中国极端气温事件对人群健康影响研究

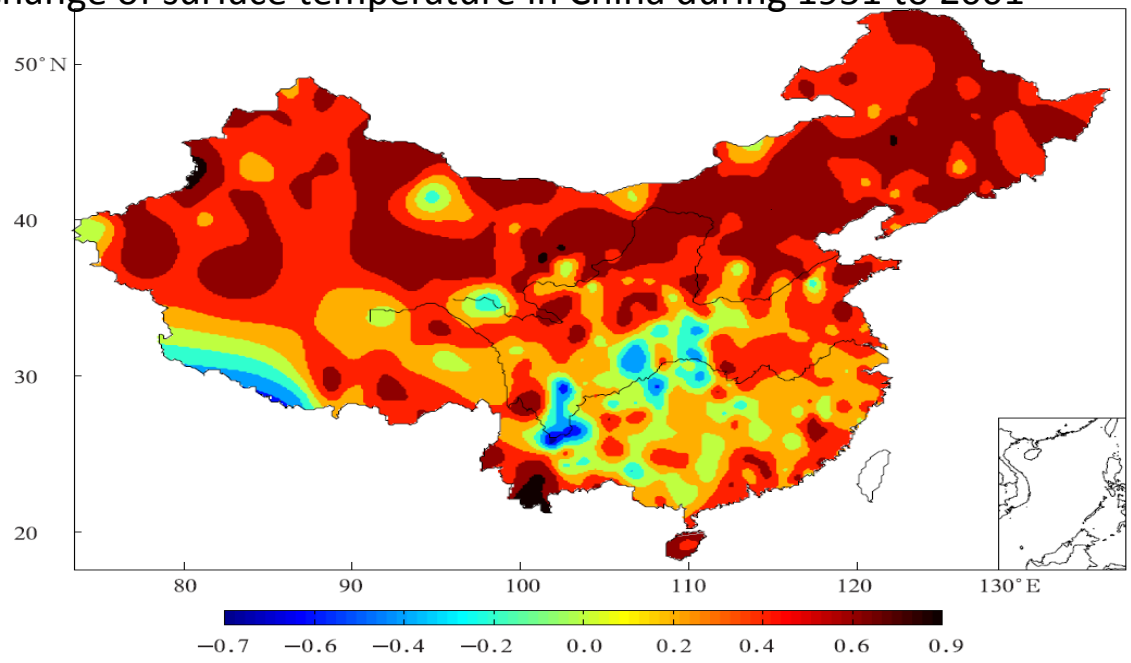
The climate and health impact assessment study(CHINAS)

马文军

广东省公共卫生研究院

2018.1

Change of surface temperature in China during 1951 to 2001



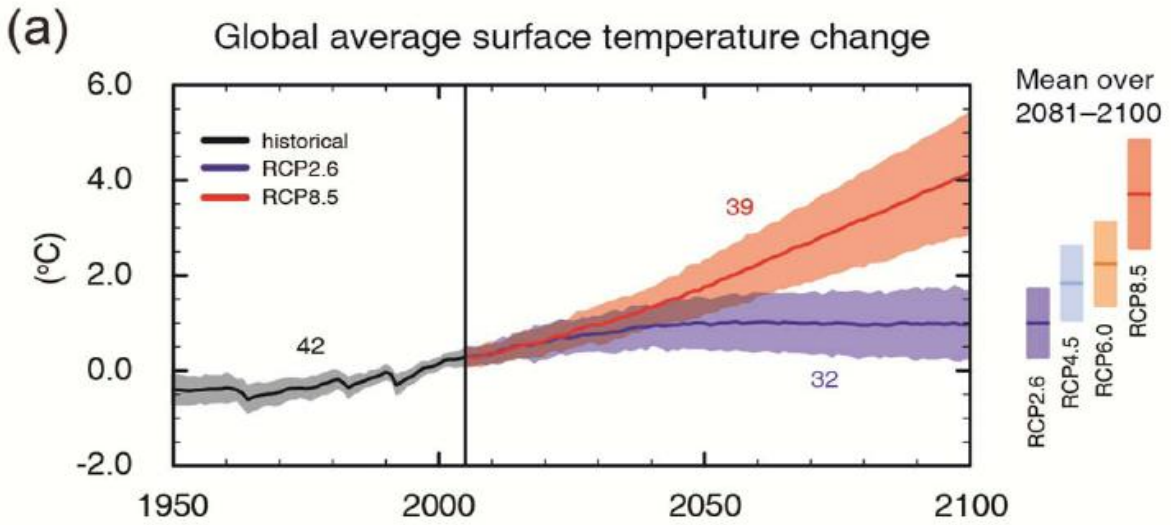
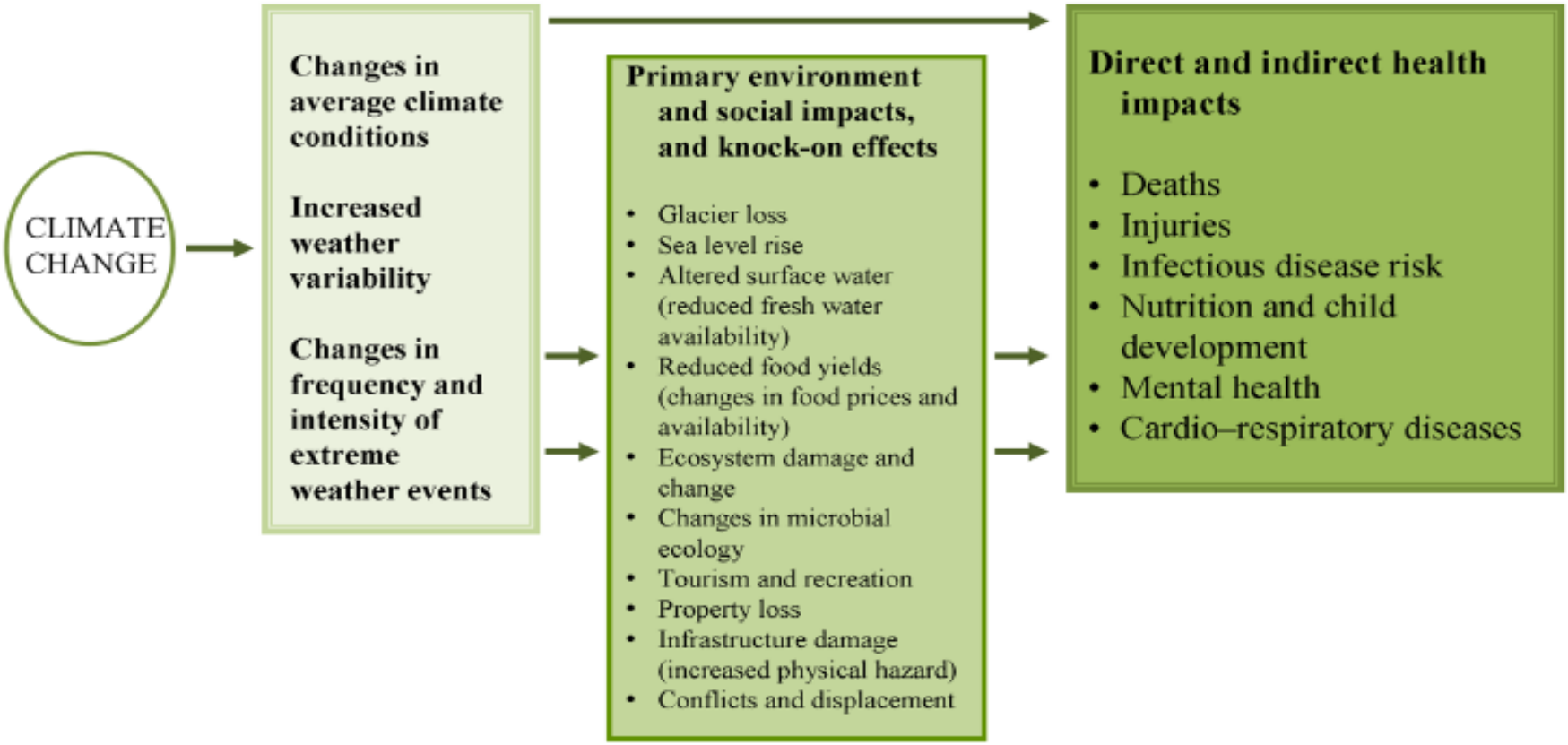
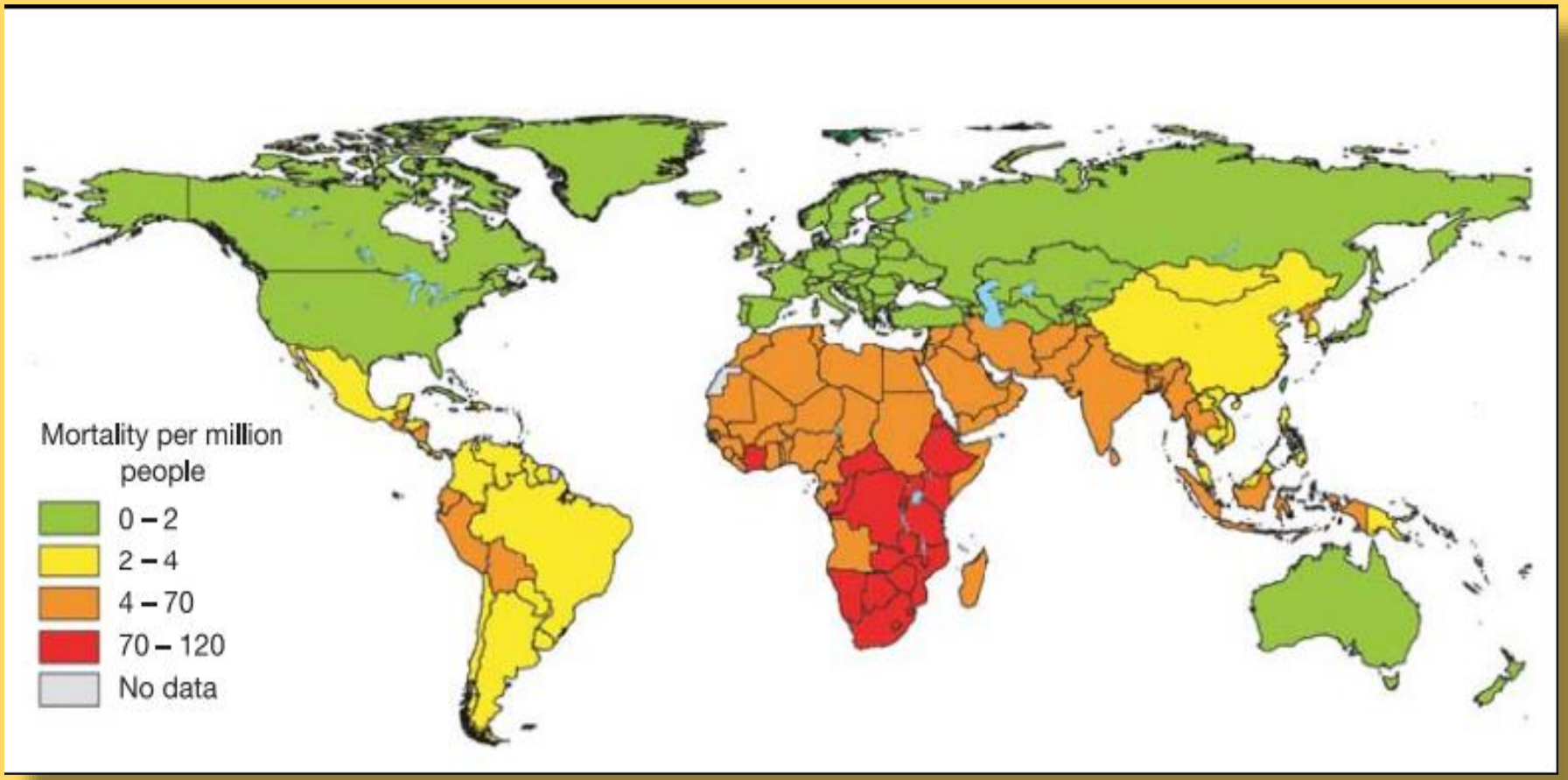


Fig. 1. Processes and pathways through which climate change influences human health





Global distribution of weather-related mortality (Patz, et al. Nature, 2005)

研究问题

?

