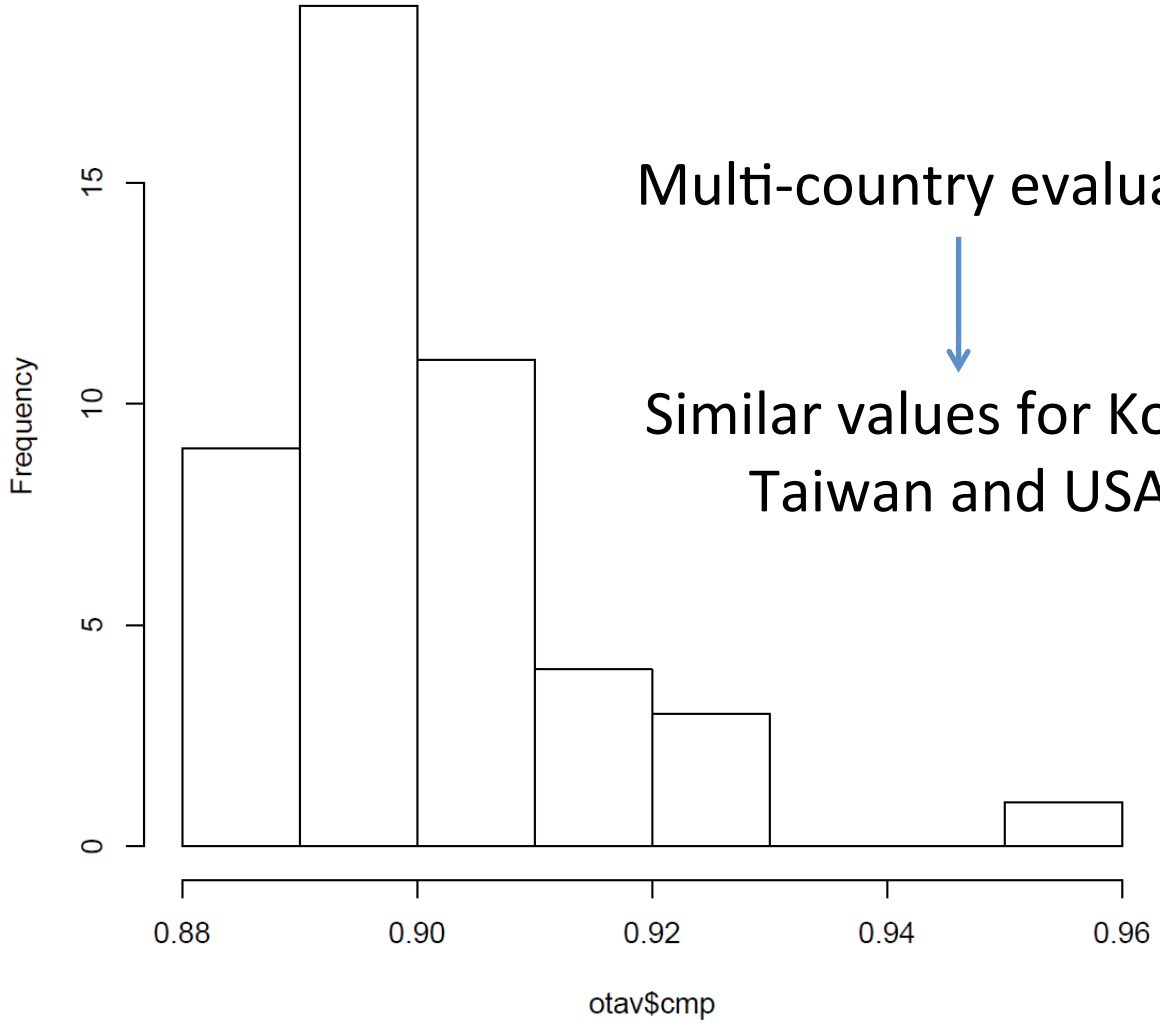
- Available information
  - ✓Annual mortality rate
  - ✓population

  → Average number of deaths

- Calculate

  # deaths at OT / Average # deaths

Distribution of #deaths at OT / average # deaths



Multi-country evaluation

Similar values for Korea, Taiwan and USA

What about abaptation?

- For heat effect, OT moves along with warming!

