

HIMSS[®] 26

EUROPE

19-21 May | Copenhagen



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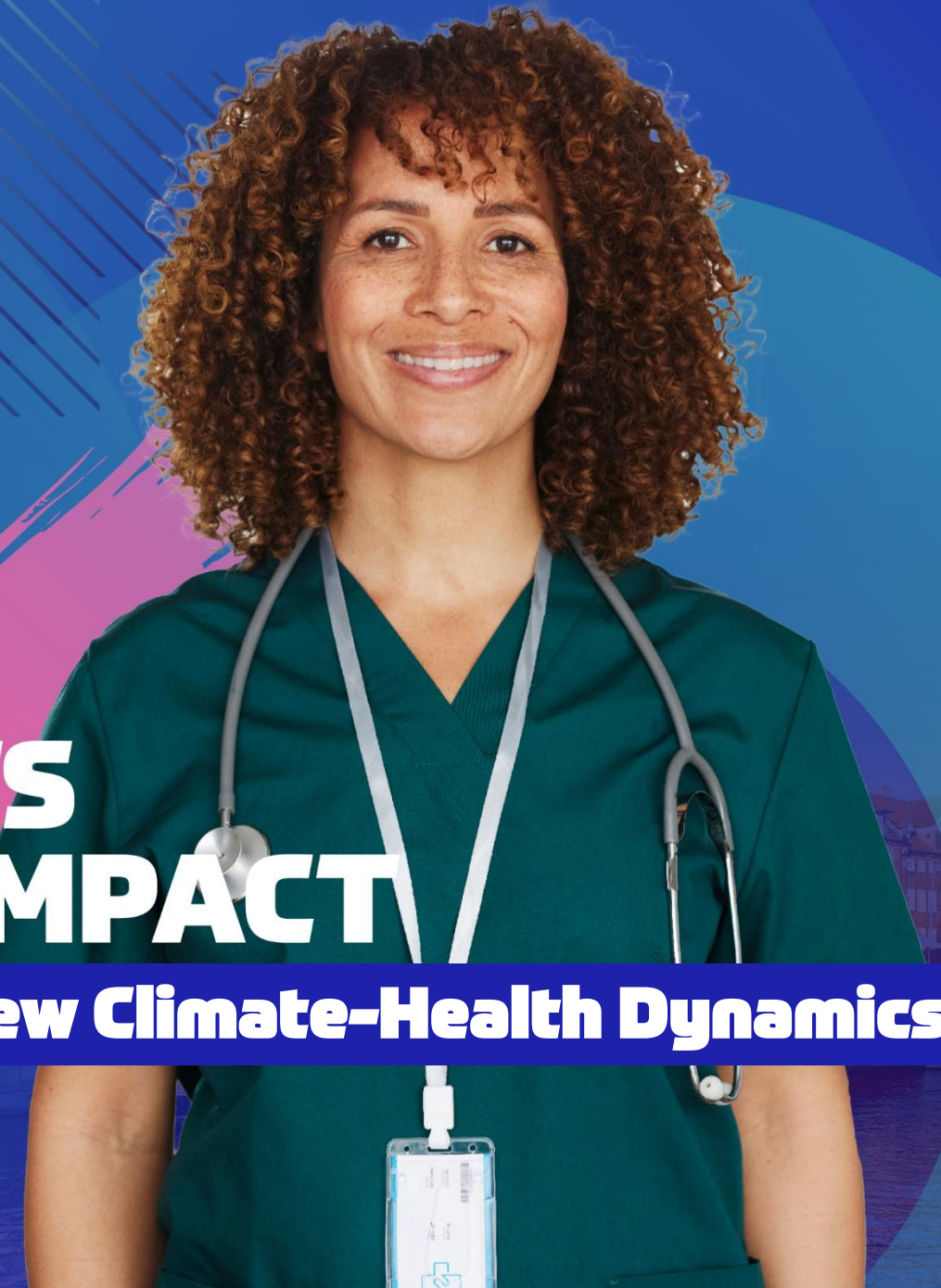


EXPERT **INSIGHTS**
EXCEPTIONAL **IMPACT**

Healthcare System Planning in the New Climate-Health Dynamics

#HIMSS26EUROPE

DISCLAIMER: The views and opinions expressed in this presentation are solely those of the author/presenter and do not necessarily represent any policy or position of HIMSS.



Healthcare



Climate



Healthcare

Climate



International Research

USA (California) - Ebi et al. (2004)

Association of stark temperature changes



UK (London) - Hajat & Haines (2002)

Association with drop in temperature with 15-day lag (elderly)



Germany - Frasch et al. (2025)

Effect of extreme temperature (Relative percentiles, >99th heat, 1st cold (also 95th / 5th



South Korea (Incheon) - Hong et al. (2003)

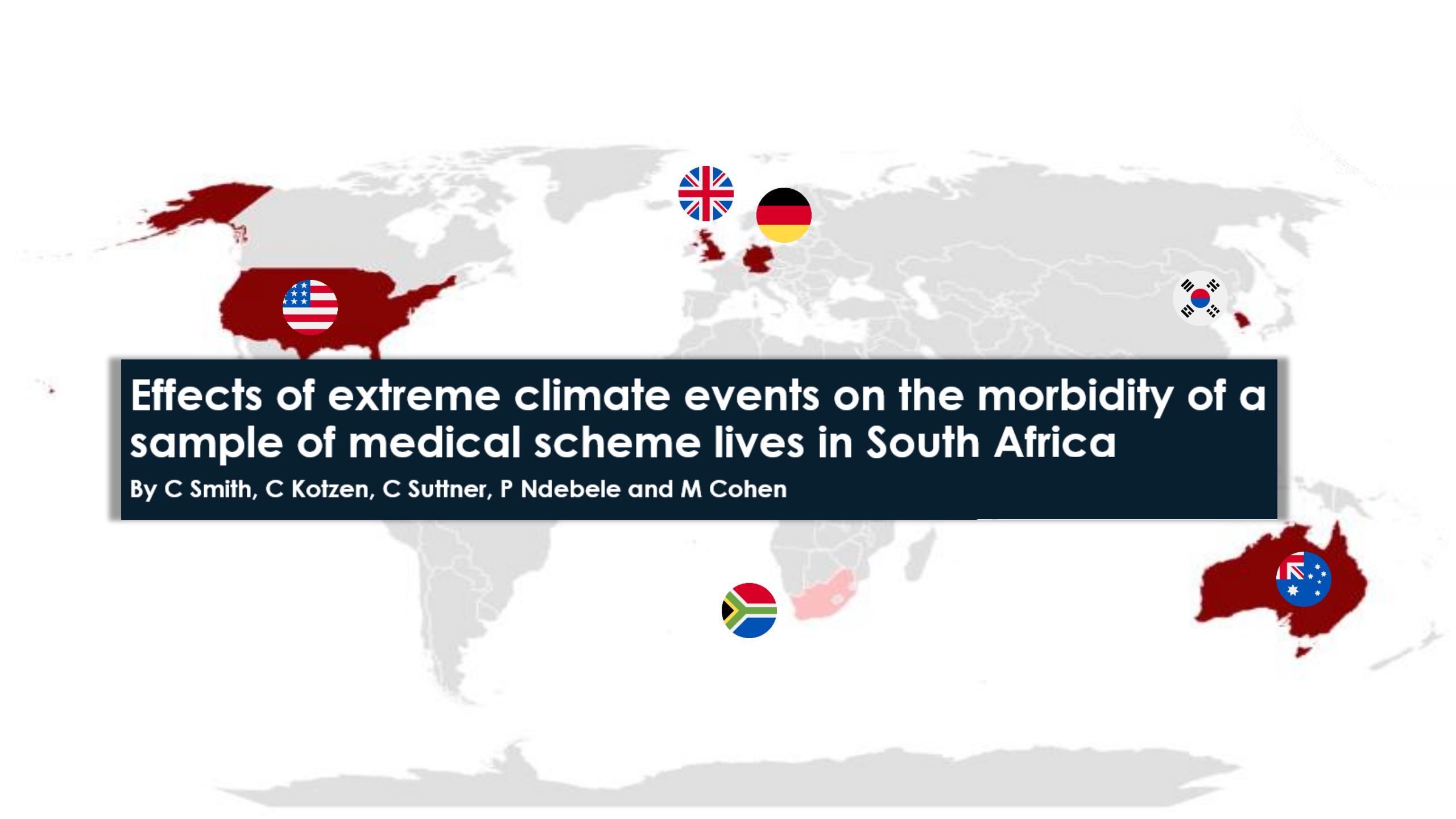
Impact of IQR drop in 24-hour average temperature



Australia (New South Wales) - Jegasothy et al. (2017)

Impact of extreme heat and extreme cold



A world map with several countries highlighted in dark red. The United States, United Kingdom, Germany, and South Korea are highlighted in the Northern Hemisphere. South Africa and Australia are highlighted in the Southern Hemisphere. National flags are placed over each of these highlighted countries: the US flag over the US, the UK flag over the UK, the German flag over Germany, the South Korean flag over South Korea, the South African flag over South Africa, and the Australian flag over Australia. A dark blue banner with white text is centered over the map.