中国气温与死亡关系及其地区变异

数据来源

★全国疾病监测点数据

根据监测点分布

监测点人口数选择

★气象数据

★空气污染数据

数据来源

地区	监测点数
东北	7
华北	8
西北	8
东部	16
中部	9
西南	11
南方	7

选择66个监测点进行分析

数据收集

- **健康数据**：2006-2011年每日死亡人数，不同疾病（循环系统、呼吸系统疾病）死亡人数。
- **气象数据**：同一时间段每日最高、平均、最低气温，相对湿度，气压，风速。
- **空气污染数据**：同一时间段每日空气污染数据。

数据分析方法

- 时间序列分析
- 分布滞后非线性模型（DLNM)
- Meta分析

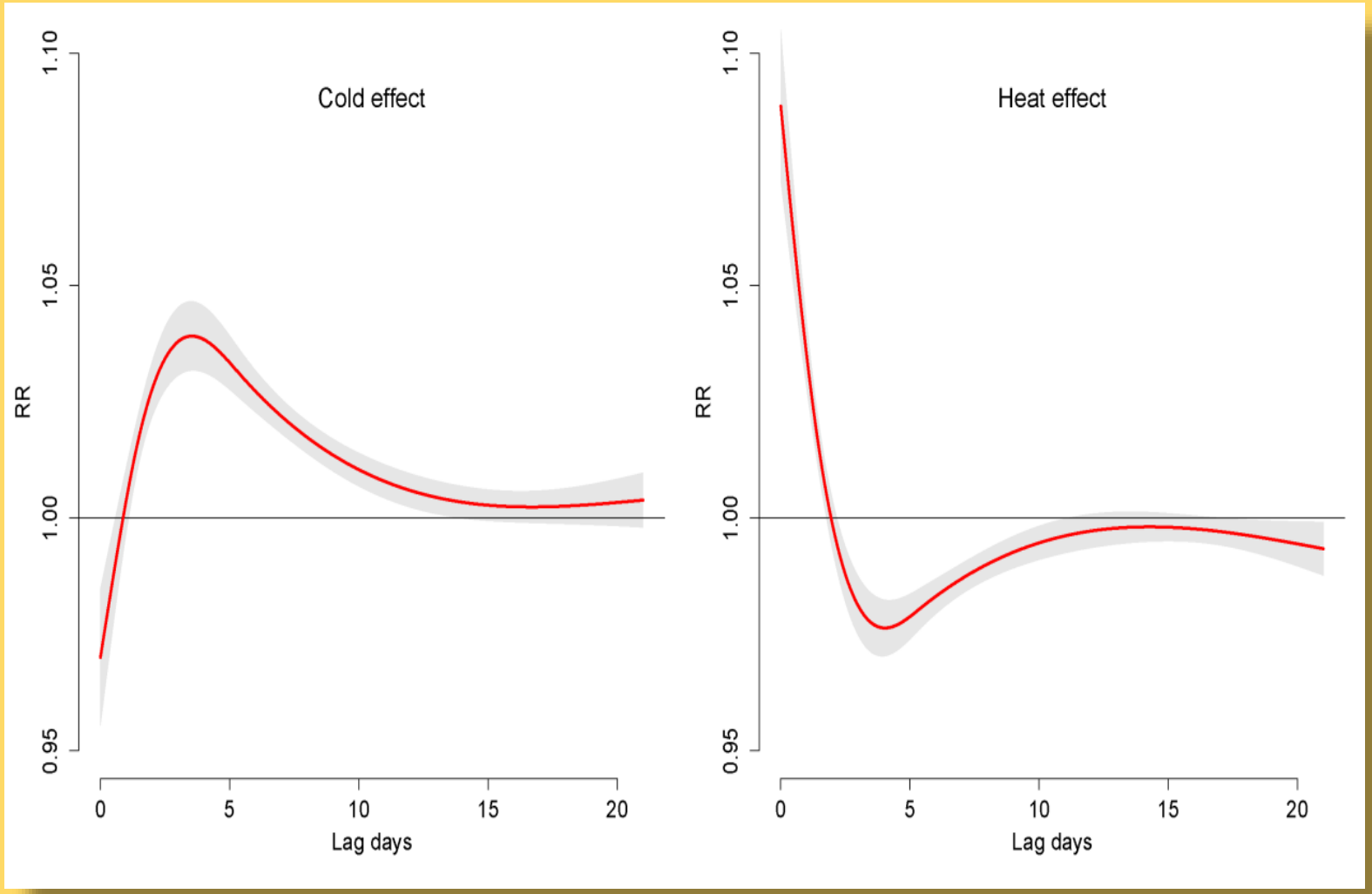
研究结果

1.中国温度死亡效应及其修饰作用

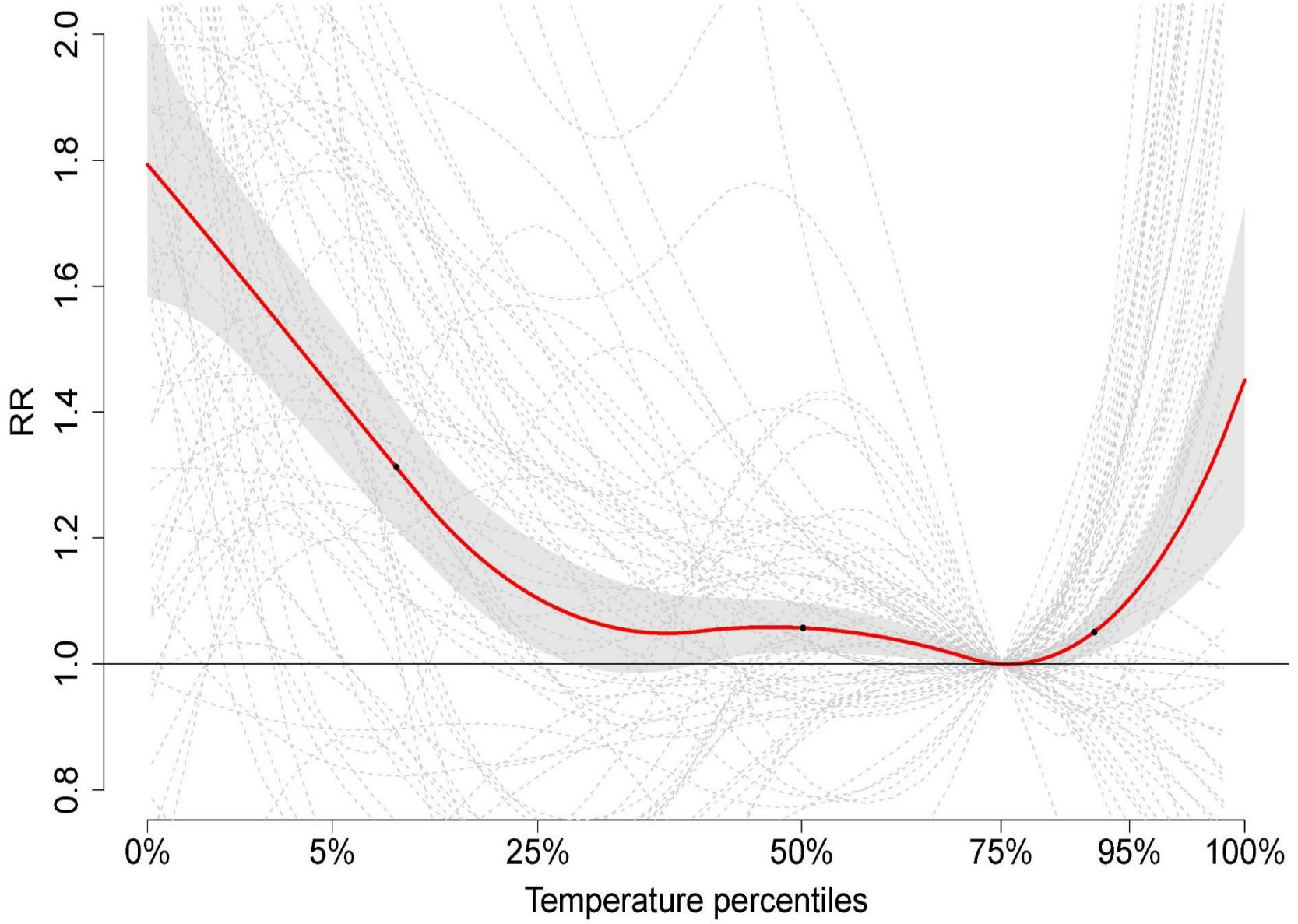
2.热浪与死亡

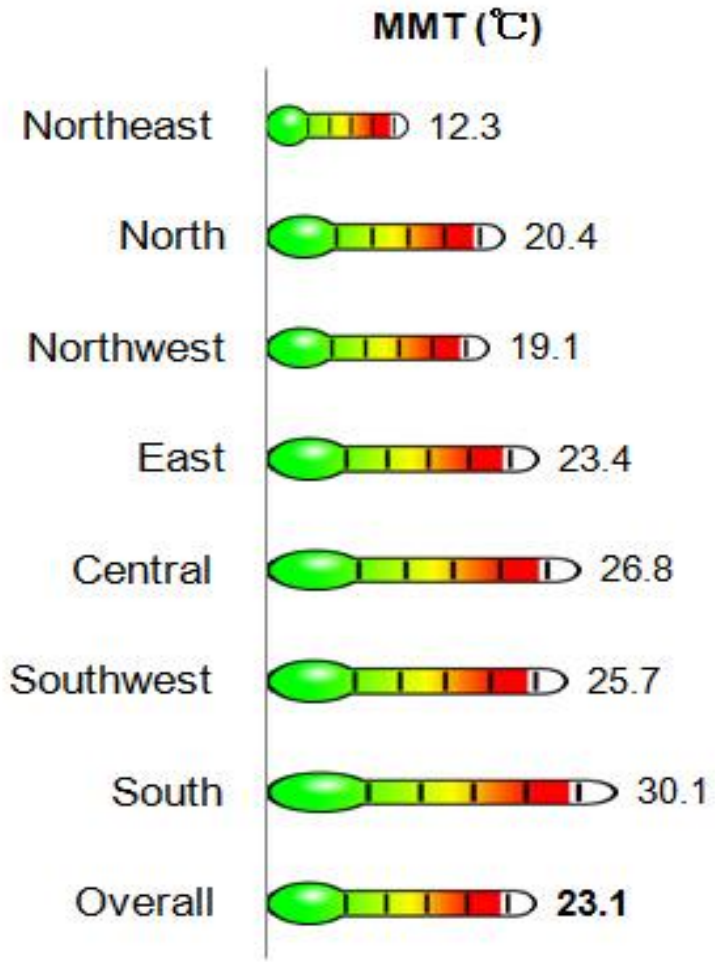
3.寒潮与死亡

研究结果



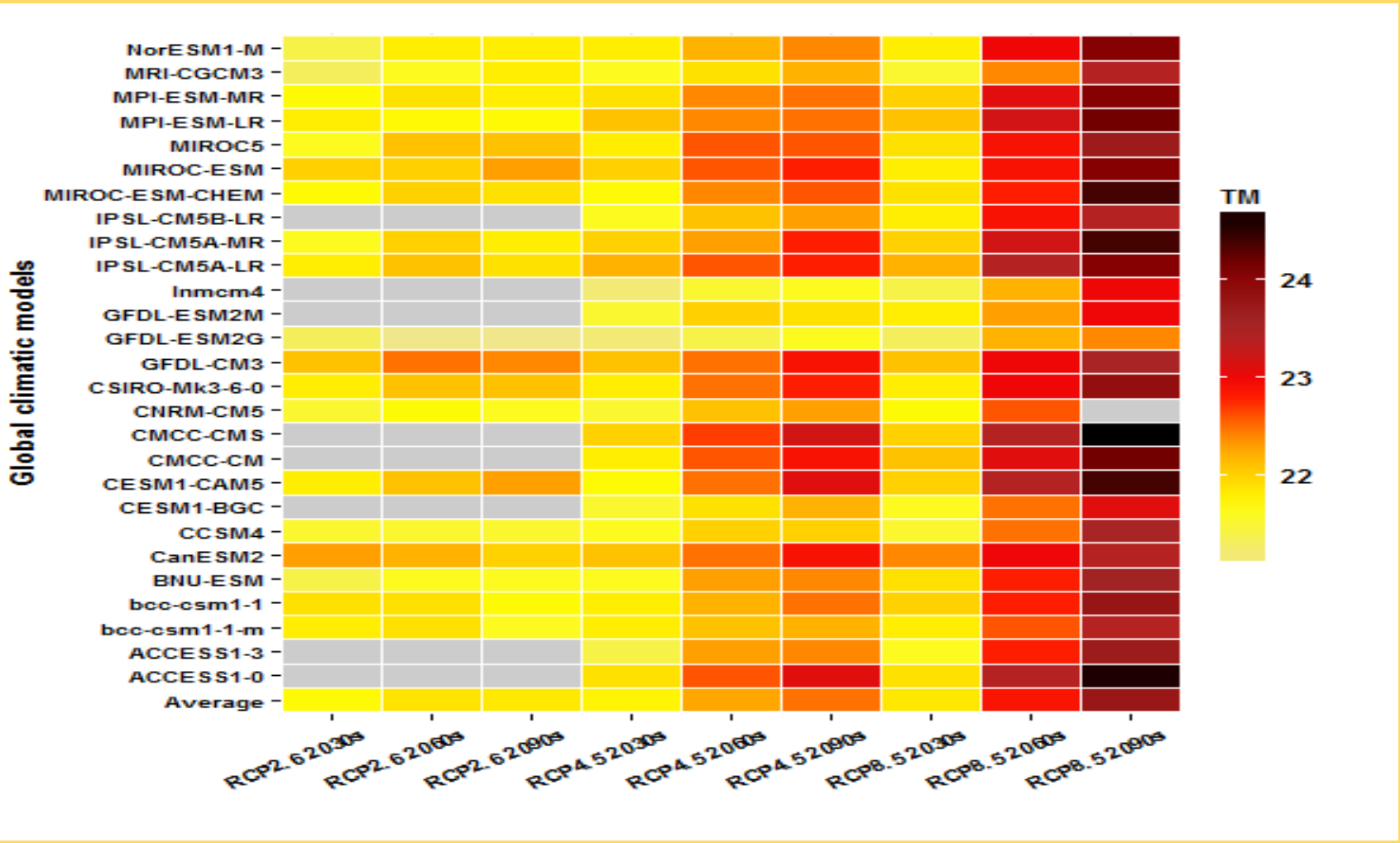
Pooled predictor-specific temperature-mortality relationship at different lag days based on 66 communities


RR
0.8
1.0
1.2
1.4
1.6
1.8
2.0
0%
5%
25%
50%
75%
95%
100%
Temperature percentiles



The MMTs(℃) in seven regions in China

Future temperature in Guangzhou



Mean temperature (℃) in the 2030s, 2060s and 2090s under different climatic scenarios and global climatic models

Heat-related YLLs in the future

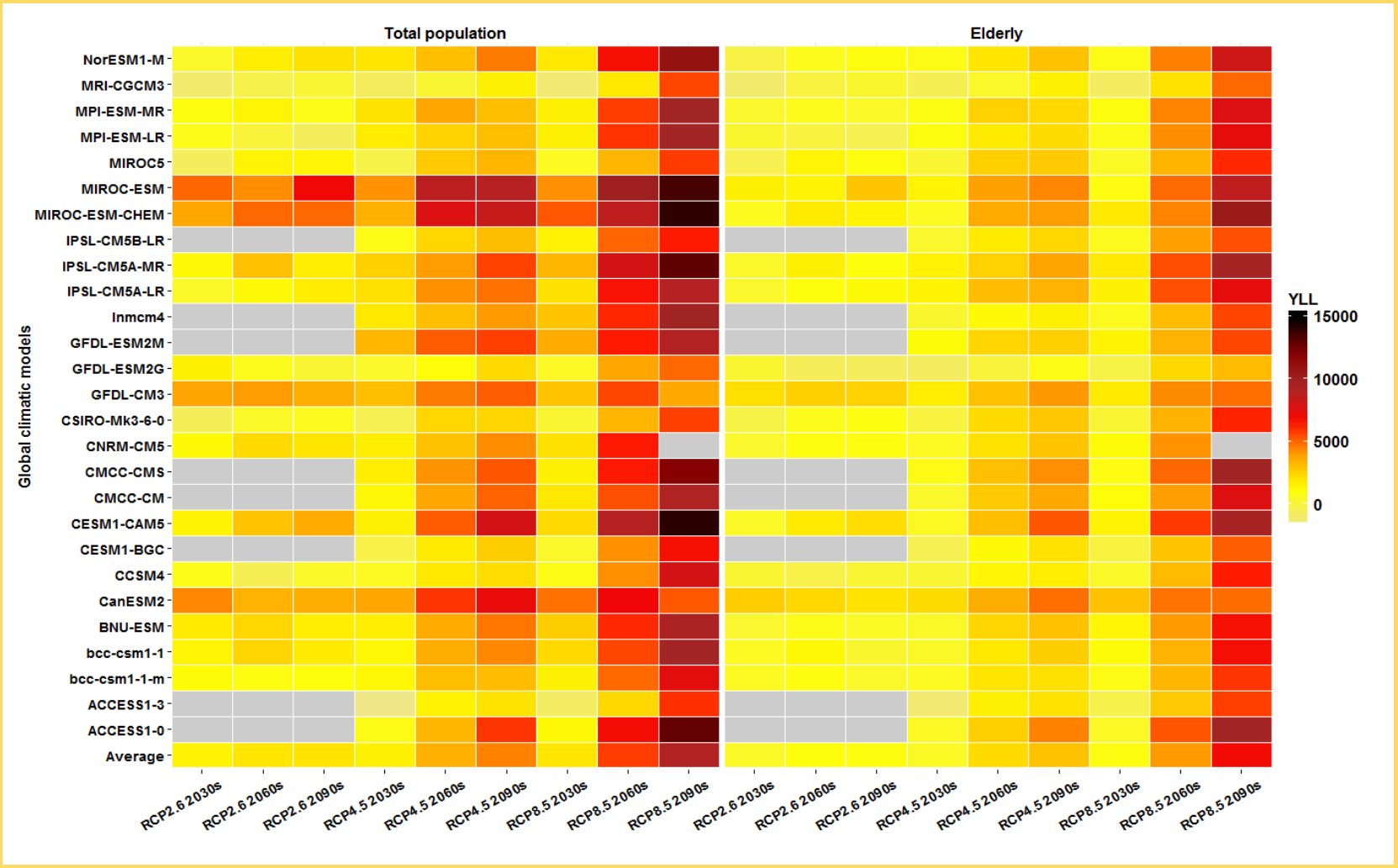


Figure 3. The annual average heat-related YLLs in the 2030s, 2060s and 2090s as compared with the 1980s under different climatic scenarios and GCMs