For year 2030 projection,

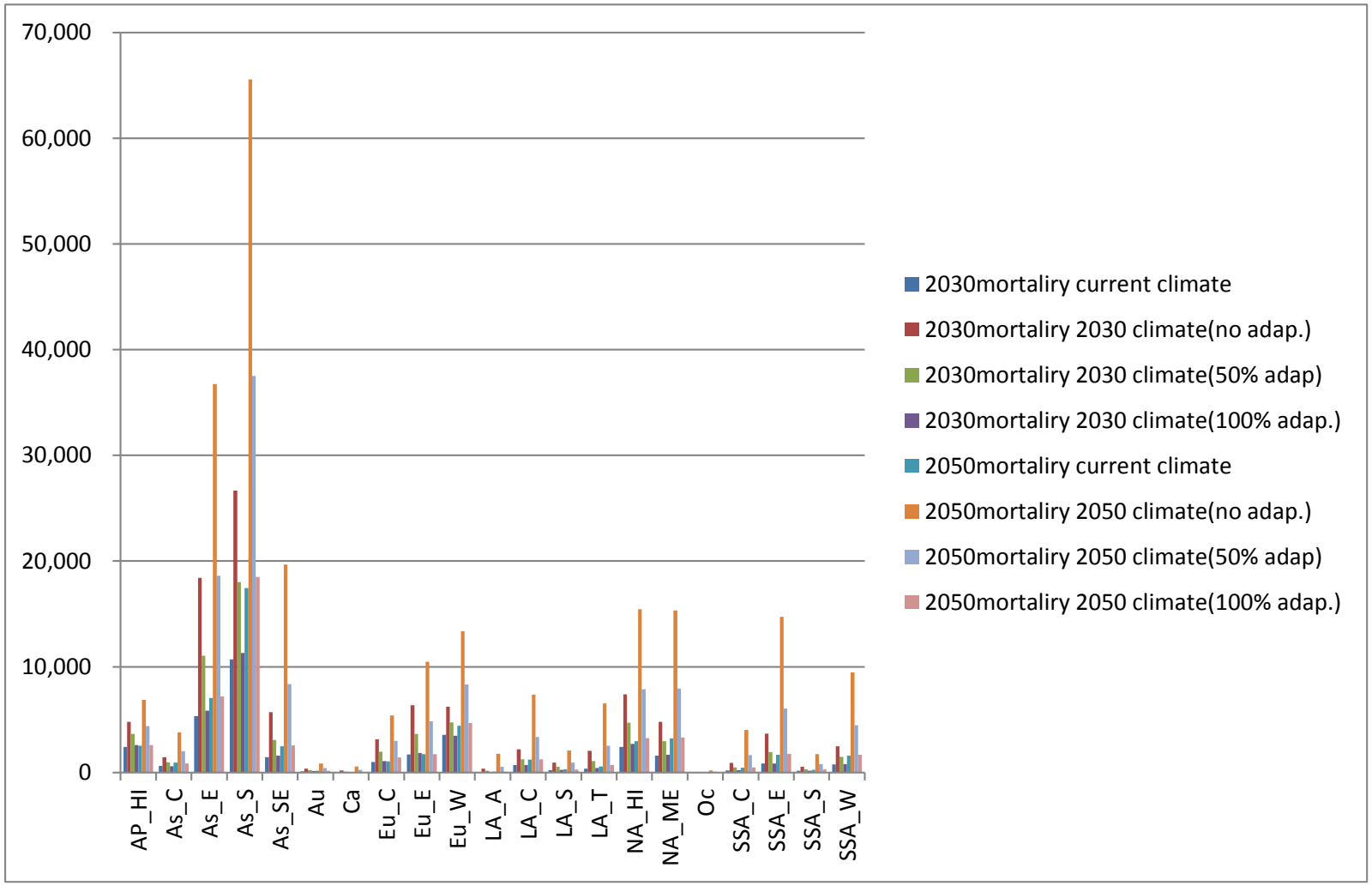
84 percentile as of today for 0% adaptation

84 percentile as of 2030 for 100% adaptation

mid-point of the above two for 50% adaptation

Projection result (65+ y.o.)