Effects of extreme climate events on the morbidity of a sample of medical scheme lives in South Africa

By C Smith, C Kotzen, C Suttner, P Ndebele and M Cohen

Methodology

How do we define extreme temperature?



Isolated Extremes

Individual extreme climate events (e.g. days) rather than long-term climate change

Relative Definition

Extremes defined using percentile (e.g. 99th) rather than absolute (e.g. 35°C) thresholds

Confounding Factors Adjusted

Negated the effects of geographical location, season and day of week



Largest Health Insurer (38.7%) in South Africa



Beneficiary coverage

DH-administered schemes, >1/3 of private medical scheme market



Exposure

2014-2024, excl. Covid-19 years ('20-'21) and public holidays; provincial-level



Daily healthcare utilisation metrics

Visits (encounter with a provider) and Admissions (hospitalisation)



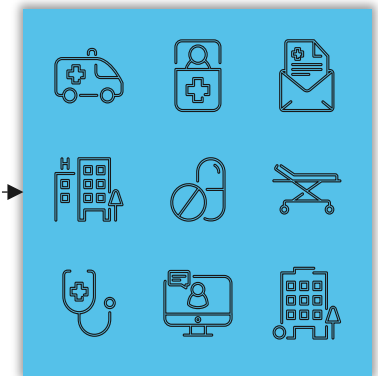
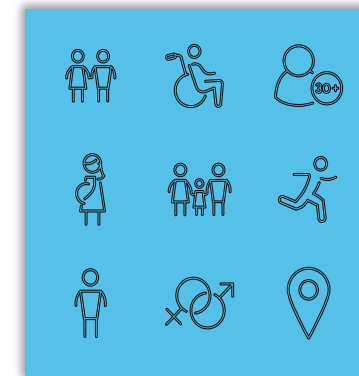
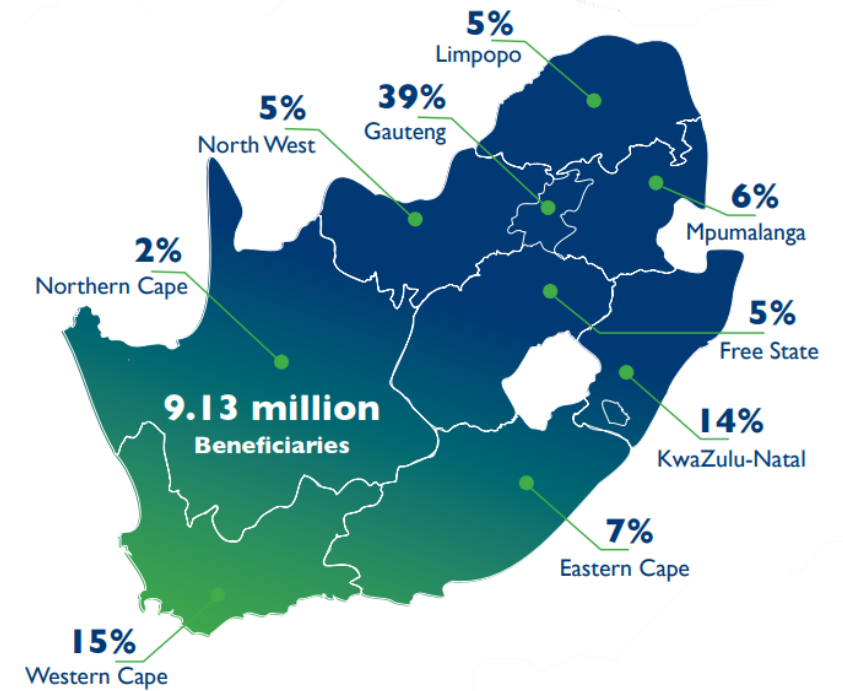
In-Hospital and Out-of-hospital visits

Classified using Discovery Episode Groupers (DEGs), ICD-10 diagnosis groups



In-hospital admissions

Classified using Major Diagnostic Categories (MDCs), DRGs



3.48m
Beneficiaries

38.7%
Market Share

>350m
Exposure Months

1.7bn
Claim Lines

>480m
Visits

29
Disease Chapters

>8m
Admissions

28
MDCs

Climate Data



ERA5-Land hourly data from 1940 to present



Hourly 2-metre temperature (T2M)

Air temperature 2m above Earth's surface, °C



Gridded surfaces

0.25° × 0.25° (~28km × 24km ≈ 670 km² per grid cell)



Province-level aggregation

Covering the landmass of South Africa



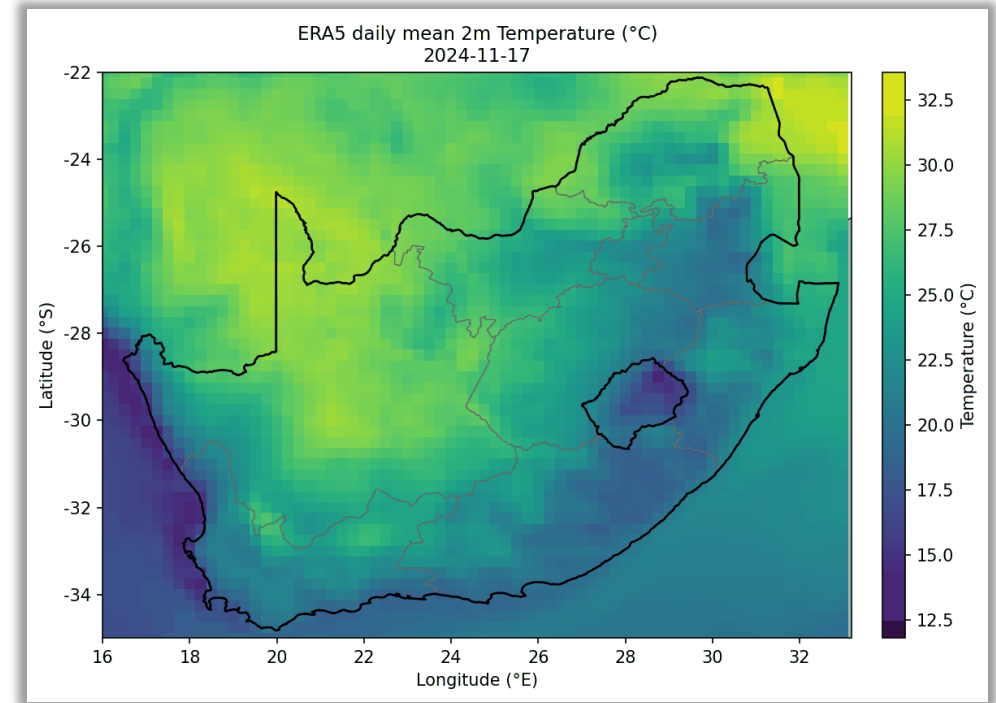
January 2014 – December 2024, points in time

