# Temperature-mortality association during and before the COVID-19 pandemic in Italy
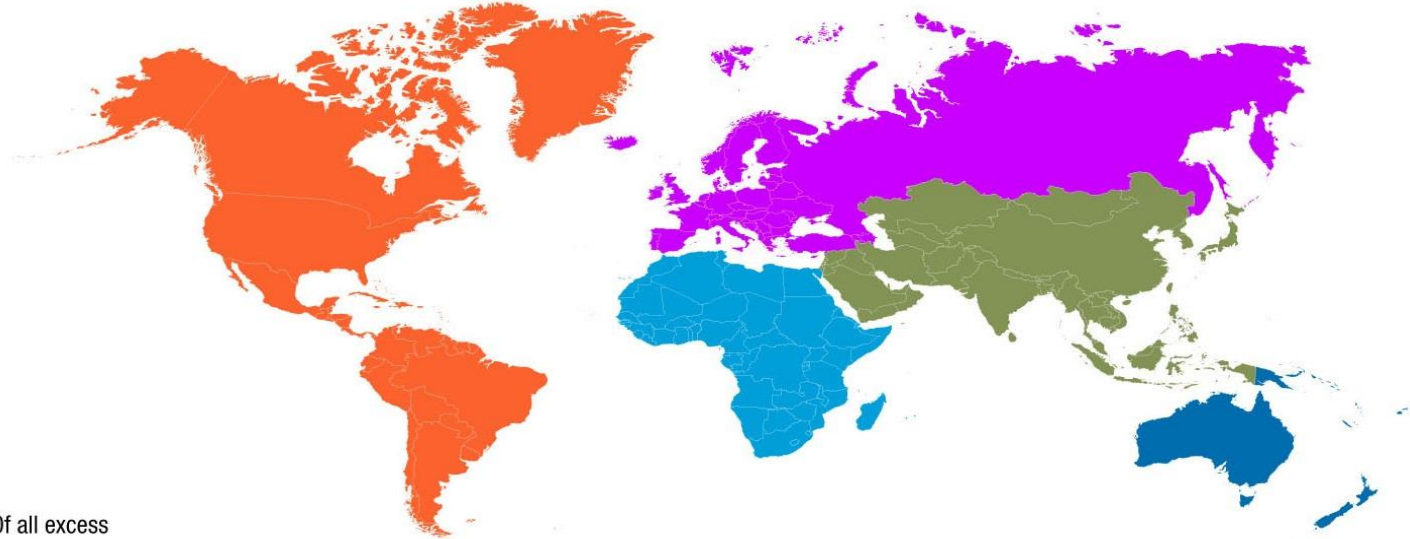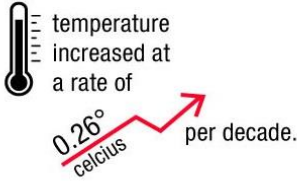
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•Temperature and Mortality

Every year non optimal (ie too hot or too cold) temperatures leads to:

5,083,000 deaths ☨

4,594,000 cold related ☨☨

489,000 heat related ☨☨
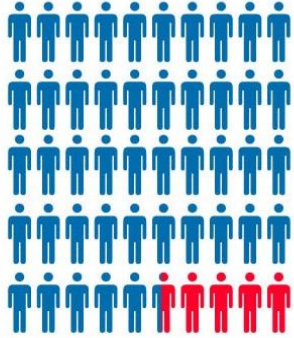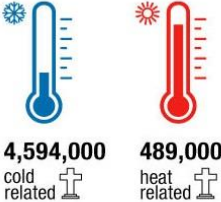
During a study conducted over two decades, between

2000 and 2019

they discovered the global average temperature increased at a rate of 0.26° celcius per decade.