■Climate schenario：NCC (present), BCM2(future)

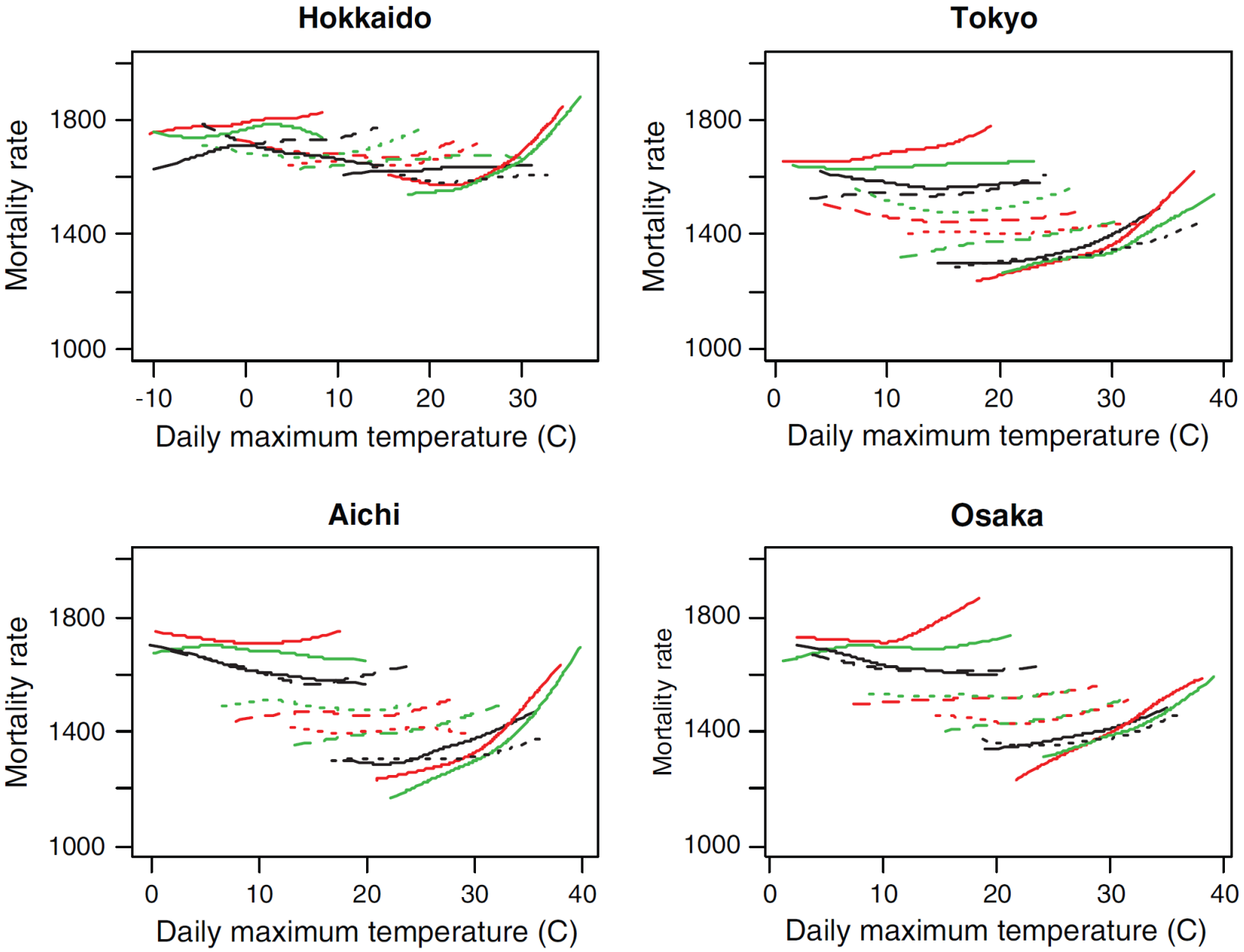


Future issues
What about cold effect?

- It is obvious that winter mortality is higher
- But is it caused by low temperature?