11 years, 4,018 days, observations at 00:00, 06:00, 12:00, 18:00 daily



Temperature measure

Min, Max, and Average derived; daily average chosen for analysis

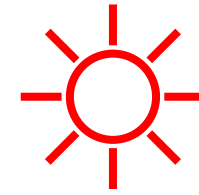
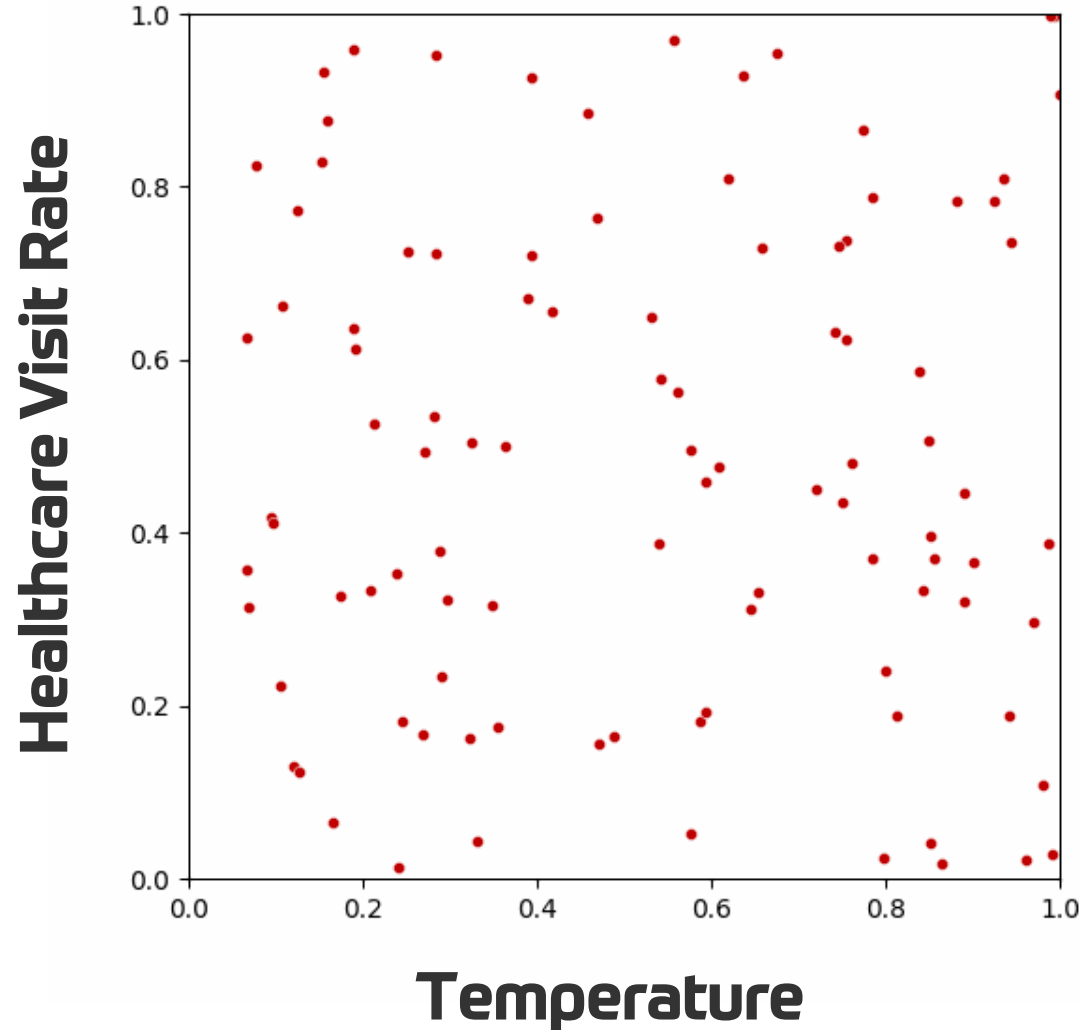


Geographic and temporal heterogeneity



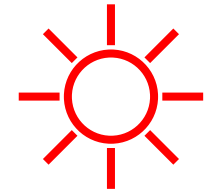
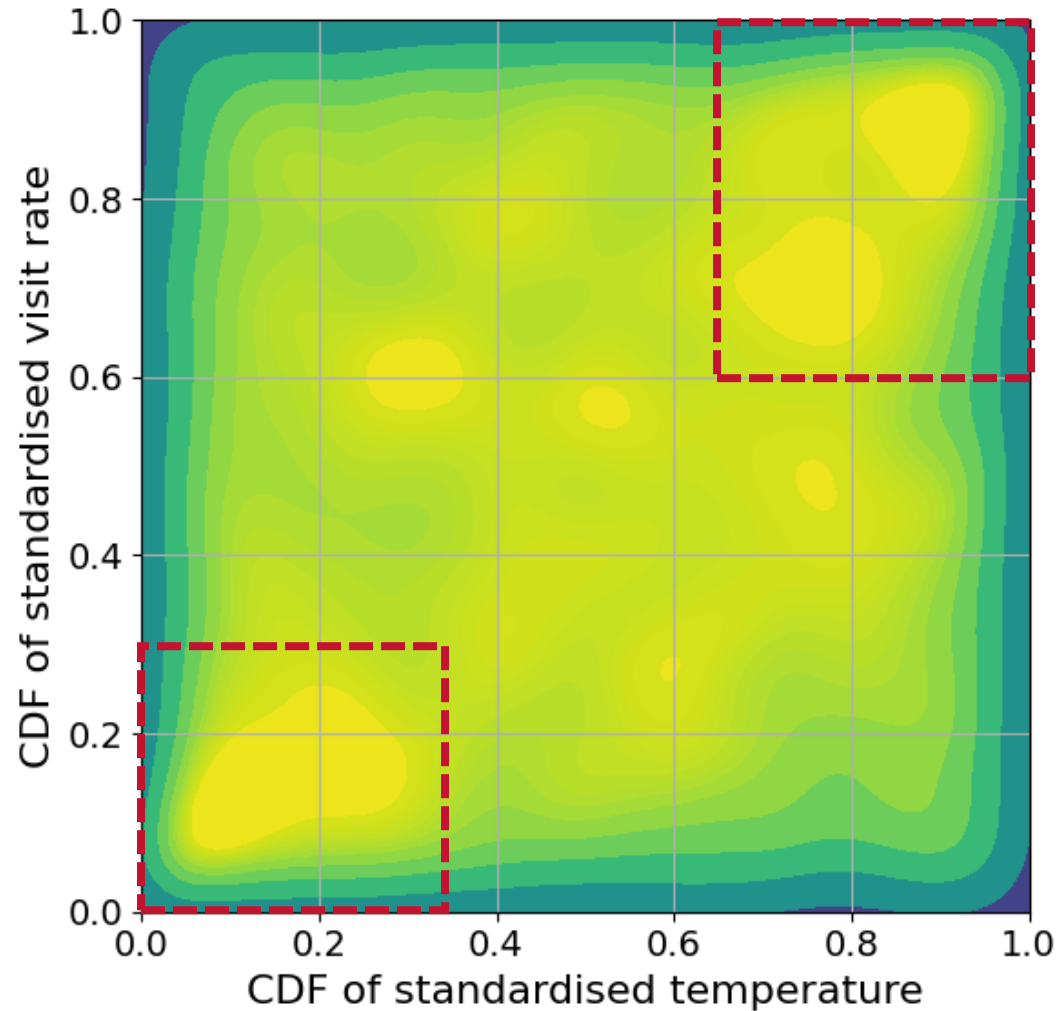
Results