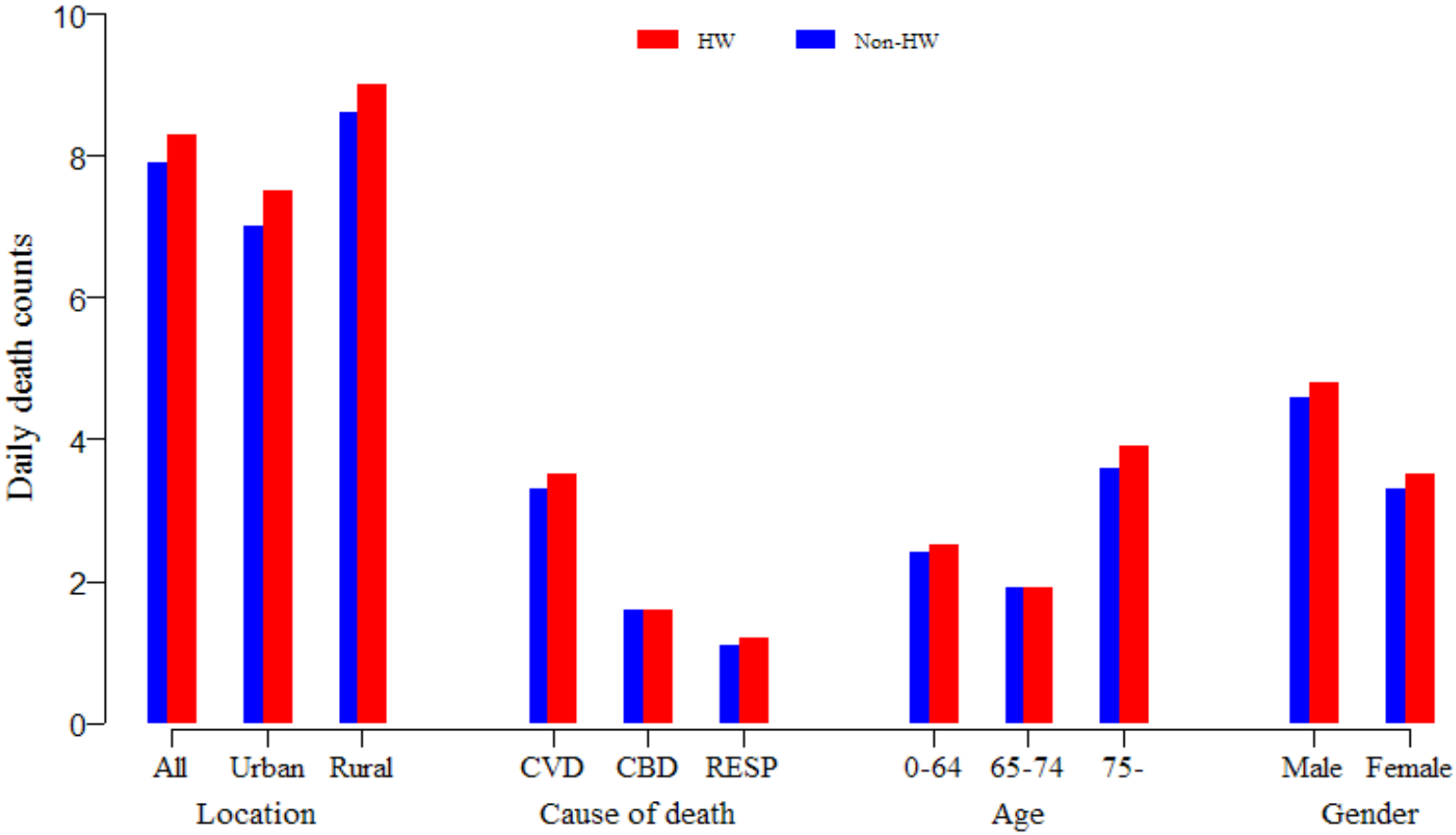
Note: We assumed that the number of population and their adaptive capacity were constant in the 21st century.