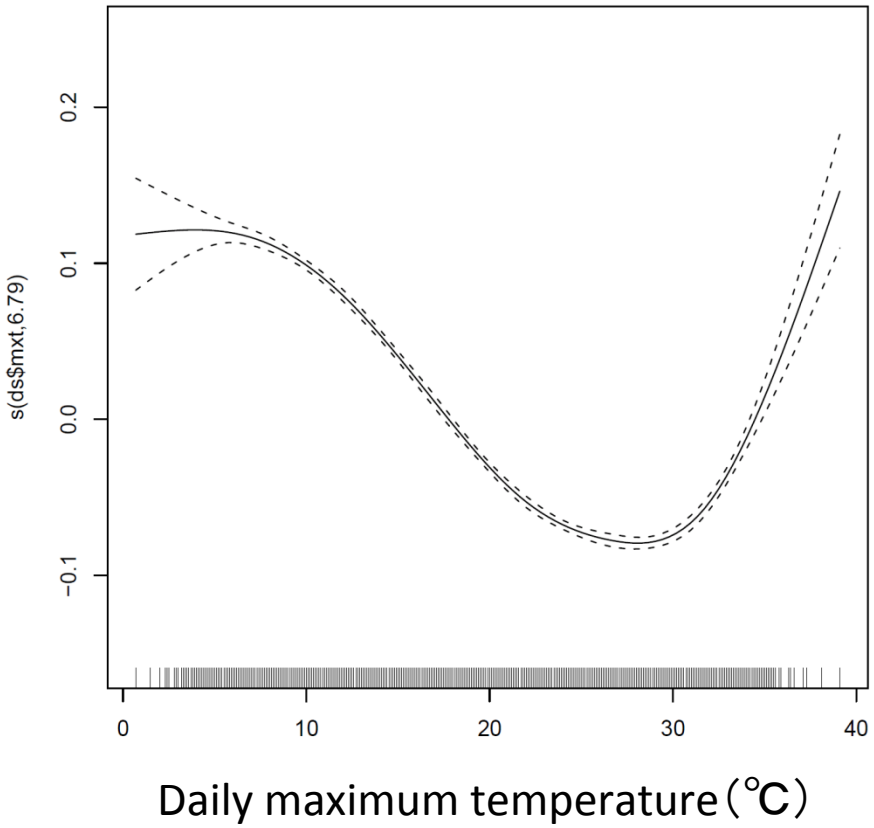
NOT necessarily!

Relation by month

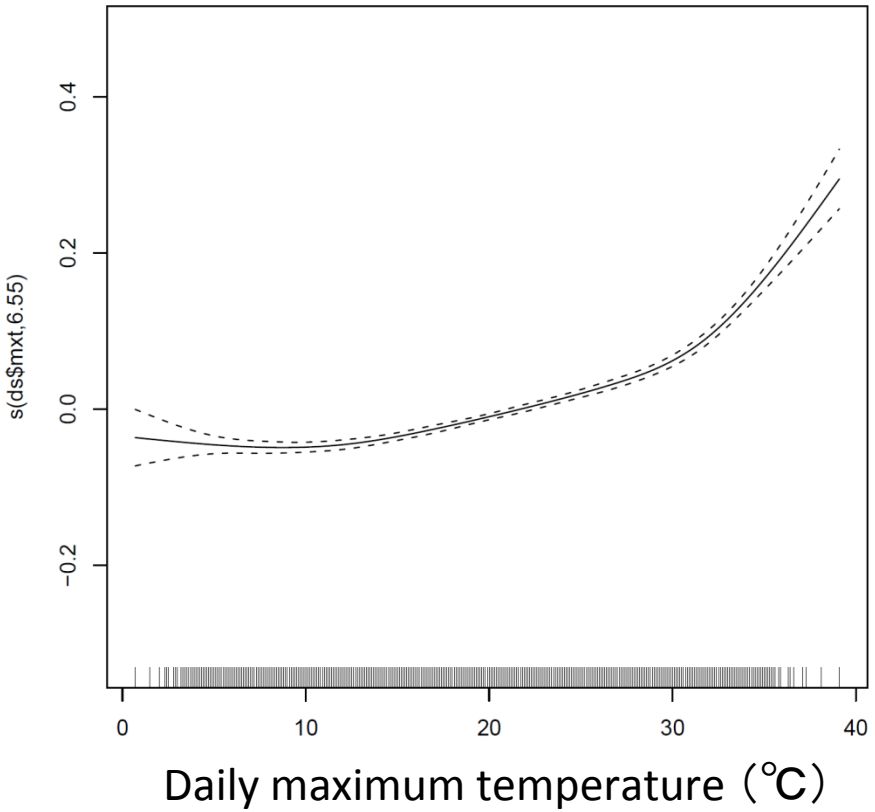


Cold temperature effect: Disappears when season is controlled.