Two-Dimensional Kernel Density Estimation

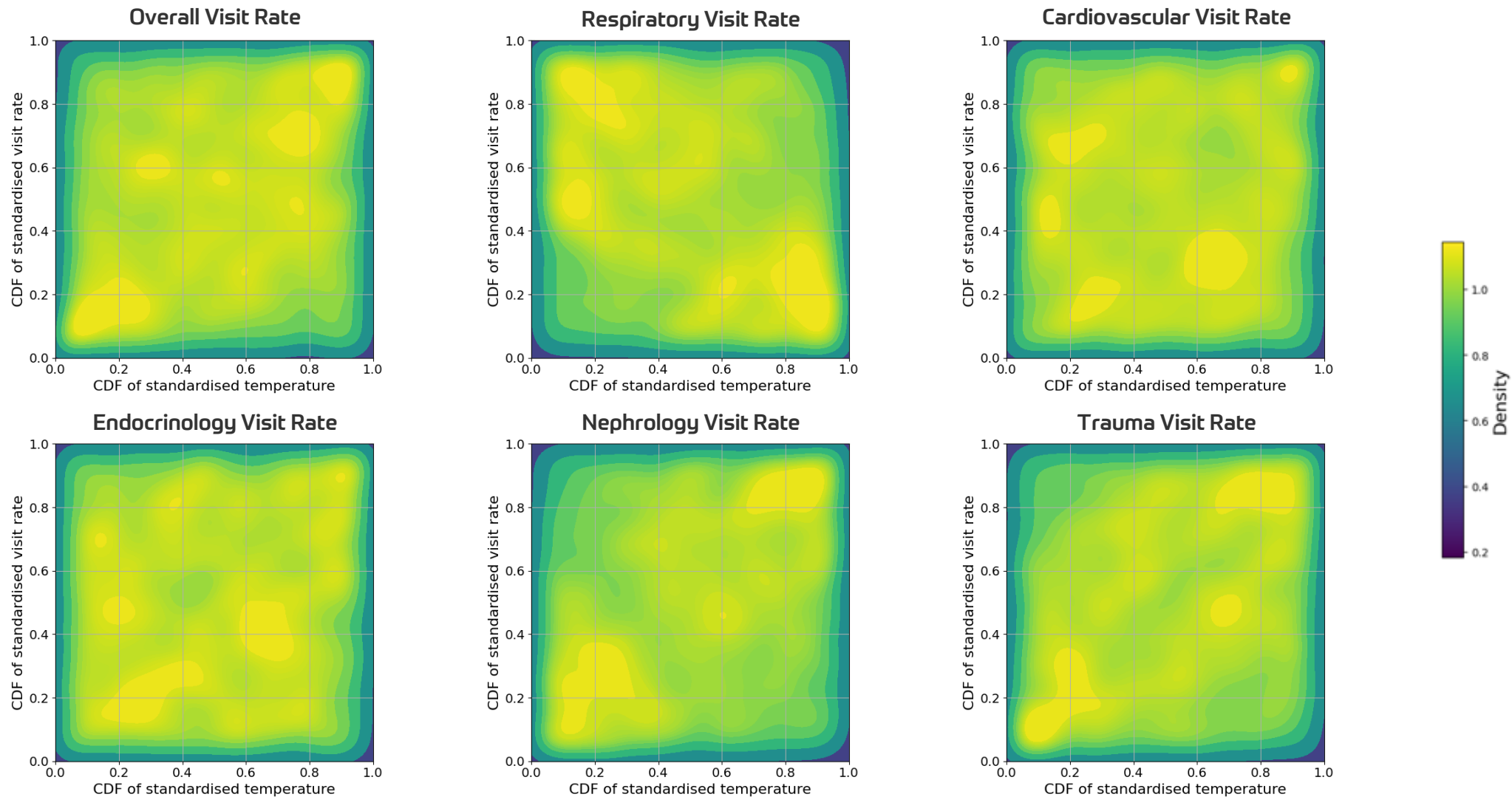


Extreme Heat Induces Higher Overall Utilisation

Overall Visit Rate



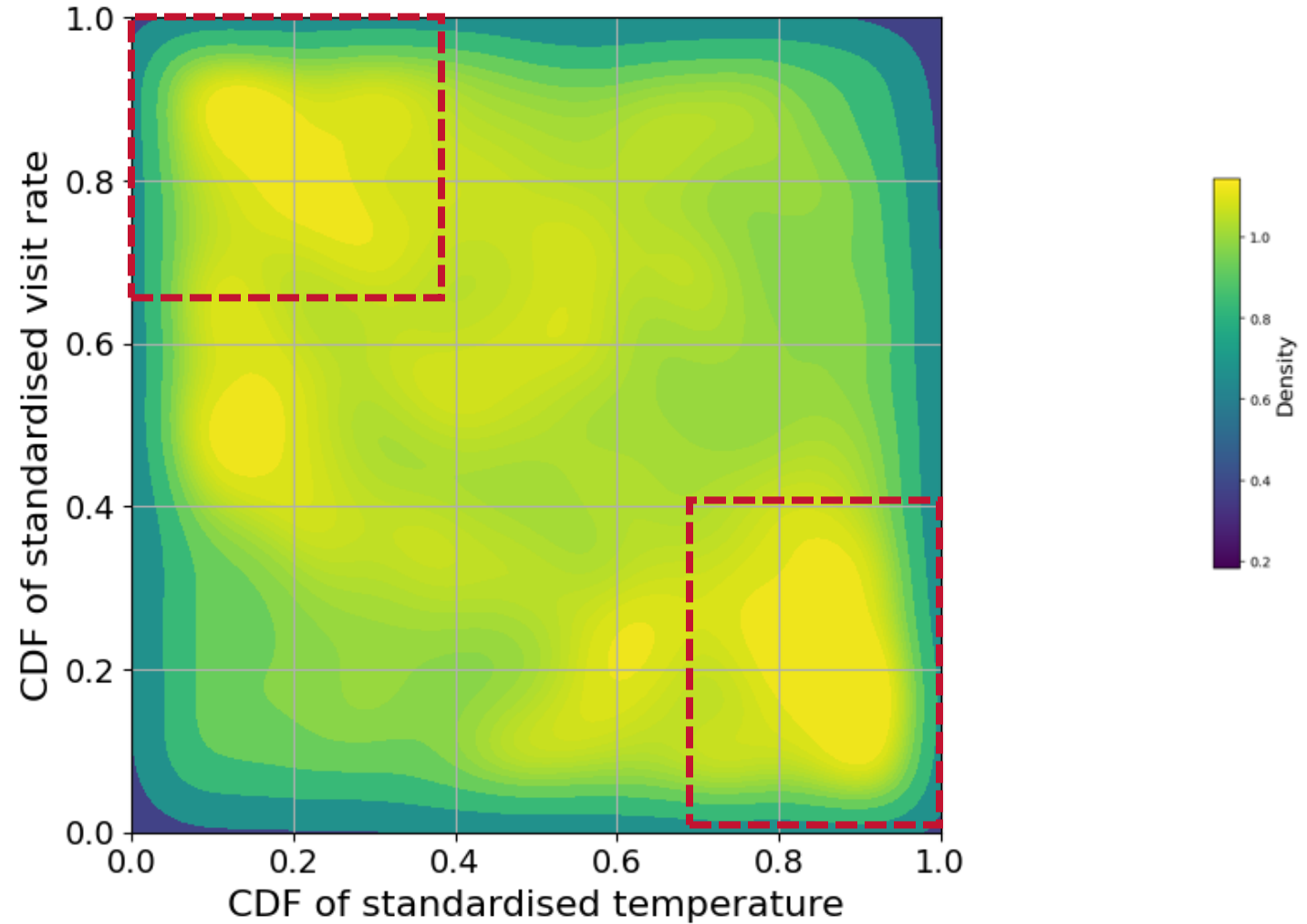
Impact Varies by Healthcare Condition



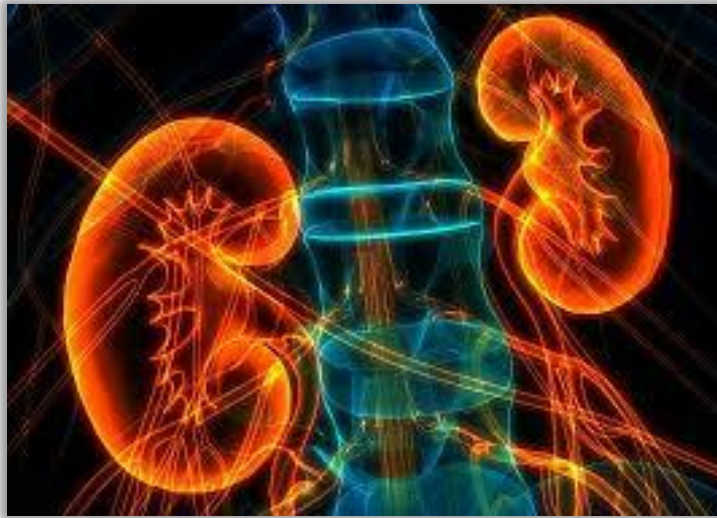
Respiratory Visits Surge During Extreme Cold