研究结果

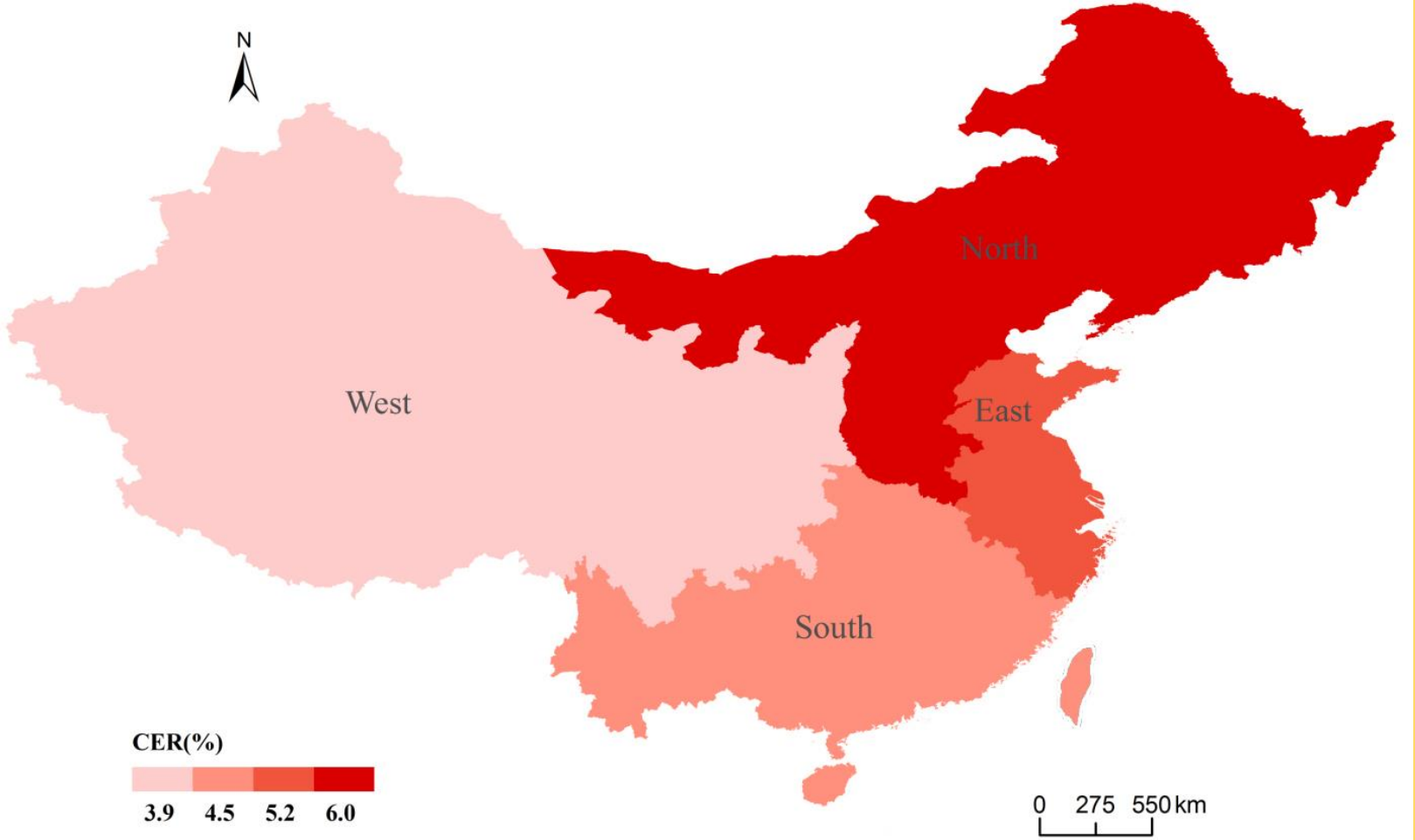
1.中国温度死亡效应及其修饰作用

2.热浪与死亡

3.寒潮与死亡

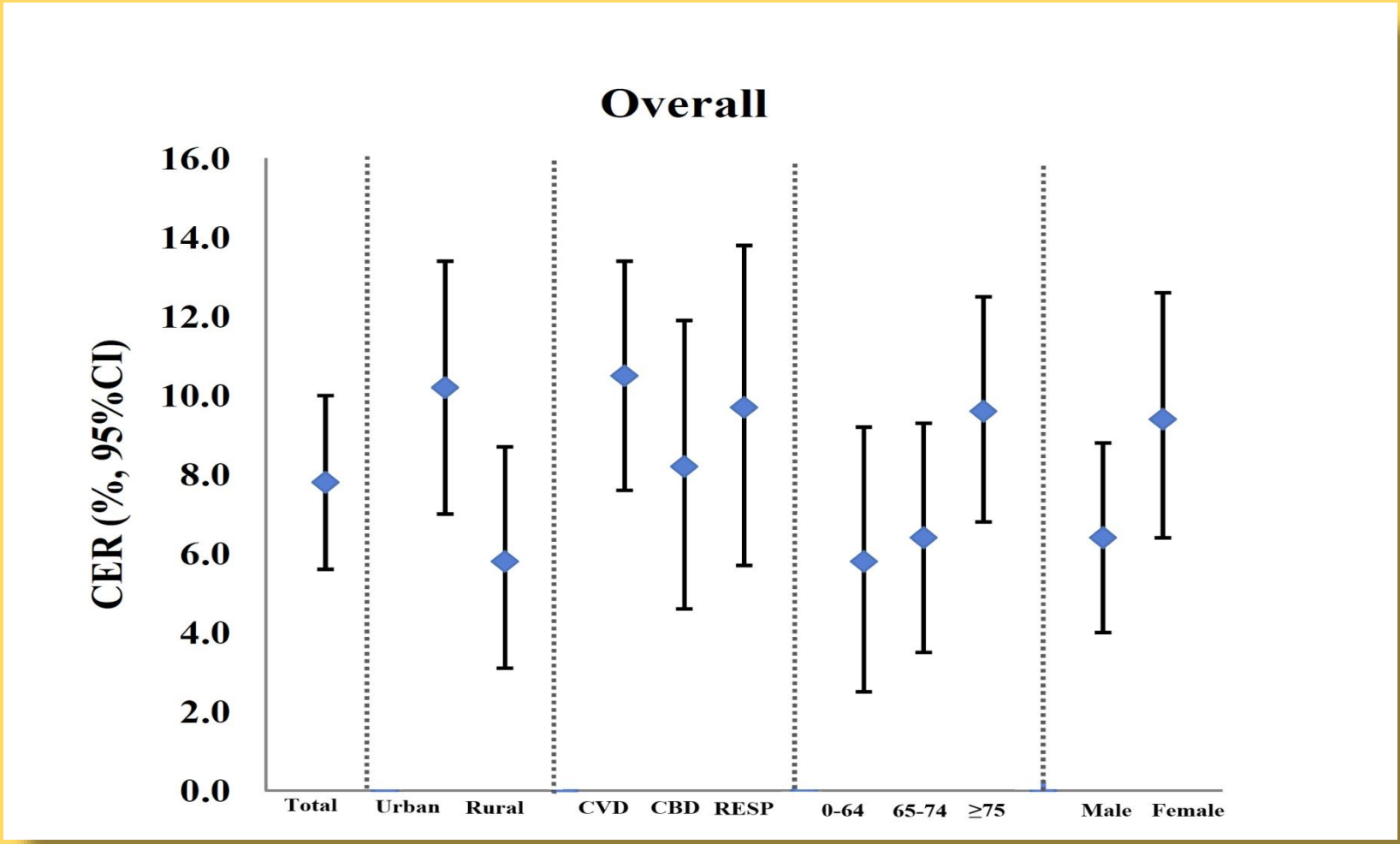


热浪期间与非热浪期间死亡人数



热浪死亡风险的地区分布

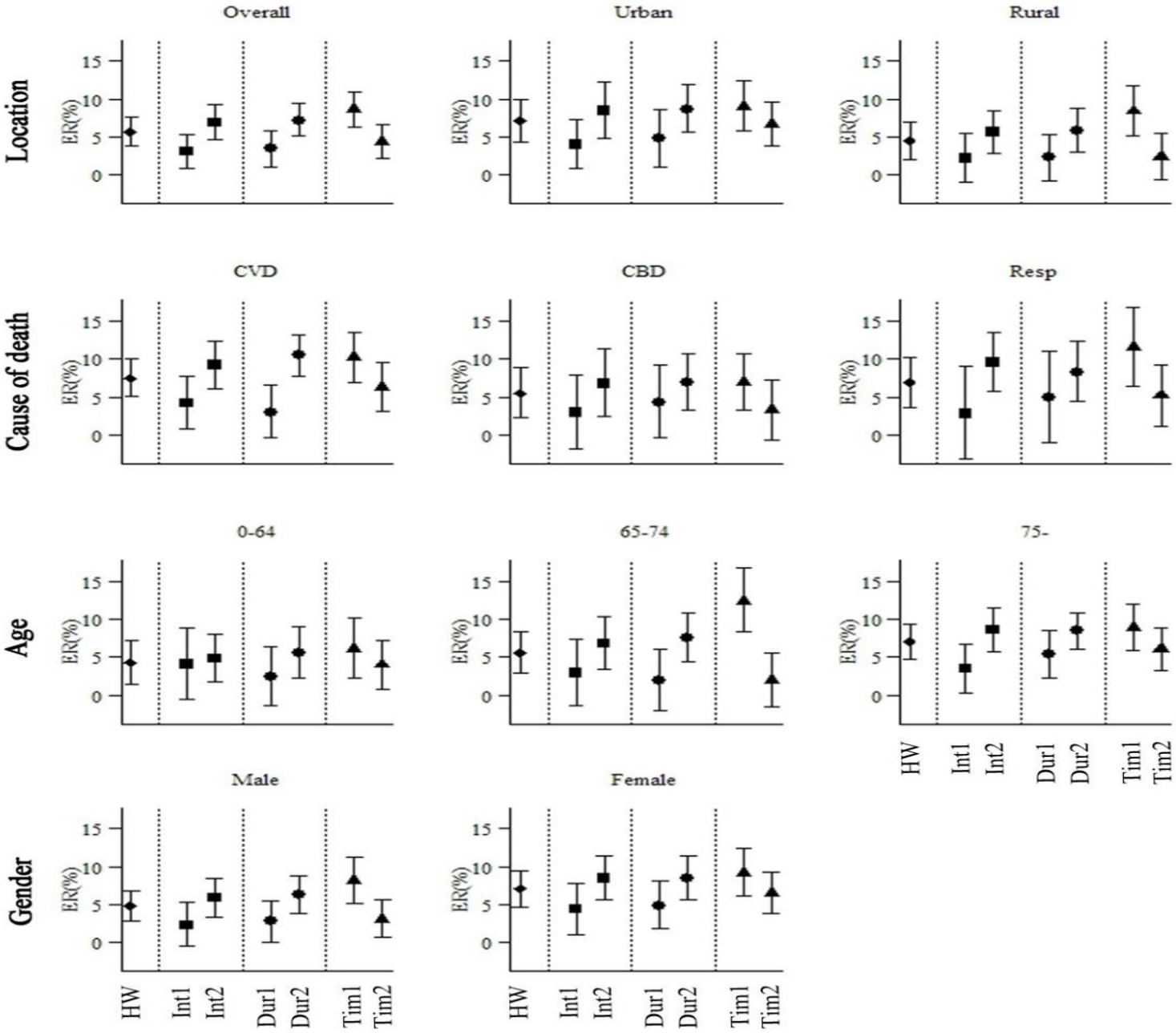
研究结果



Heat wave effect was modified by individual characteristics