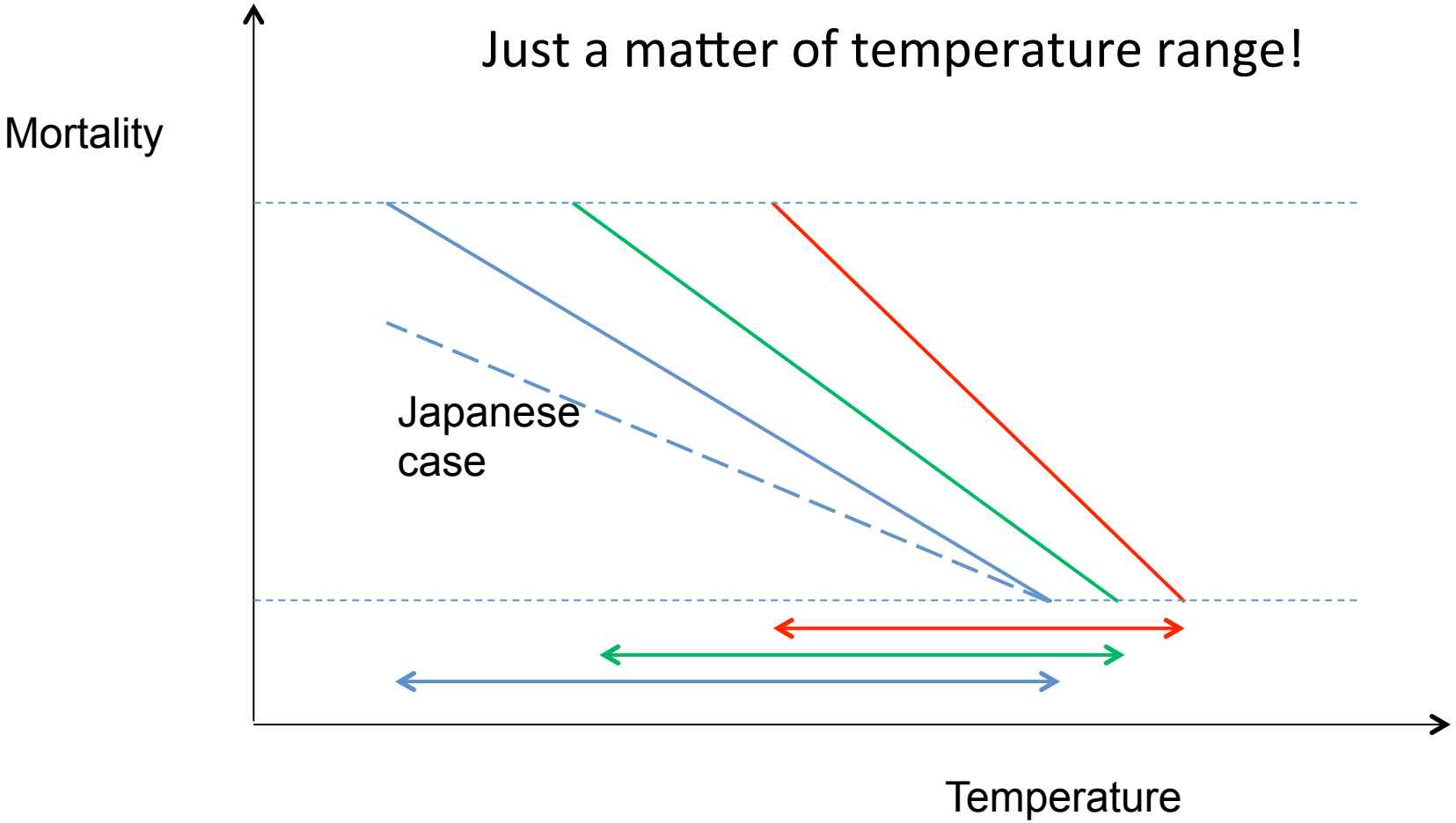
Year-controlled



Year- and Season- controlled



Scheme of area-difference



Thank you for your attention!