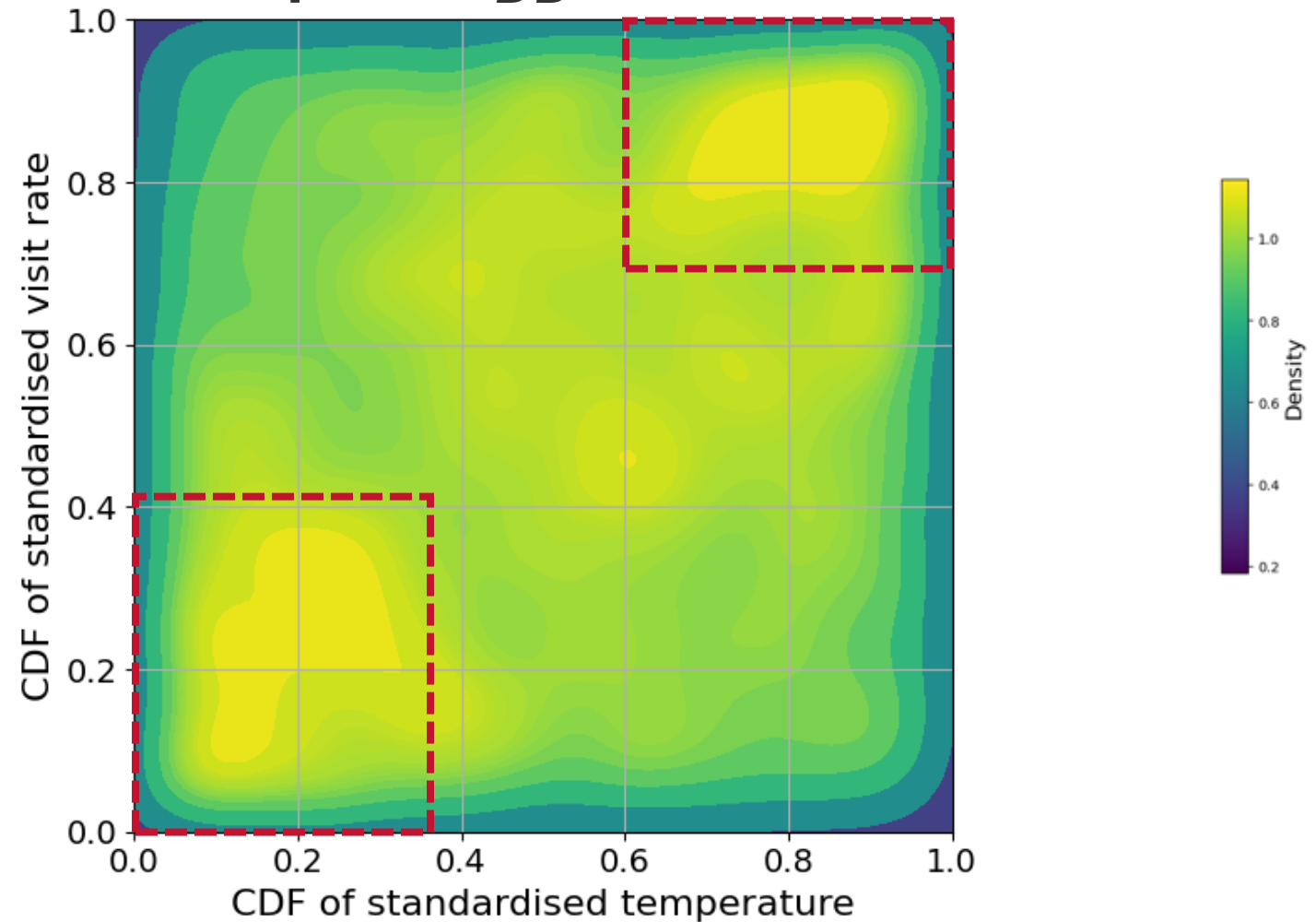
Respiratory Visit Rate



Nephrology Visits Surge During Extreme Heat



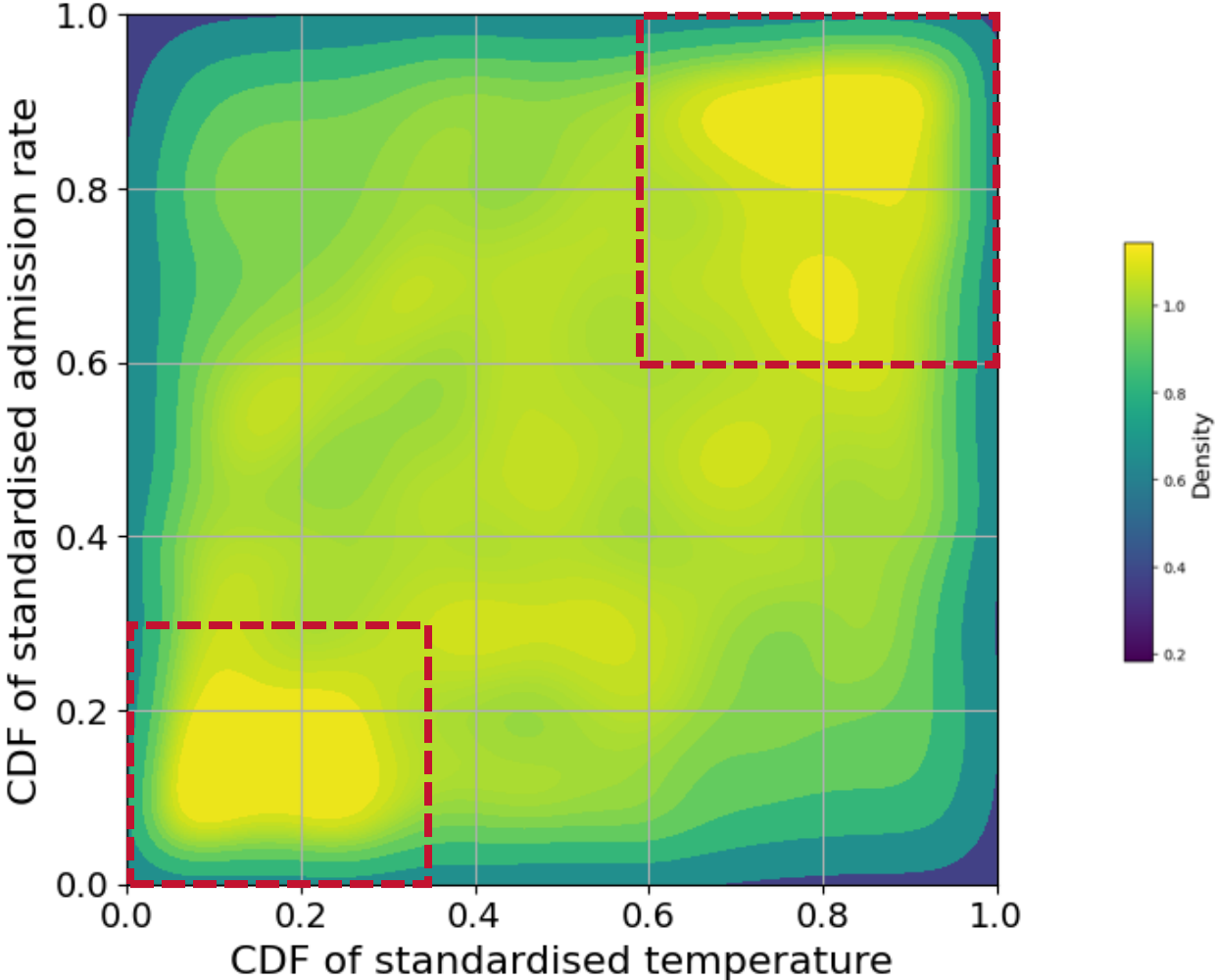
Nephrology Visit Rate



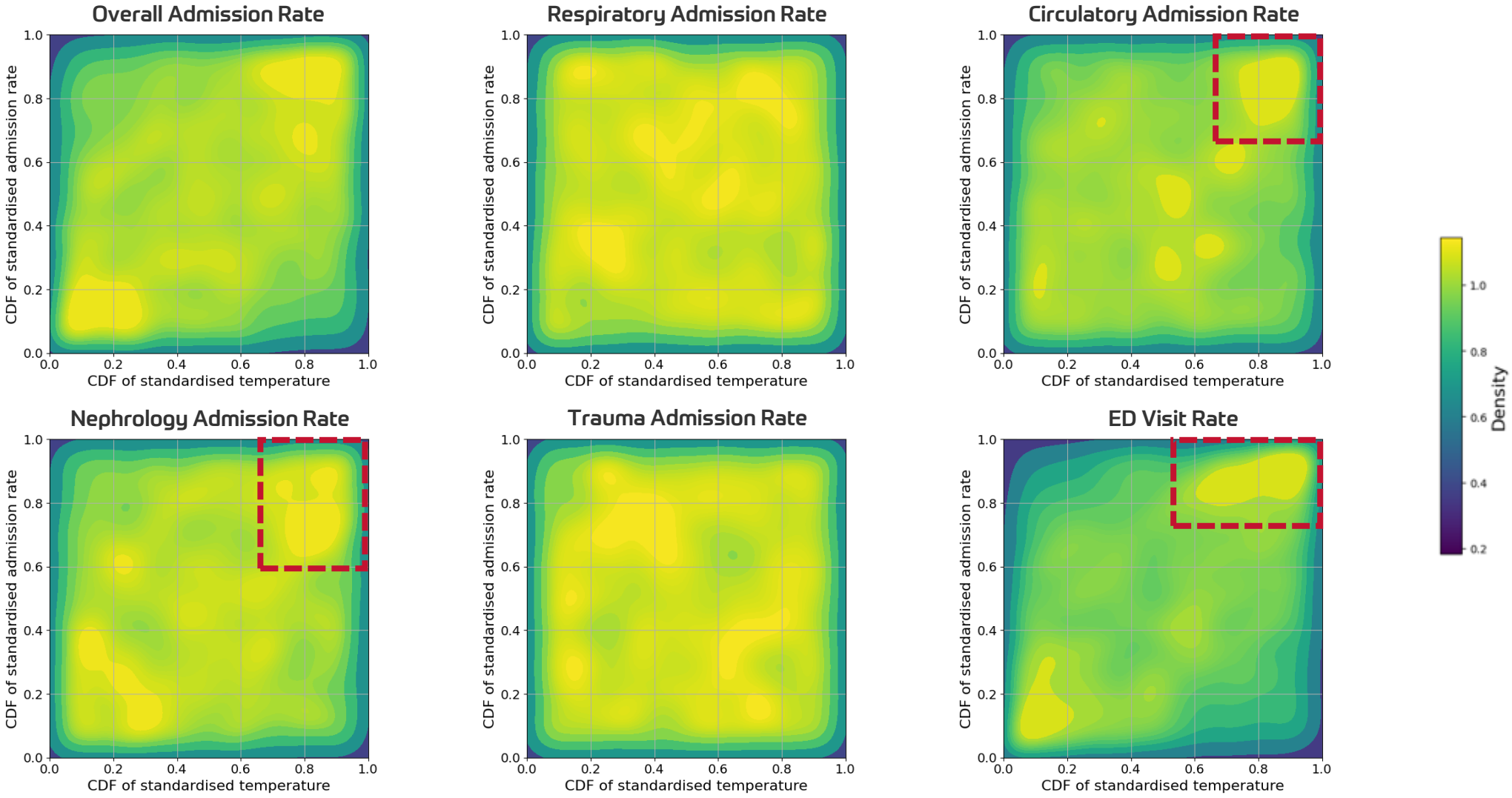
What happens when we focus on hospital admission experience?