Of all excess temperature related deaths:

51.5%
51.5% occur in Asia

23.9%
23.9% in Africa

16.4%
16.4% in Europe

7.7%
7.7% in America
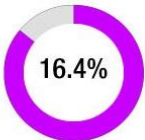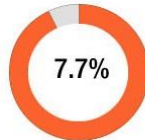
0.5%
0.5% in Oceania

(Qi, et al, Lancet Planet Health, 2021)

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•Temperature-mortality association

• **Non-linear association with a J-, V-, or U-shaped curve in different regions and countries**

  • **Influencing factors:**
    • Geographic location
    • Climatological features
    • Socioeconomic conditions
    • Human behaviours
    • Social intervention
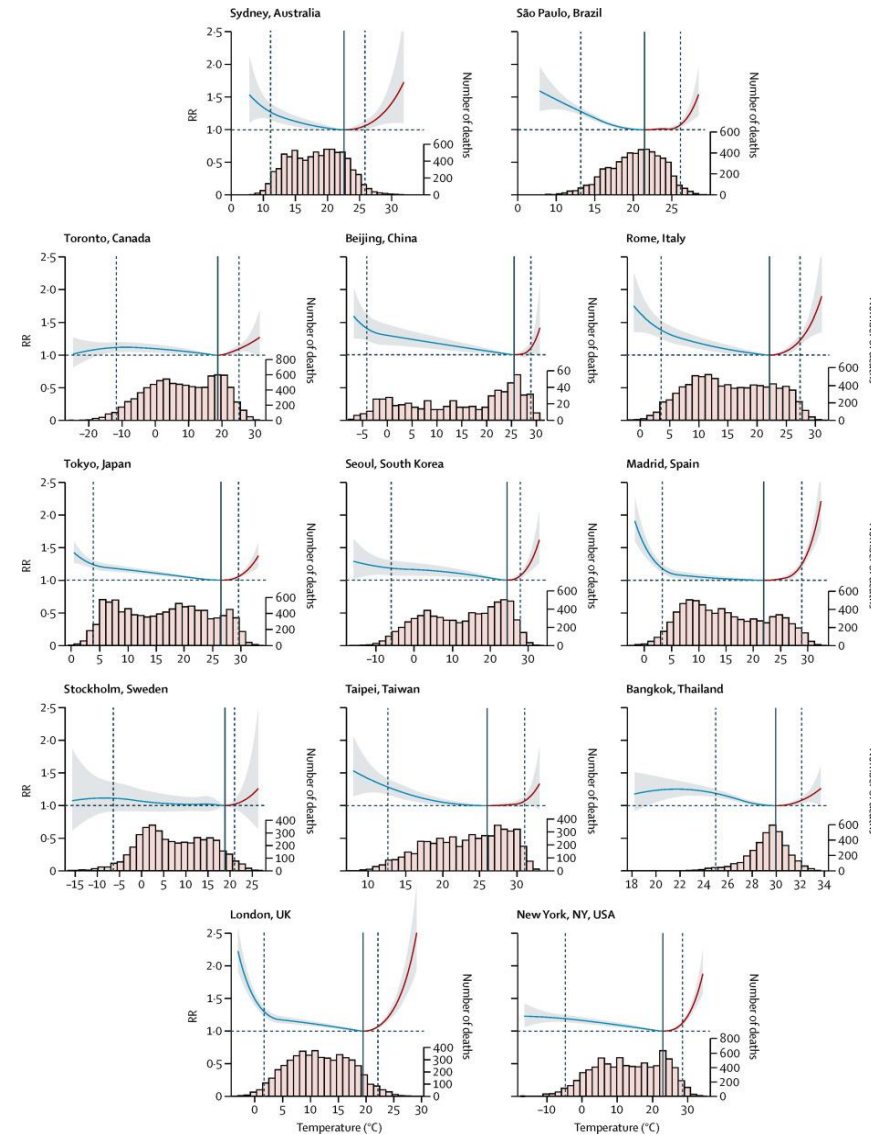
(Gasparrini et al, The lancet, 2015)

•Assumptions and Aims

- **Assumptions:**
- The individual vulnerability to the temperature-mortality association would be changed during the pandemic period.
- Extreme high or low temperatures are related to more non-COVID-19 and all-cause mortality during the pandemic period than non-pandemic period.

- **Aims:**
- 1) the temperature-mortality association in the pandemic 2020 (non-COVID-19 mortality and all-cause mortality)
- 2) the temperature-mortality association in the non-pandemic(2015-2019)
- 3) compare the difference of those associations

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• Methods

• Data:

- Mortality data: 3,189,790 total daily all-cause mortality (including 3,134,137 non-COVID-19 deaths) in 2015-2020 in Italy from the Italian Institute of Statistics

- Meteorological data include hourly ambient (dew point) temperature; humidity (RH &SH); PM2.5 from the ERA5 dataset.