研究结果

热浪特点影响热浪的死亡效应



研究结果

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2.热浪与死亡

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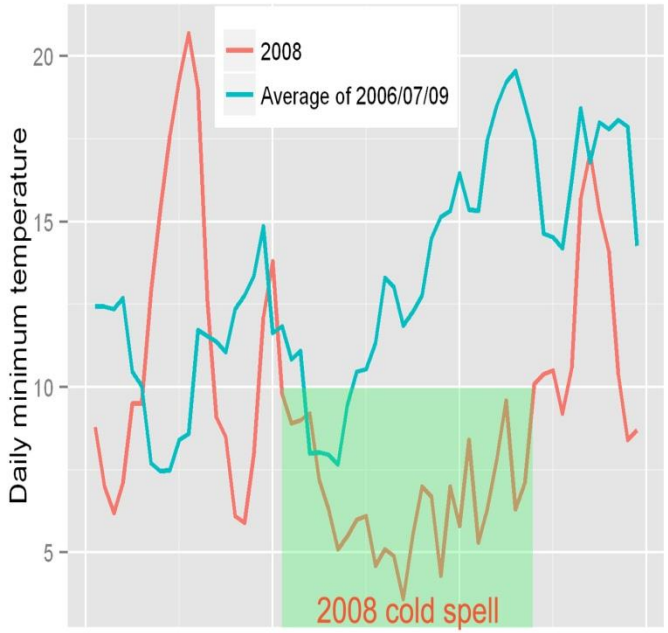
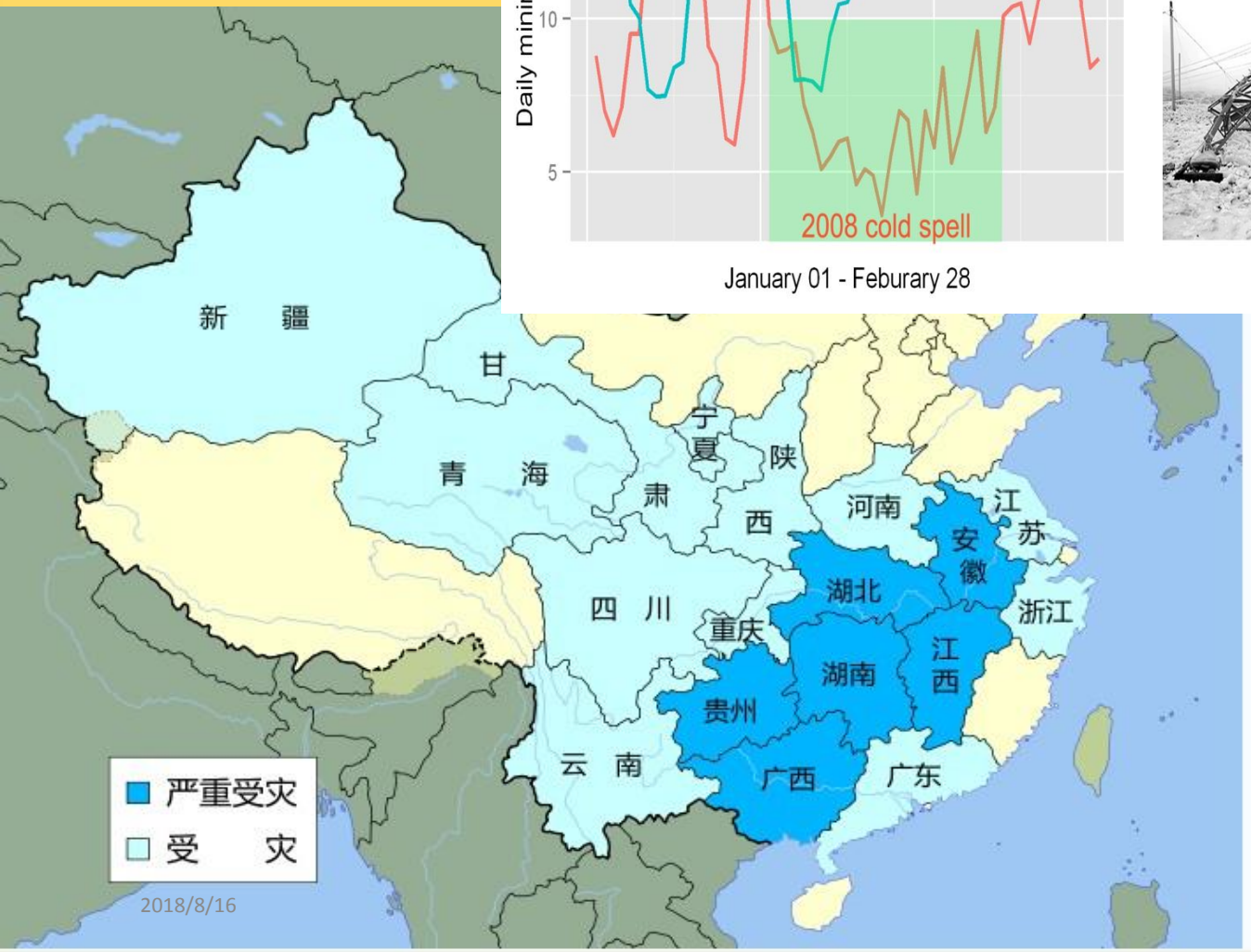
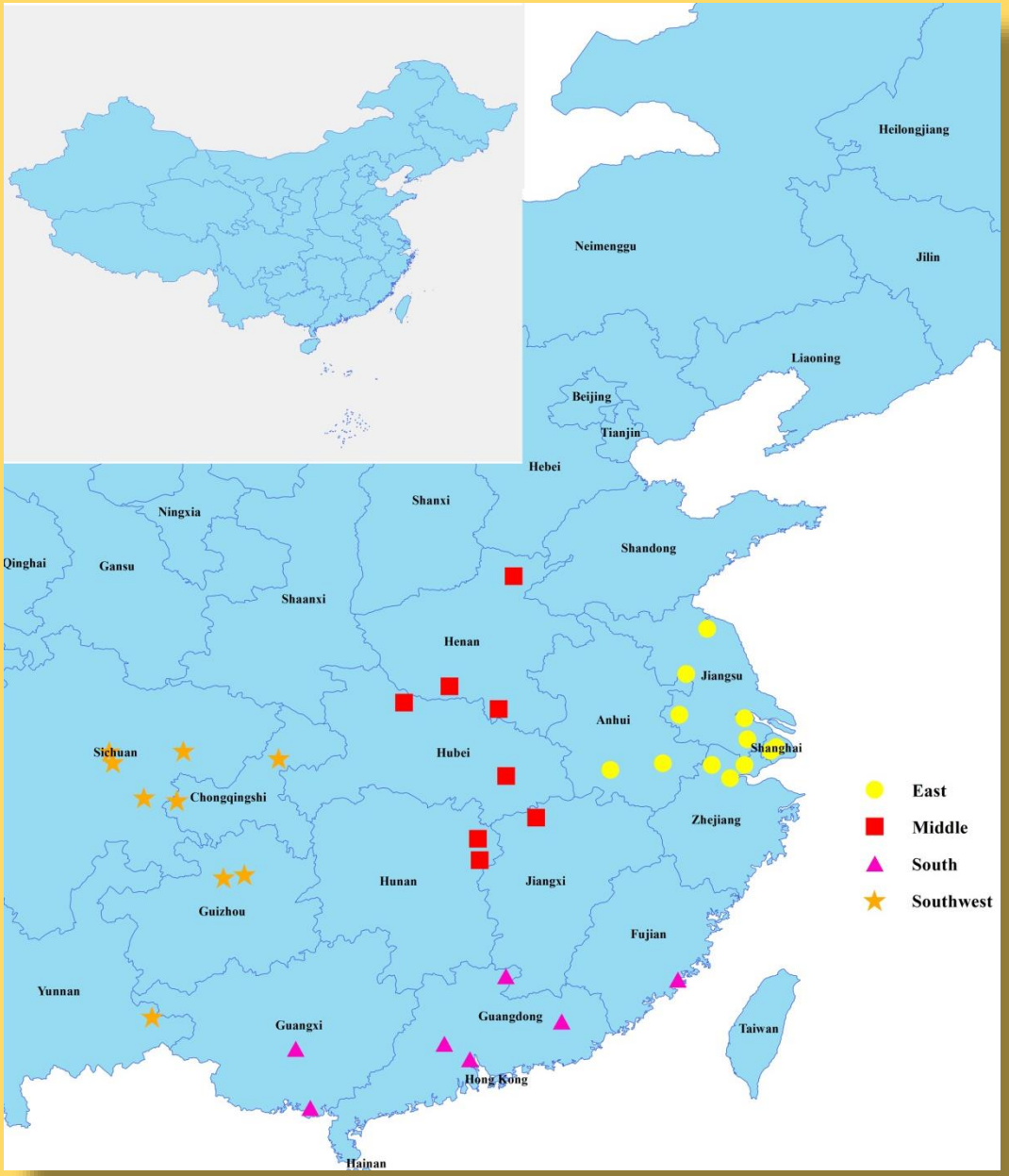