Hospital Admissions Increase During Extreme Heat

Overall Admission Rate

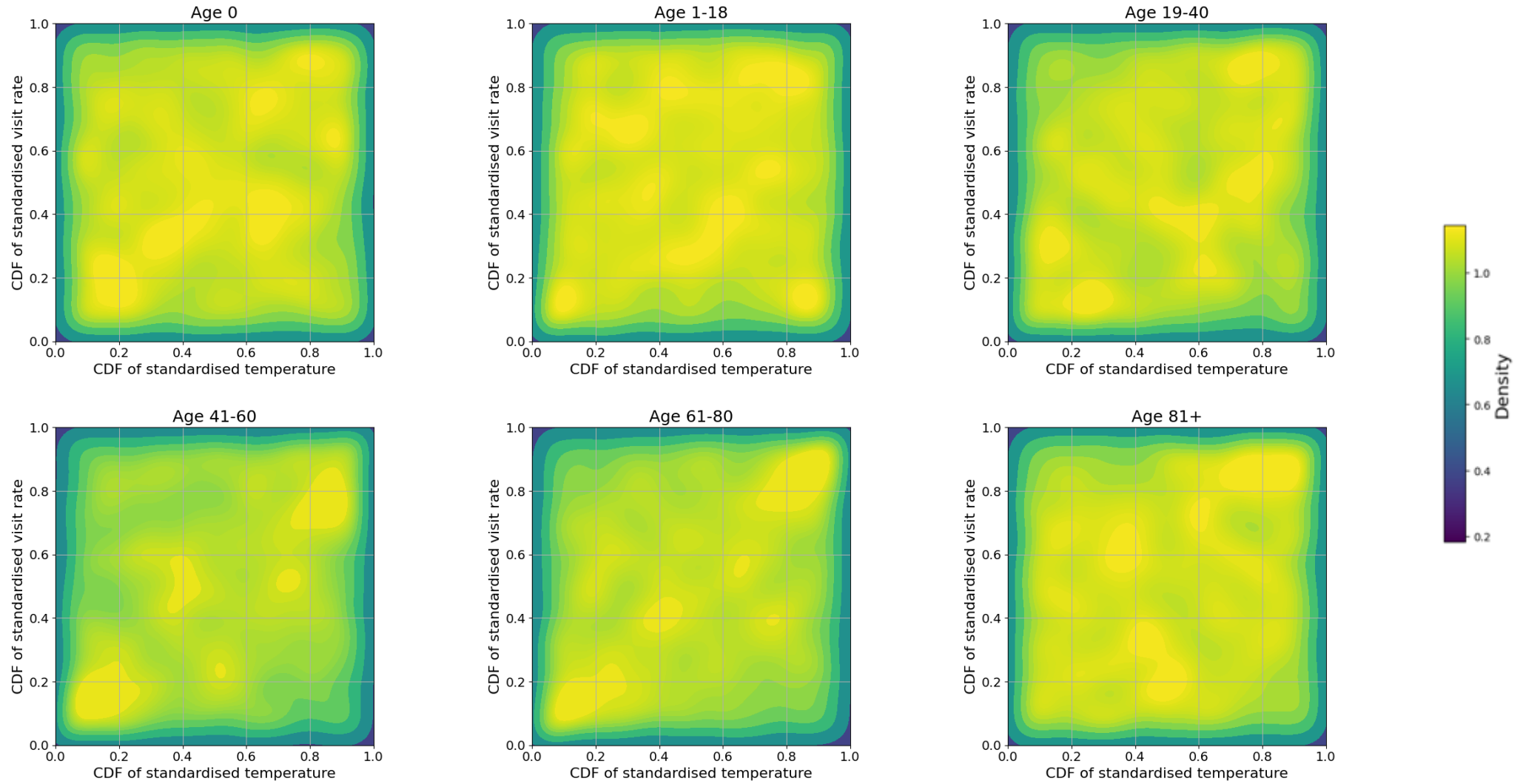


Driven by Circulatory, Nephrology and Emergencies

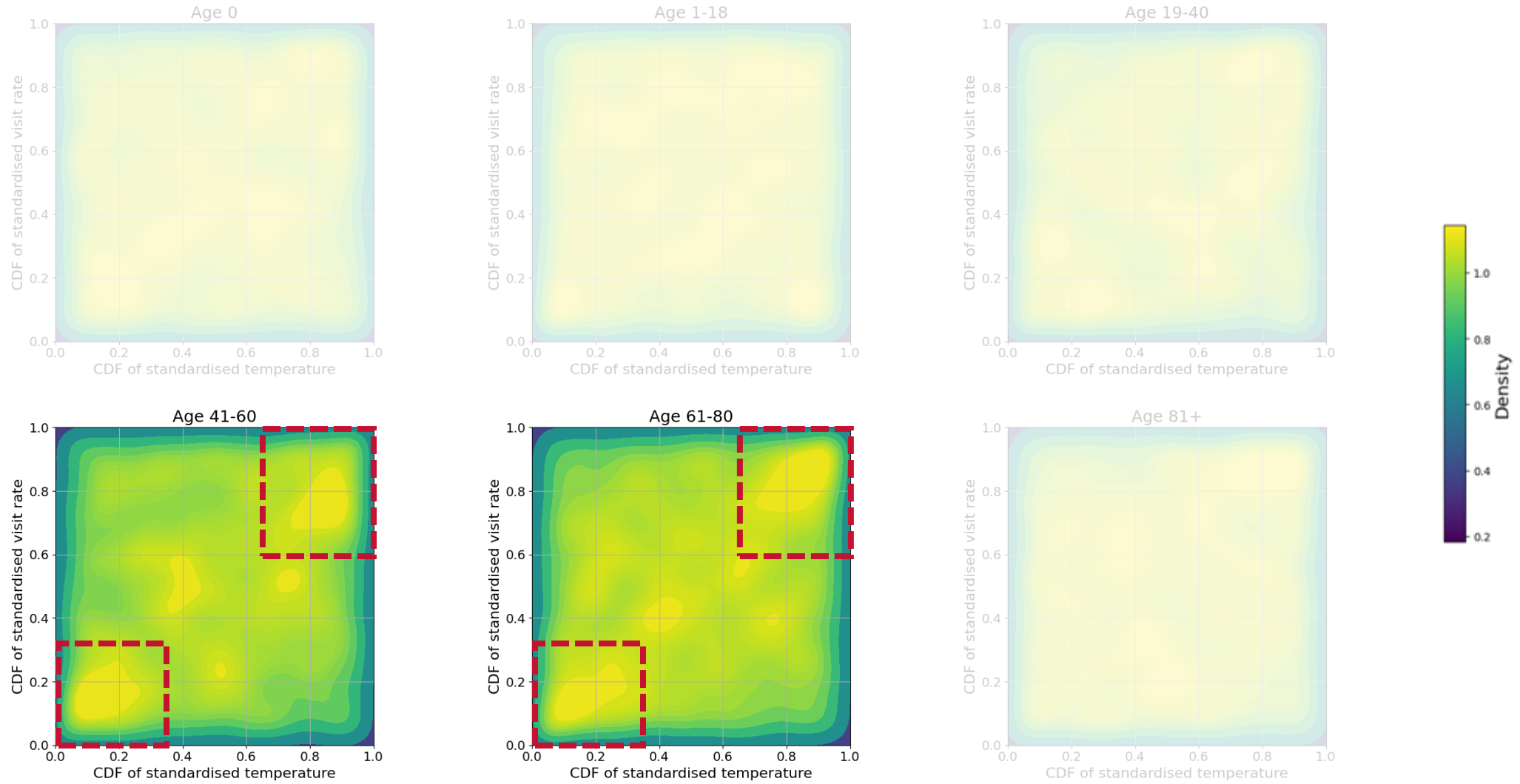


**Which population
segments are most
affected?**

Demographic Cohorts Driving Population Effect



Ages 41-60 and 61-80 Vulnerable During Extreme Heat



BUT

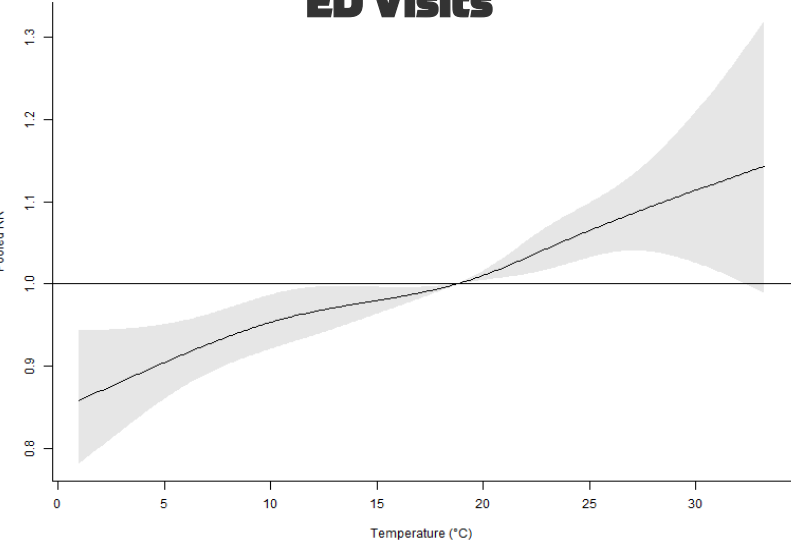
**What if there is a delayed
effect...?**