• Analysis:

- 1) Time-stratified case-crossover study design achieved with the Conditional quasi-Poisson regression

- 2) The lag effect was tested using a distributed lag non-linear model (DLNM)

- 3) Subgroup analysis with sex, age, and urban-rural regions

- 4) Sensitivity analysis with the maximum lags to 18 and 24 days, and replacing RH with SH and using the daily maximum and minimum temperature separately
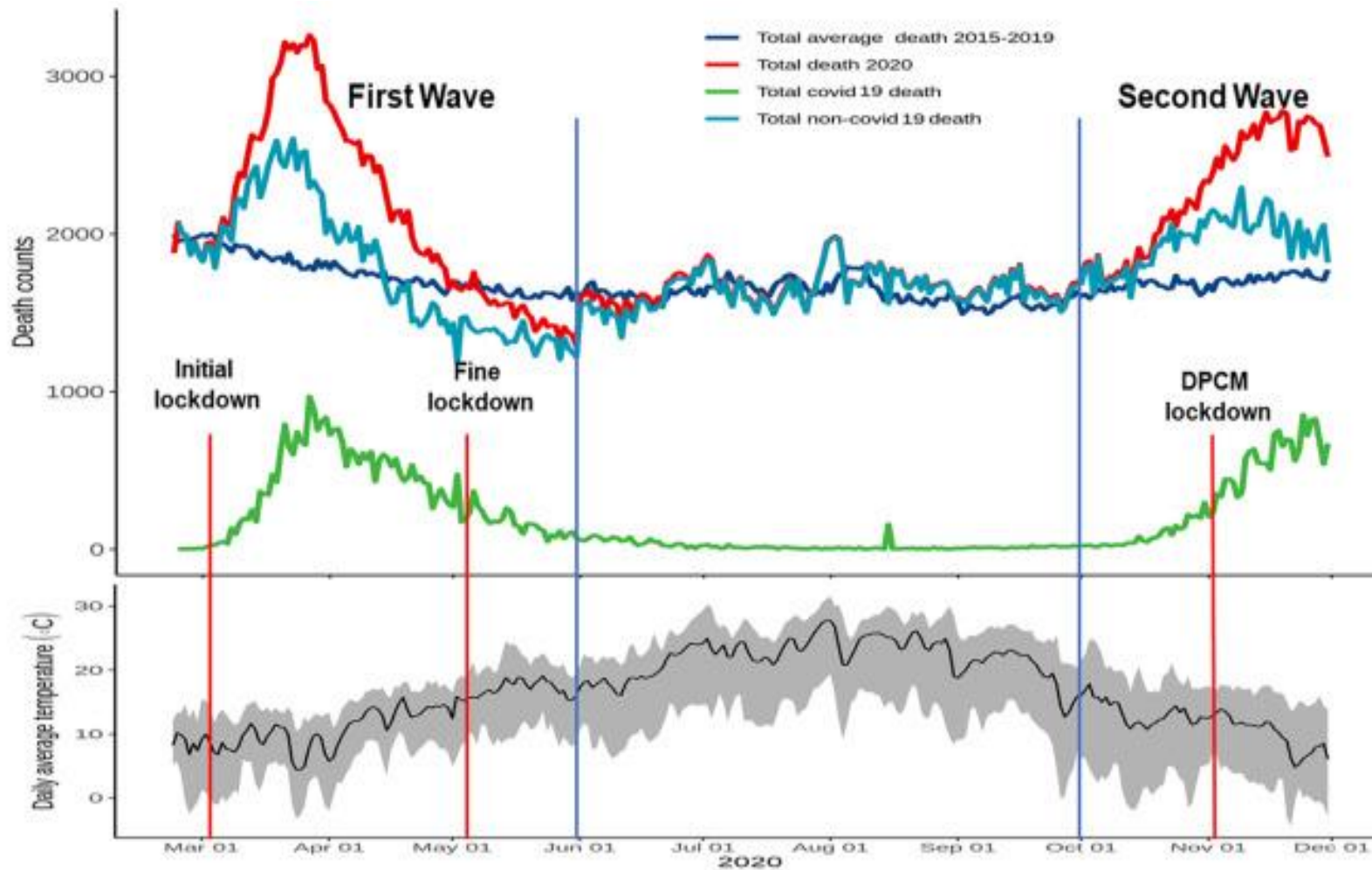
•Results