January 01 - Feburary 28

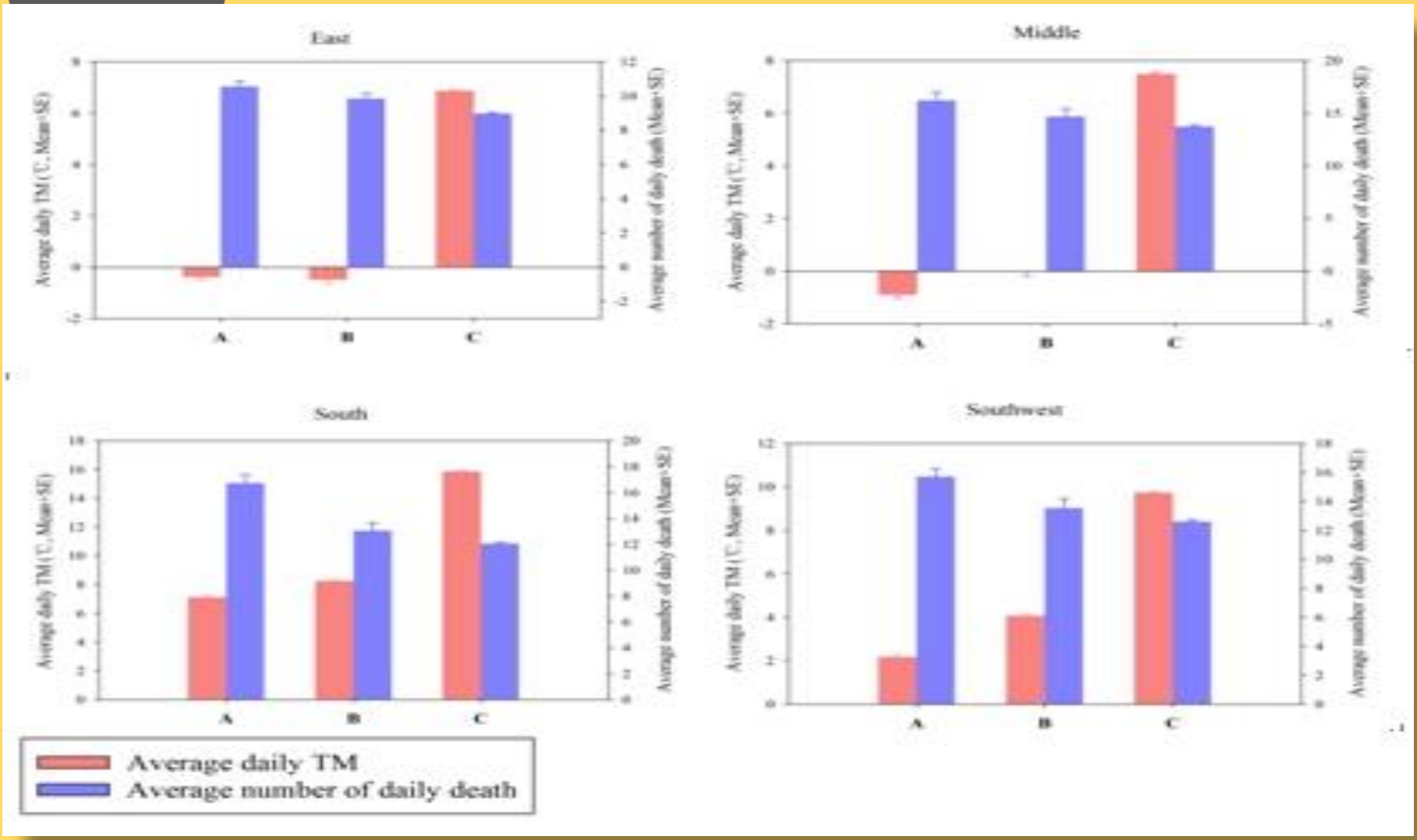
2008 cold spell in southern China



研究结果


Heilongjiang
Neimenggu
Jilin
Liaoning
Beijing
Tianjin
Hebei
Shanxi
Ningxia
Qinghai
Gansu
Shaanxi
Shandong
Henan
Jiangsu
Anhui
Shanghai
Sichuan
Hubei
Chongqingshi
Zhejiang
Hunan
Jiangxi
Guizhou
Fujian
Yunnan
Guangxi
Guangdong
Taiwan
Hong Kong
Hainan
East
Middle
South
Southwest

研究结果



A: 2008 cold spells;
B: 2006, 2007, 2009 and 2010 cold spells;
C: none cold spell days.

研究结果

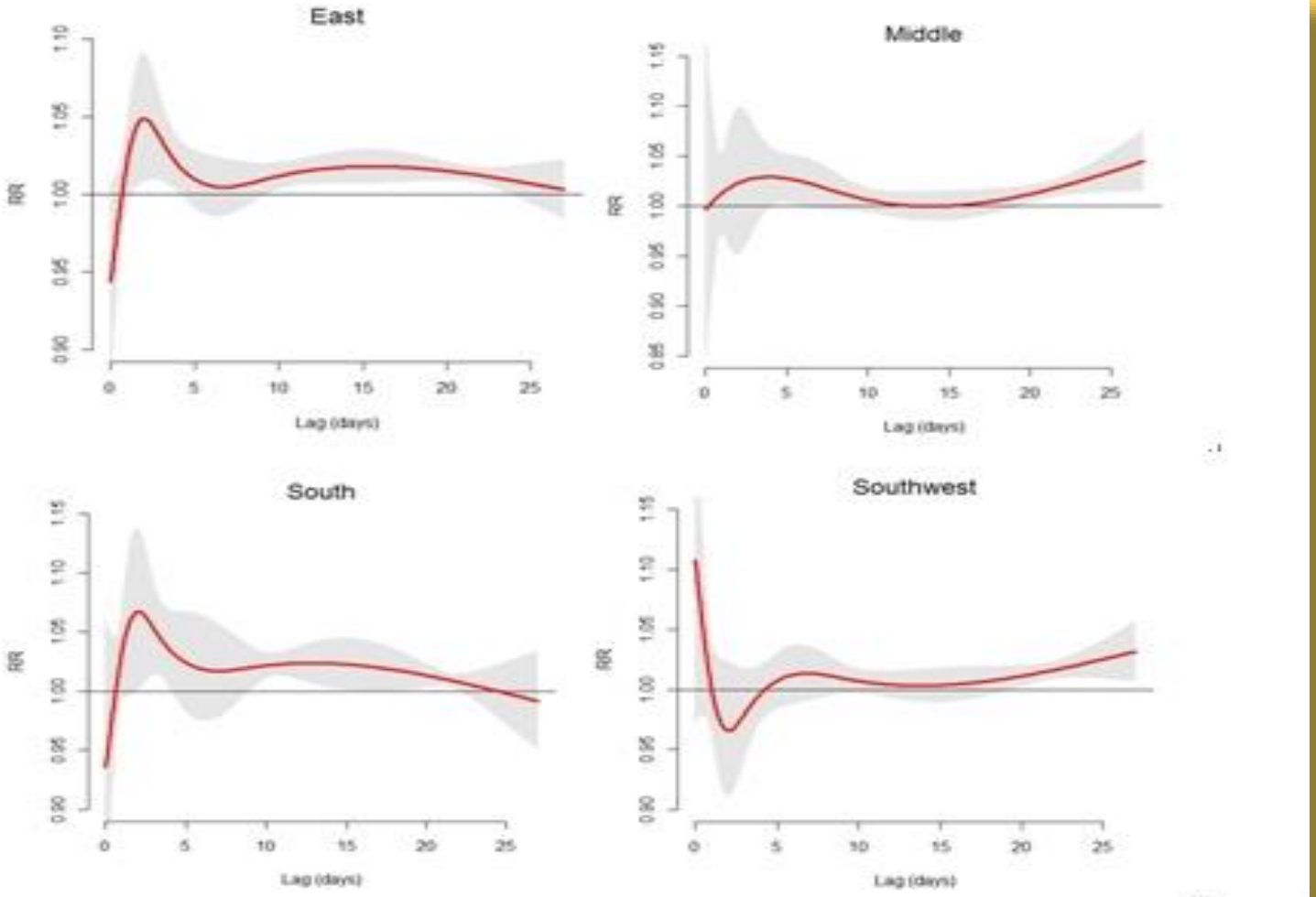
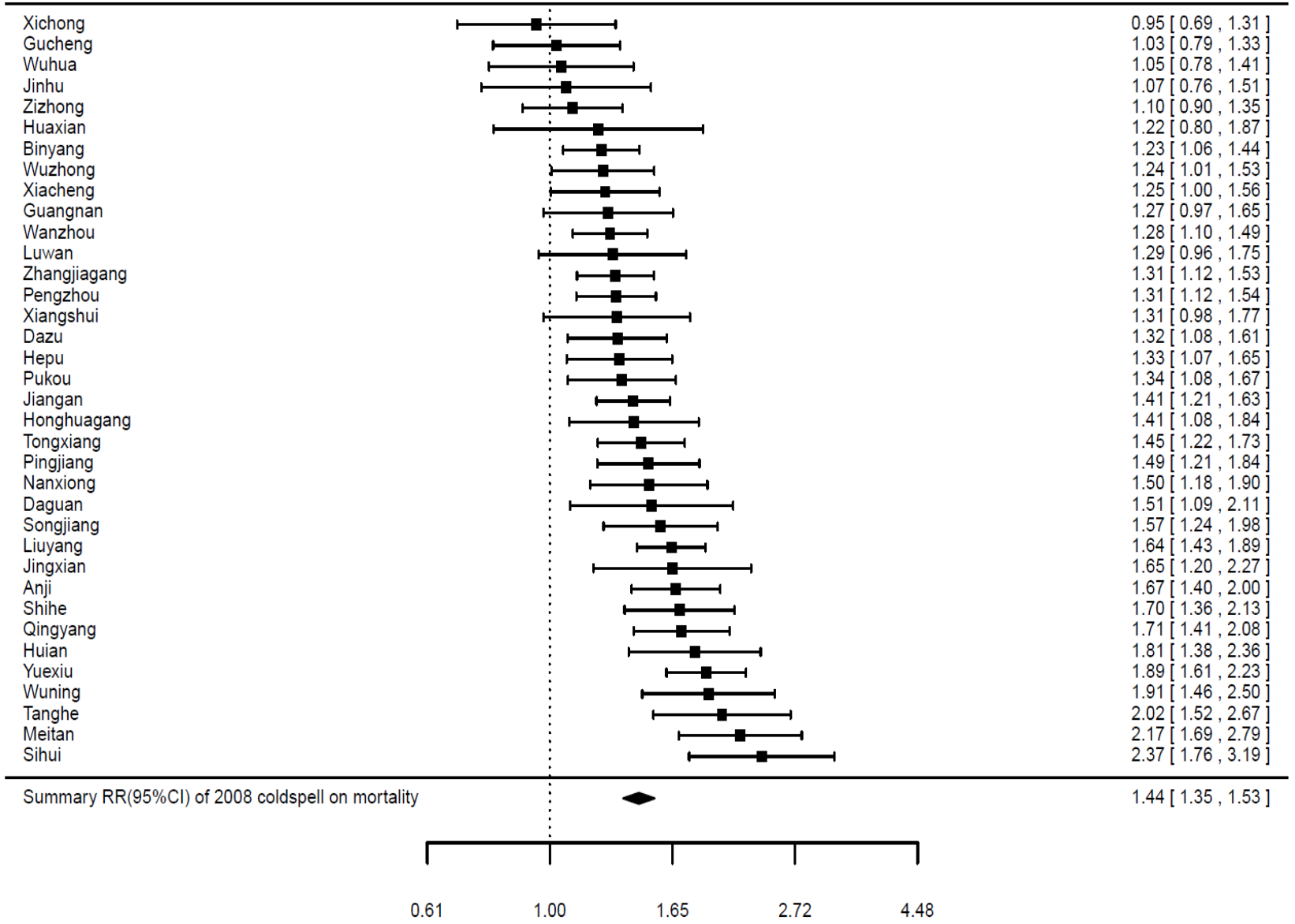