Emergency Department (ED) Visits – Immediate & Lagged Effects

Overall Effects

Showing the overall effect of temperature on the healthcare outcome

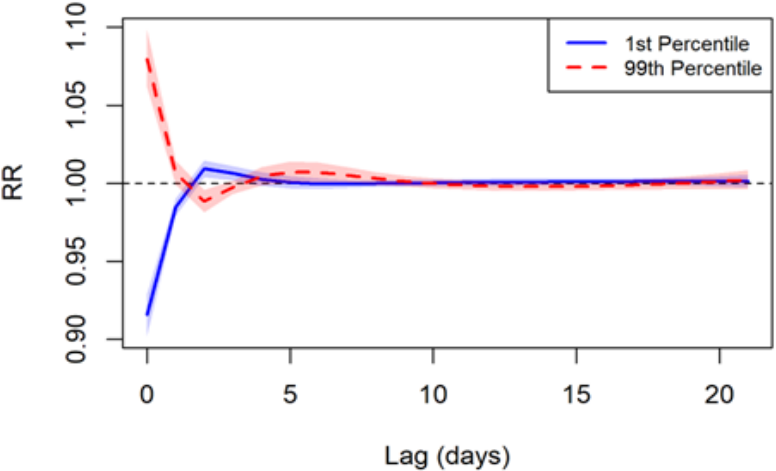
ED Visits



Temperature-Response Effect

Highlighting effects of extreme hot and cold days over 21-day period

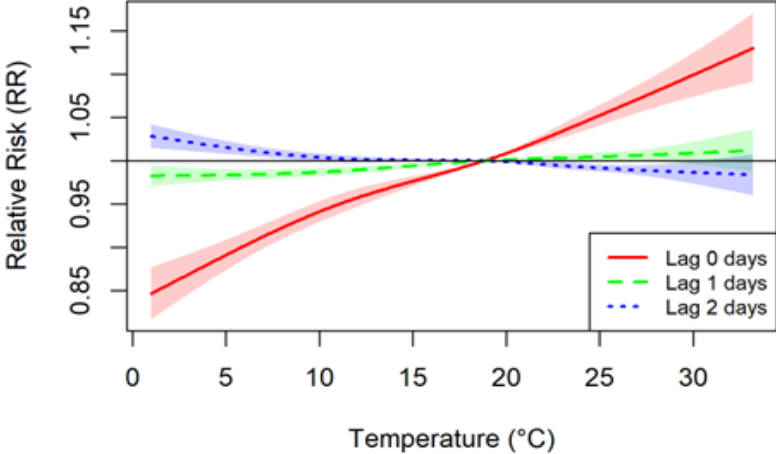
ED Visits



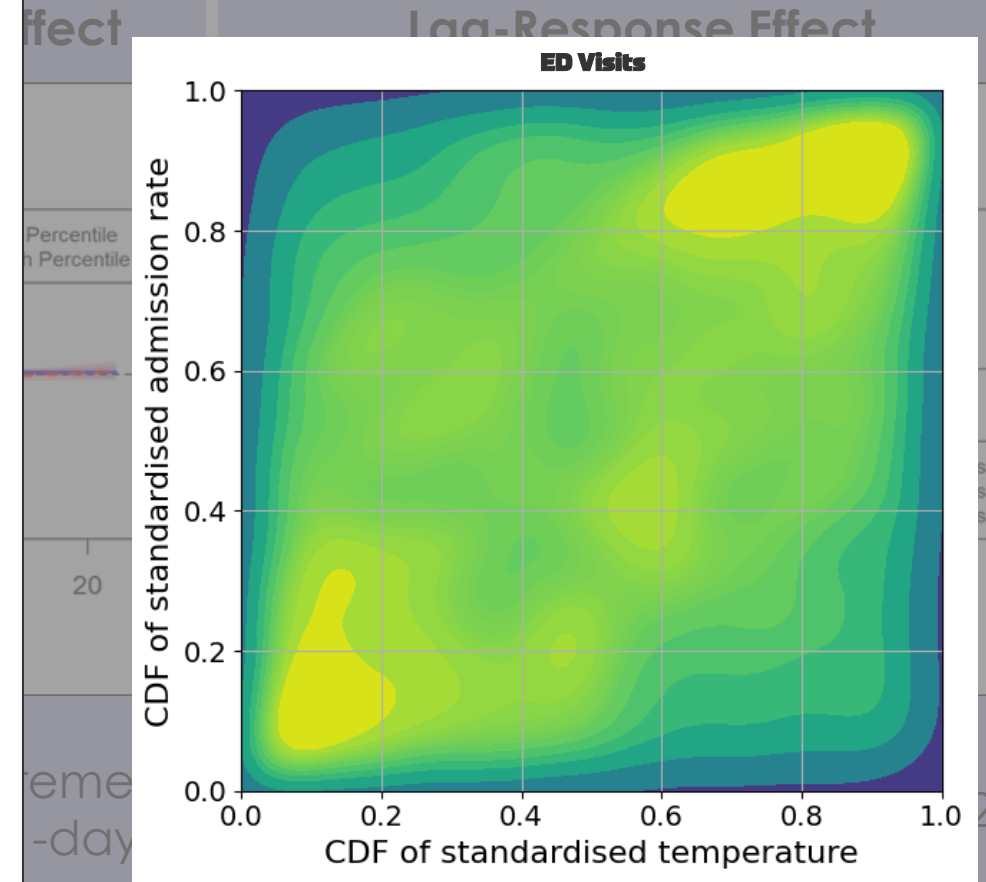