Fig. 1. The trend of daily average all-cause and COVID-19 mortality, daily average temperature in the pandemic period in 2020 and the counterpart in 2015–2019
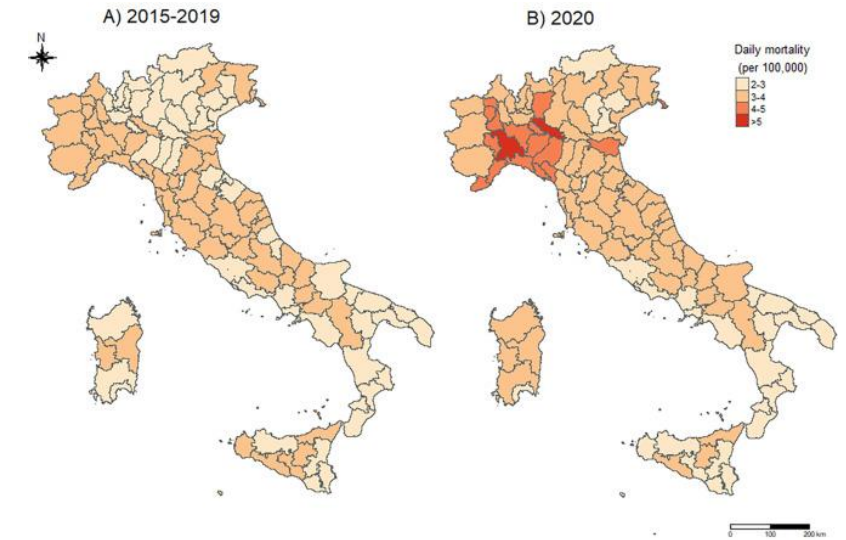

Fig. 2. The daily average all-cause mortality rate (per 100,000) in the pandemic (2020) and the non-pandemic period (2015–2019).

(Yu, et al, Urban Climate, 2021)

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Results

- U-shaped curves of temperature-mortality associations for both periods

- Higher risks of all-cause mortality (1.63 (95%CI: 1.55–1.72)) and non- COVID-19 mortality (1.45 (95%CI: 1.31–1.61)) for extreme cold temperature in 2020 than 2015-2019 with an RR of 1.19 (95%CI: 1.17–1.21).
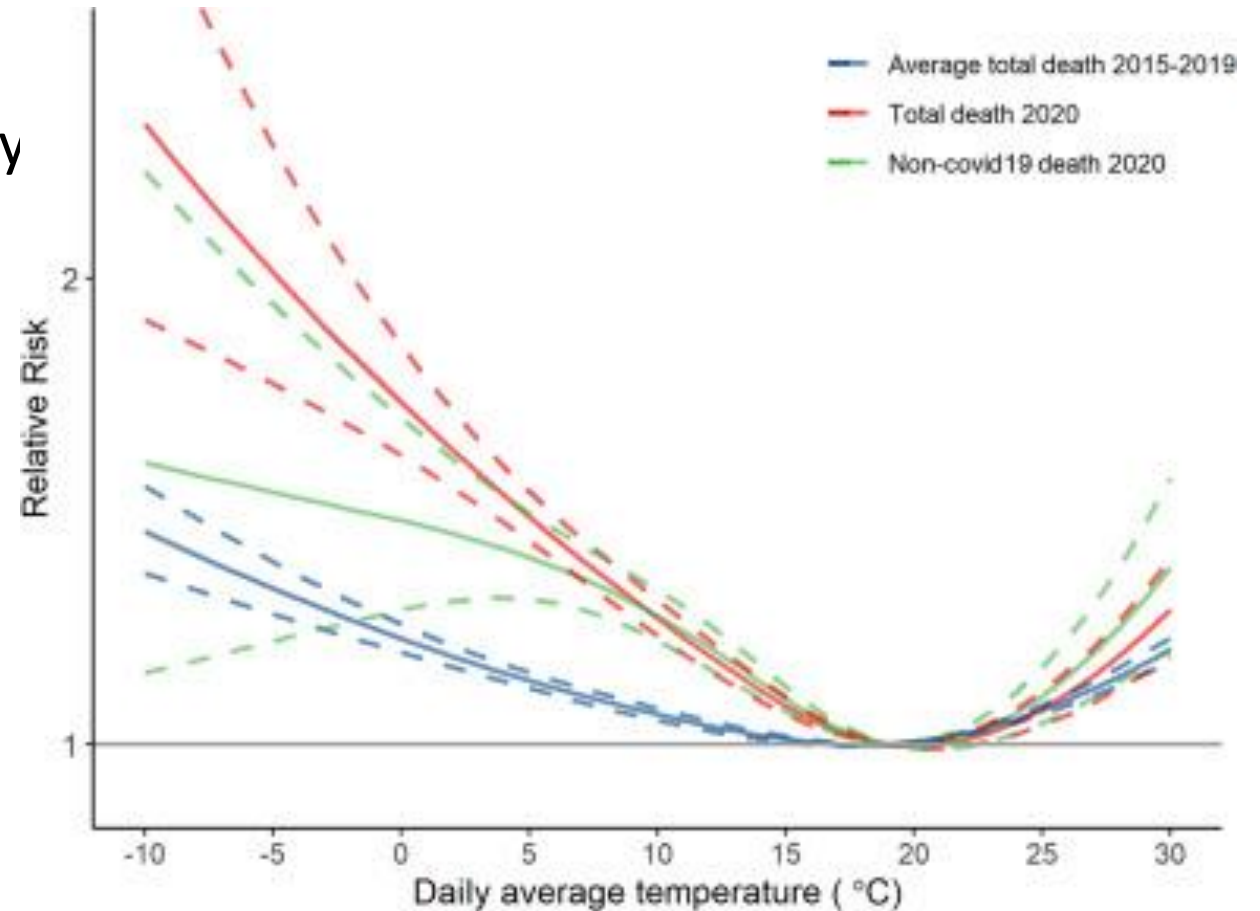
- A similar association for heat in both periods.