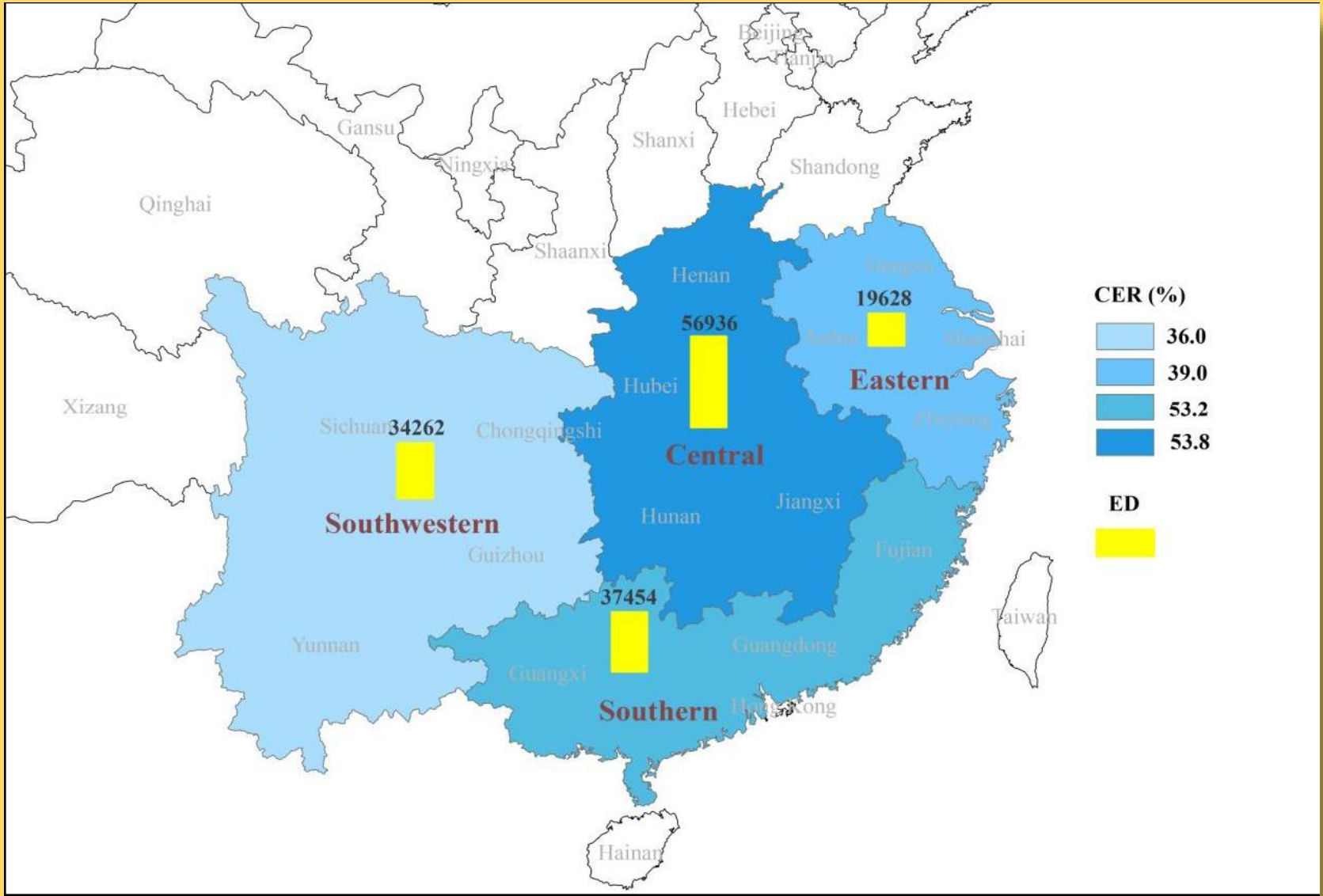
Figure 2. Summary single day RR (95%CI) of 2008 cold spell on non-accidental mortality during lag 0-27 days in 36 study locations, subtropical China.

Note: Adjustment for secular trend, wind speed, day of week and relative humidity.

研究结果


Xichong 0.95 [0.69 , 1.31]
Gucheng 1.03 [0.79 , 1.33]
Wuhua 1.05 [0.78 , 1.41]
Jinhu 1.07 [0.76 , 1.51]
Zizhong 1.10 [0.90 , 1.35]
Huaxian 1.22 [0.80 , 1.87]
Binyang 1.23 [1.06 , 1.44]
Wuzhong 1.24 [1.01 , 1.53]
Xiacheng 1.25 [1.00 , 1.56]
Guangnan 1.27 [0.97 , 1.65]
Wanzhou 1.28 [1.10 , 1.49]
Luwan 1.29 [0.96 , 1.75]
Zhangjiagang 1.31 [1.12 , 1.53]
Pengzhou 1.31 [1.12 , 1.54]
Xiangshui 1.31 [0.98 , 1.77]
Dazu 1.32 [1.08 , 1.61]
Hepu 1.33 [1.07 , 1.65]
Pukou 1.34 [1.08 , 1.67]
Jiangan 1.41 [1.21 , 1.63]
Honghuagang 1.41 [1.08 , 1.84]
Tongxiang 1.45 [1.22 , 1.73]
Pingjiang 1.49 [1.21 , 1.84]
Nanxiong 1.50 [1.18 , 1.90]
Daguan 1.51 [1.09 , 2.11]
Songjiang 1.57 [1.24 , 1.98]
Liuyang 1.64 [1.43 , 1.89]
Jingxian 1.65 [1.20 , 2.27]
Anji 1.67 [1.40 , 2.00]
Shihe 1.70 [1.36 , 2.13]
Qingyang 1.71 [1.41 , 2.08]
Huian 1.81 [1.38 , 2.36]
Yuexiu 1.89 [1.61 , 2.23]
Wuning 1.91 [1.46 , 2.50]
Tanghe 2.02 [1.52 , 2.67]
Meitan 2.17 [1.69 , 2.79]
Sihui 2.37 [1.76 , 3.19]
Summary RR(95%CI) of 2008 coldspell on mortality
1.44 [1.35 , 1.53]
0.61
1.00
1.65
2.72
4.48

研究结果


Gansu
Shanxi
Hebei
Shandong
Qinghai
Shaanxi
Henan
19628
56936
Hubei
Eastern
Xizang
34262
Central
Southwestern
Hunan
Jiangxi
Guizhou
Fujian
37454
Yunnan
Guangdong
Guangxi
Southern
Taiwan
Hainan
CER (%)
36.0
39.0
53.2
53.8
ED

结 论

- 温度与死亡呈U型关系，MMT与纬度密切相关；
- 极端气温可以显著增加死亡风险；
- 热浪（高温）影响比较急，寒潮（低温）的效应持续时间比较久；
- 热浪（高温）与寒潮（低温）的健康效应受到个体特征的影响；
- 热浪（高温）和寒潮（低温）的健康效应还受到其特征的影响；
- 在气候变暖情景下，健康风险可能增加，要加强气候变化适应，降低风险。

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The temperature–mortality relationship in China: An analysis fr

Chinese communities

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Distributed lag non-linear model
Multivariate meta-analysis
Extreme temperature
Mortality

ABSTRACT

Background: Previous studies examining temperature–mortality asso
single city or a small number of cities. A multi-city study covering differe
better understand regional differences in temperature risk on mortality
Methods: Sixty-six communities from 7 regions across China were inclu
Distributed Lag Non-linear Model (DLNM) to estimate community-sp
non-accidental mortality during 2006–2011. A multivariate meta-analy
estimates of community-specific effects.
Results: A U-shaped curve was observed between temperature and m
China, indicating both low and high temperatures were associated wi
overall threshold was at about the 75th percentile of the pooled tempe
risk was 1.61 (95% CI: 1.48–1.74) for extremely cold temperature (1st per
(95% CI: 1.30–1.34) for extreme hot temperature (99th percentile of tem
temperature–mortality relationship is different for different regions. Co
China had a higher minimum mortality temperature (MMT), and then
more southern parts of China and a more pronounced hot effect in mo
Conclusions: Both cold and hot temperatures increase mortality risk in C
geographically. Our findings suggest that public health policies for clim
tailored to the local climate conditions.