Fig. 3. Cumulative temperature–all-cause mortality and cumulative temperature-non-COVID-19 deaths associations along 21 lag days in the pandemic (2020) and the non-pandemic period (2015–2019)
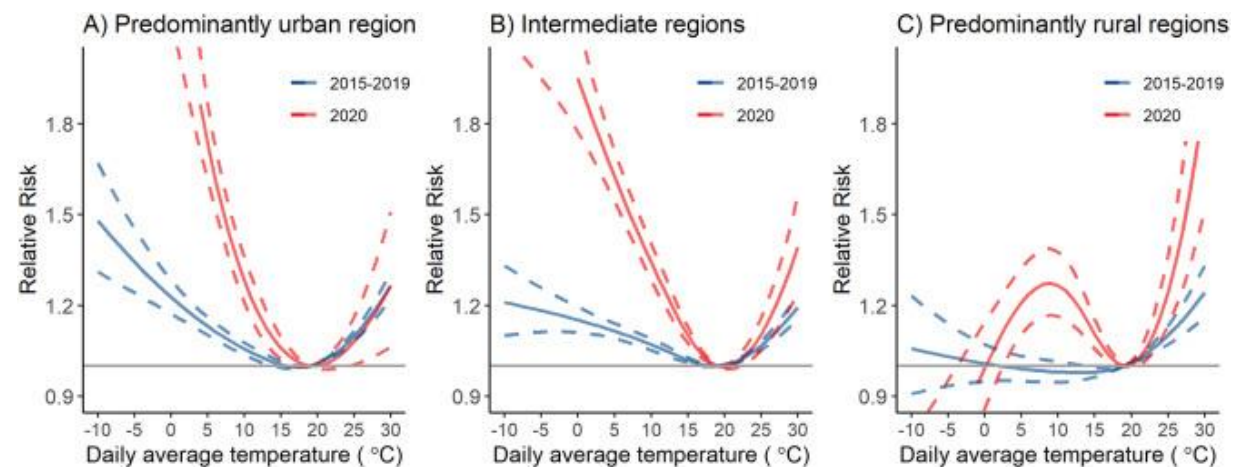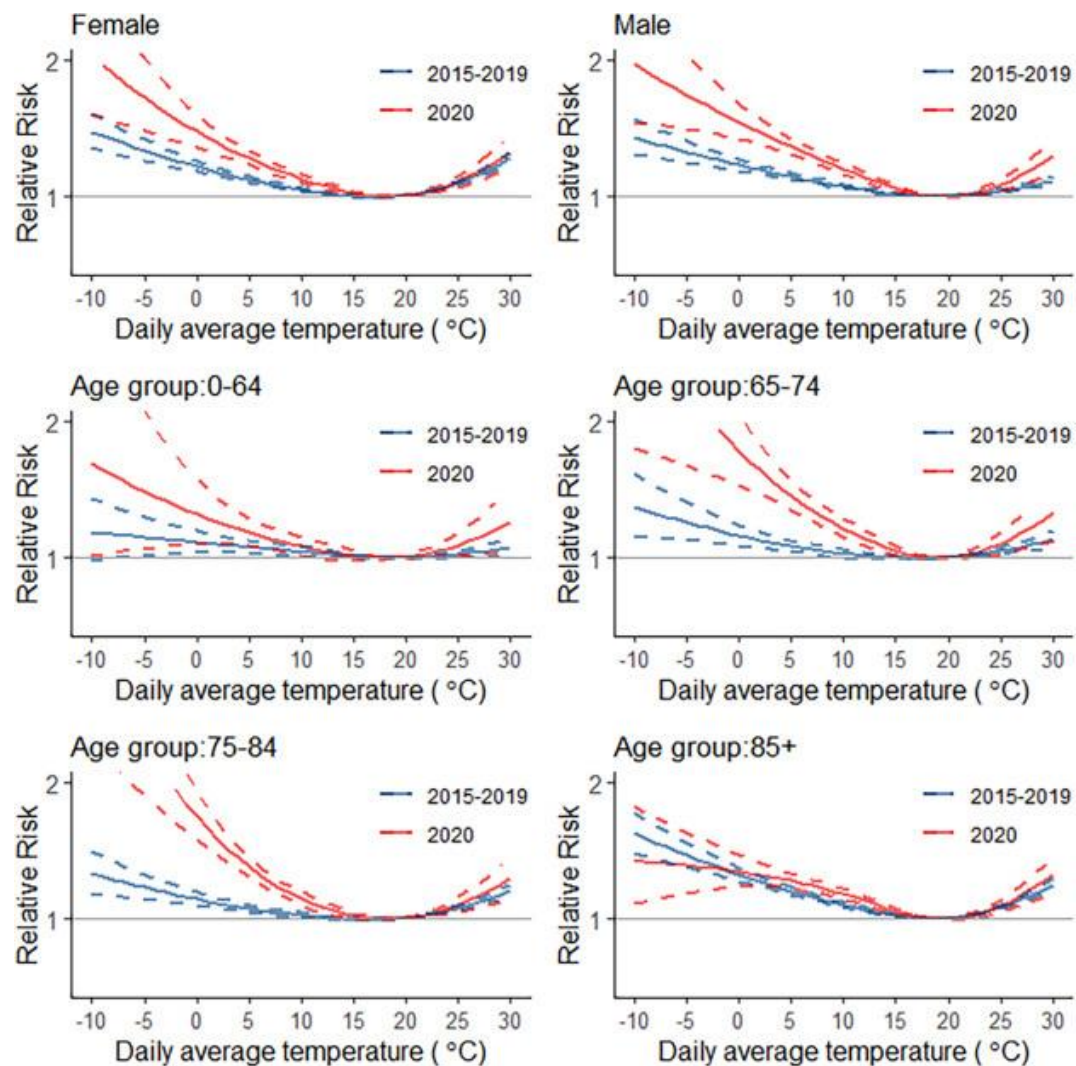
(Yu, et al, Urban Climate, 2021)

• Results

Fig 4. Cumulative temperature–all-cause mortality stratified by sex, age, and urban-rural regions

(Yu, et al, Urban Climate, 2021)

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• **Conclusion and Limitations**

• Italy experienced higher cold-related all-cause and non-COVID-19 mortality in the pandemic 2020 in comparison to the counterpart from 2015 to 2019, while no difference was found for the effects of heat.

Limitations:

➢It is an ecological study without individual data (associations on group-level)

➢Potential exposure misclassification

➢the disease-specific mortality and the patient-specific non-COVID-19 deaths were missing due to the data unavailability

➢the intervention measures like stay-at-home rules in the different pandemic stages may influence the exposure to temperatures and modify human behaviors

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