1. Introduction

Generally, the temperature–mortality

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Environment International

journal homepage: www.elsevier.com/locate/envint

The short-term effect of heat waves on mortality and its modifiers in China: An analysis from 66 communities

Wenjun Ma[a,b,*,1], Weilin Zeng[a,1], Maigeng Zhou[c,1], Lijun Wang[c], Shannon Rutherford[b], Hualiang Lin[a], Tao Liu[a], Yonghui Zhang[d], Jianpeng Xiao[a], Yewu Zhang[e], Xiaofeng Wang[e], Xin Gu[e], Cordia Chu[b]

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Mortality

ABSTRACT

Background: Many studies have reported increased mortality risk associated with heat waves. However, assessed the health impacts at a nation scale in a developing country. This study examines the mortality heat waves in China and explores whether the effects are modified by individual-level and commu characteristics.
Methods: Daily mortality and meteorological variables from 66 Chinese communities were collected f riod 2006–2011. Heat waves were defined as ≥2 consecutive days with mean temperature ≥95th p of the year-round community-specific distribution. The community-specific mortality effects of he were first estimated using a Distributed Lag Non-linear Model (DLNM), adjusting for potential confou investigate effect modification by individual characteristics (age, gender, cause of death, educatio place of death), separate DLNM models were further fitted. Potential effect modification by communit teristics was examined using a meta-regression analysis.
Results: A total of 5.0% (95% confidence intervals (CI): 2.9%–7.2%) excess deaths were associated with h in 66 Chinese communities, with the highest excess deaths in north China (6.0%, 95% CI: 1%–11.3%), fo east China (5.2%, 95% CI: 0.4%–10.2%) and south China (4.5%, 95% CI: 1.4%–7.6%). Our results indicate th ual characteristics significantly modified heat waves effects in China, with greater effects on cardiovasc tality, cerebrovascular mortality, respiratory mortality, the elderly, females, the population dying ou hospital and those with a higher education attainment. Heat wave mortality effects were also more pr for those living in urban cities or densely populated communities.
Conclusion: Heat waves significantly increased mortality risk in China with apparent spatial heterogene was modified by some individual-level and community-level factors. Our findings suggest adaptation target vulnerable populations in susceptible communities during heat wave events should be develo duce health risks.

1. Introduction

Numerous studies have demonstrated that heat waves are associated with increased mortality (Anderson and Bell, 2011; Hajnes et al., 2001; Le Tertre et al., 2006; Ostro et al., 2009; Son et al., 2012). Some of these studies also reported that individual characteristics the association between heat waves and mortality (Lin et a Medina-Ramón et al., 2006; Son et al., 2012). For instance, a st ducted in seven U.S. cities found that age, gender and cause of d nificantly modified the heat effects on mortality (O'Neill et al and studies from Guangdong province and Shanghai city showed that heat wave effects were higher for respiratory and the elderly ≥75 years old (Ma et al., 2012; Zeng et al., 201

Some multi-city studies have also reported that the mortali of heat-wave were spatially heterogeneous, which may be par plained by city-level modifiers such as socio-economic status a tive capacity (Curriero et al., 2002; Reid et al., 2009). For examp United States, one study revealed a greater increase in heat

Abbreviations: AIC, Akaike information criterion; AC, air conditioning; CI, confidence interval; CBD, cerebrovascular disease; CER, cumulative excess risk; CVD, cardiovascular disease; GDP, Gross Domestic Product; HW, heat wave; IQR, inter-quartile range; PM_{10}, particulate matter with aerodynamic diameters less than 10 μm; RESP, respiratory disease.

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1 Co-first authors.

Open Access Research

BMJ Open

Individual-level and community-level effect modifiers of the temperature-mortality relationship in 66 Chinese communities

Zhengjing Huang,[1] Hualiang Lin,[2] Yunning Liu,[1] Maigeng Zhou,[1] Tao Liu,[2] Jianpeng Xiao,[2] Weilin Zeng,[2] Xing Li,[2] Yonghui Zhang,[3] Kristie L Ebi,[4] Shilu Tong,[5] Wenjun Ma,[2] Lijun Wang[1]

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ABSTRACT

Objectives: To examine the modification of temperature-mortality association by factors at the individual and community levels.

Design and methods: This study investigated this issue using a national database comprising daily data of 66 Chinese communities for 2006–2011. A 'threshold-natural cubic spline' distributed lag non-linear model was utilised to estimate the mortality effects of daily mean temperature, and then examined the modification of the relationship by individual factors (age, sex, education level, place of death and cause of death) using a meta-analysis approach and

Strengths and limitations of this study

- This is a national effort to assess the temperature–mortality relationship using data from a wide geographical coverage of China.
- We examined the effect modifiers at the individual and community levels simultaneously.
- We were not able to control for air pollution and influenza epidemics due to data unavailability.
- We used ambient temperature as a surrogate for personal exposure, which might cause exposu misclassification.
- The small number of daily mortality count

·气候变化、空气污染与健康·

中国66个县/区日温差对人群死亡影响的时间序列研究

赵永谦 王黎君 罗圆 殷鹏 黄正京 刘涛 林华亮 肖建鹏 李杏
曾韦霖 马文军 周脉耕
510632 广州,暨南大学医学院(赵永谦); 100050 北京,中国疾病预防控制中心慢性非传染性疾病预防控制中心(王黎君、殷鹏、黄正京、周脉耕); 511430 广州,广东省疾病预防控制中心 广东省公共卫生研究院(罗圆、刘涛、林华亮、肖建鹏、李杏、曾韦霖、马文军)
赵永谦、王黎君同为第一作者
通信作者:马文军, Email:mwj68@vip.tom.com; 周脉耕, Email:maigengzhou@126.com

DOI:10.3760/cma.j.issn.0254-6450.2017.03.004

【摘要】 **目的** 了解中国不同城市日温差对居民死亡风险的影响。**方法** 用时间序列方法分析中国66个县/区日温差与居民日死亡数的关系,利用Meta分析方法整合不同县/区的结果。在调整季节、年龄、性别和死亡地影响后,以累计超额危险度(*CER*)为指标,分析极端日温差对死亡的影响。**结果** 研究共收集1 260 913 例死亡信息,北部、中部和南部县/区的日均死亡人数分别

Zhou *et al. Environmental Health* 2014, 13:60
http://www.ehjournal.net/content/13/1/60

ENVIRONMENTAL HEALTH

RESEARCH Open Access

Health impact of the 2008 cold spell on mortality in subtropical China: the climate and health impact national assessment study (CHINAs)

Mai Geng Zhou[1†], Li Jun Wang[1†], Tao Liu[2,3*], Yong Hui Zhang[4], Hua Liang Lin[2,3], Yuan Luo[2,3], Jian Peng Xiao[2,3], Wei Lin Zeng[2,3], Ye Wu Zhang[5], Xiao Feng Wang[5], Xin Gu[5], Shannon Rutherford[6], Cordia Chu[6] and Wen Jun Ma[2,3*]

Abstract

Background: Many studies have investigated heat wave related mortality, but less attention has been given to the health effects of cold spells in the context of global warming. The 2008 cold spell in China provided a unique opportunity to estimate the effects of the 2008 cold spell on mortality in subtropical regions, spatial heterogeneity of the effects, stratification effect and added effects caused by sustained cold days.

Methods: Thirty-six study communities were selected from 15 provinces in subtropical China. Daily mortality and meteorological data were collected for each community from 2006 to 2010. A distributed lag linear non-linear model (DLNM) with a lag structure of up to 27 days was used to analyze the association between the 2008 cold spell and mortality. Multivariate meta-analyses were used to combine the cold effects across each community.

Results: The 2008 cold spell increased mortality by 43.8% (95% CI: 34.8% ~ 53.4%) compared to non-cold spell days with the highest effects in southern and central China. The effects were more pronounced for respiratory mortality (RESP) than for cardiovascular (CVD) or cerebrovascular mortality (CBD), for females more than for males, and for the elderly aged ≥75 years old more than for younger people. Overall, 148,279 excess deaths were attributable to the 2008 cold spell. The cold effect was mainly from extreme low temperatures rather than sustained cold days during this 2008 cold spell.

Conclusions: The 2008 cold spell increased mortality in subtropical China, which was mainly attributable to the low temperature rather than the sustained duration of the cold spell. The cold effects were spatially heterogeneous and modified by individual-specific characteristics such as gender and age.

Keywords: Cold spell, Mortality, China, Subtropical, Extreme temperatures

Introduction

The Intergovernmental Panel on Climate Change (IPCC) has projected that in the coming decades, extreme weather events will become more frequent and more intense in some parts of the world and such events will impact on health [1]. Generally, the health effects of extreme heat events are acute and some harvesting is observed, but the effects of extreme cold temperatures are generally more prolonged than heat without mortality displacement [2-4]. Due to the projections associated with climate change many more studies have been conducted on health effects of heat waves compared to cold-related health impacts [2,5-11]. Moreover, most previous studies on health effects of cold spells were conducted in temperate climate developed countries with very few in tropical or subtropical regions [2,8,9]. However, the health effects of extreme cold spells may be larger in these warm regions because populations are not acclimatized to cold spells and are unprepared for such events [3].

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The impact of cold spells on mortality and effect modification by cold spell characteristics

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In China, the health impact of cold weather has received little attention, which limits our understanding of the health impacts of climate change. We collected daily mortality and meteorological data in 66 communities across China from 2006 to 2011. Within each community, we estimated the effect of cold spell exposure on mortality using a Distributed Lag Nonlinear Model (DLNM). We also examined the modification effect of cold spell characteristics (intensity, duration, and timing) and individual-specific factors (causes of death, age, gender and education). Meta-analysis method was finally used to estimate the overall effects. The overall cumulative excess risk (CER) of non-accidental mortality during cold spell days was 28.2% (95% CI: 21.4%, 35.3%) compared with non-cold spell days. There was a significant increase in mortality when the cold spell duration and intensity increased or occurred earlier in the season. Cold spell effects and effect modification by cold spell characteristics were more pronounced in south China. The elderly, people with low education level and those with respiratory diseases were generally more vulnerable to cold spells. Cold spells statistically significantly increase mortality risk in China, with greater effects in southern China. This effect is modified by cold spell characteristics and individual-level factors.

End

Thanks

Comments | Questions