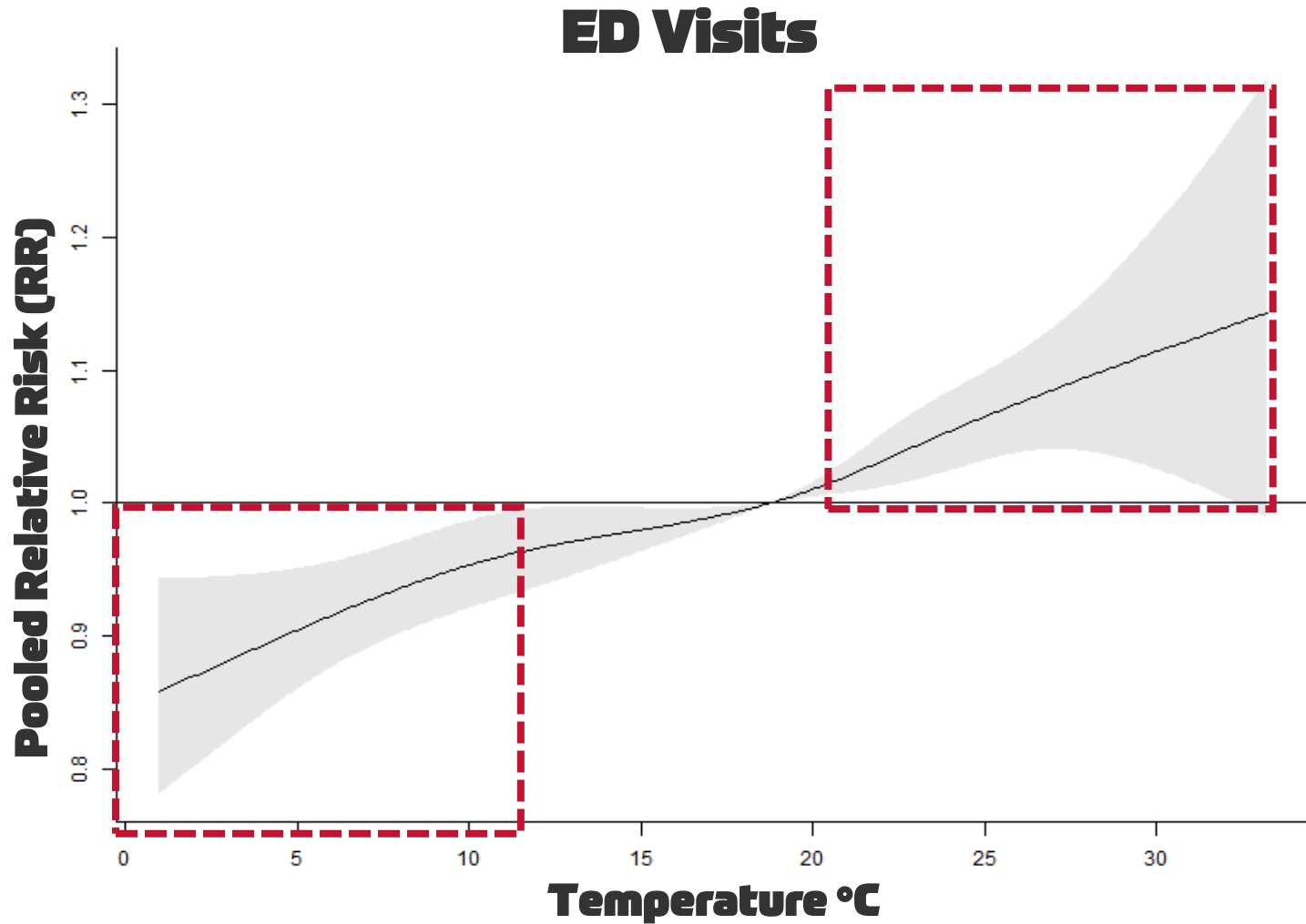
Lag-Response Effect

Highlighting relative risk 0,1,2 days post exposure across all temperatures

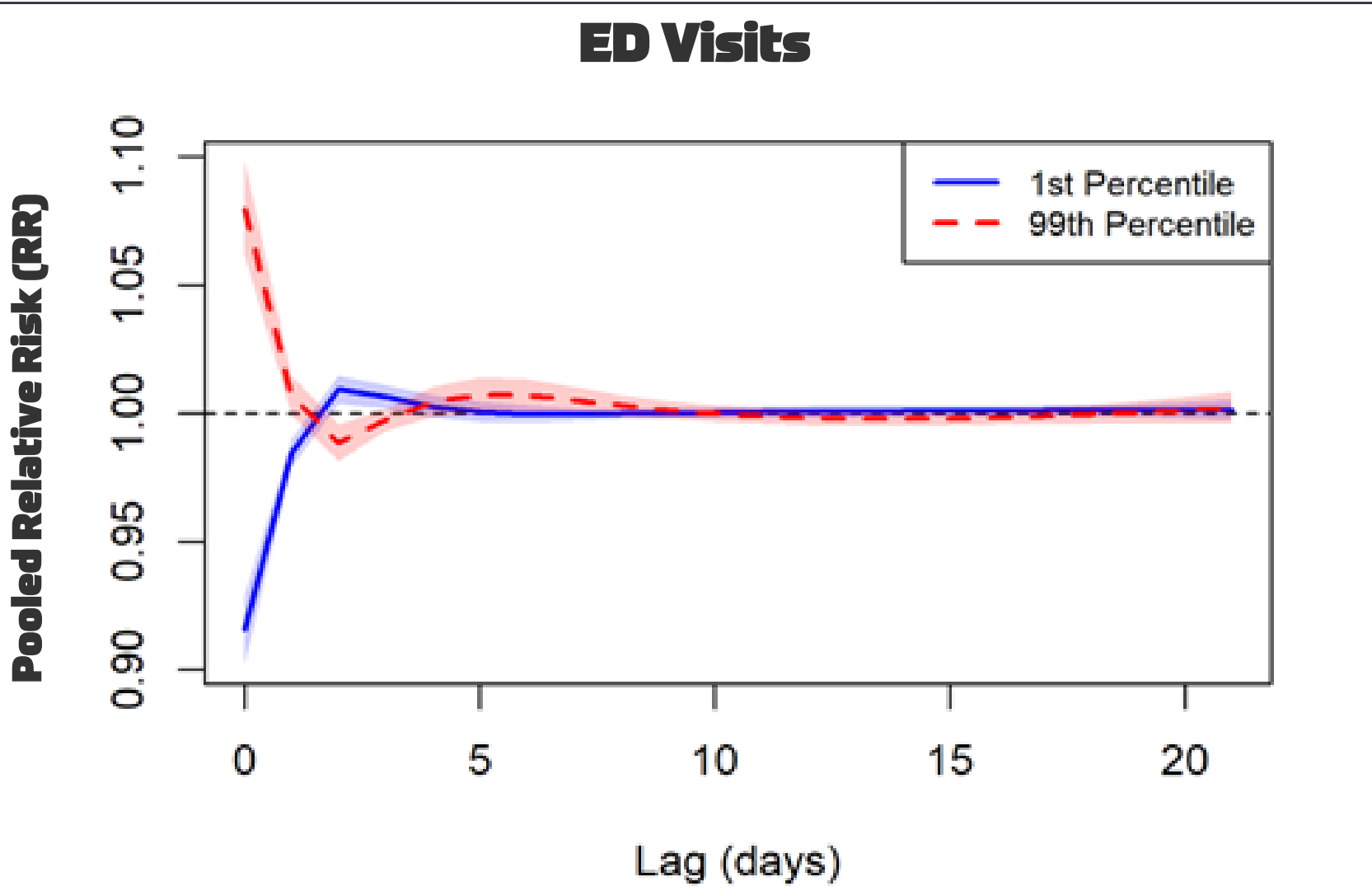
ED Visits



ED Visits Up At High Temperatures; Down at Low



Lagged ED Visit Effect on Extreme Cold; Immediate on Hot



Overall

Casualty

Pooled RR

Temperature (°C)

Showing the overall temperature on outcome

Cochran Q-Multivariate

Response Effect

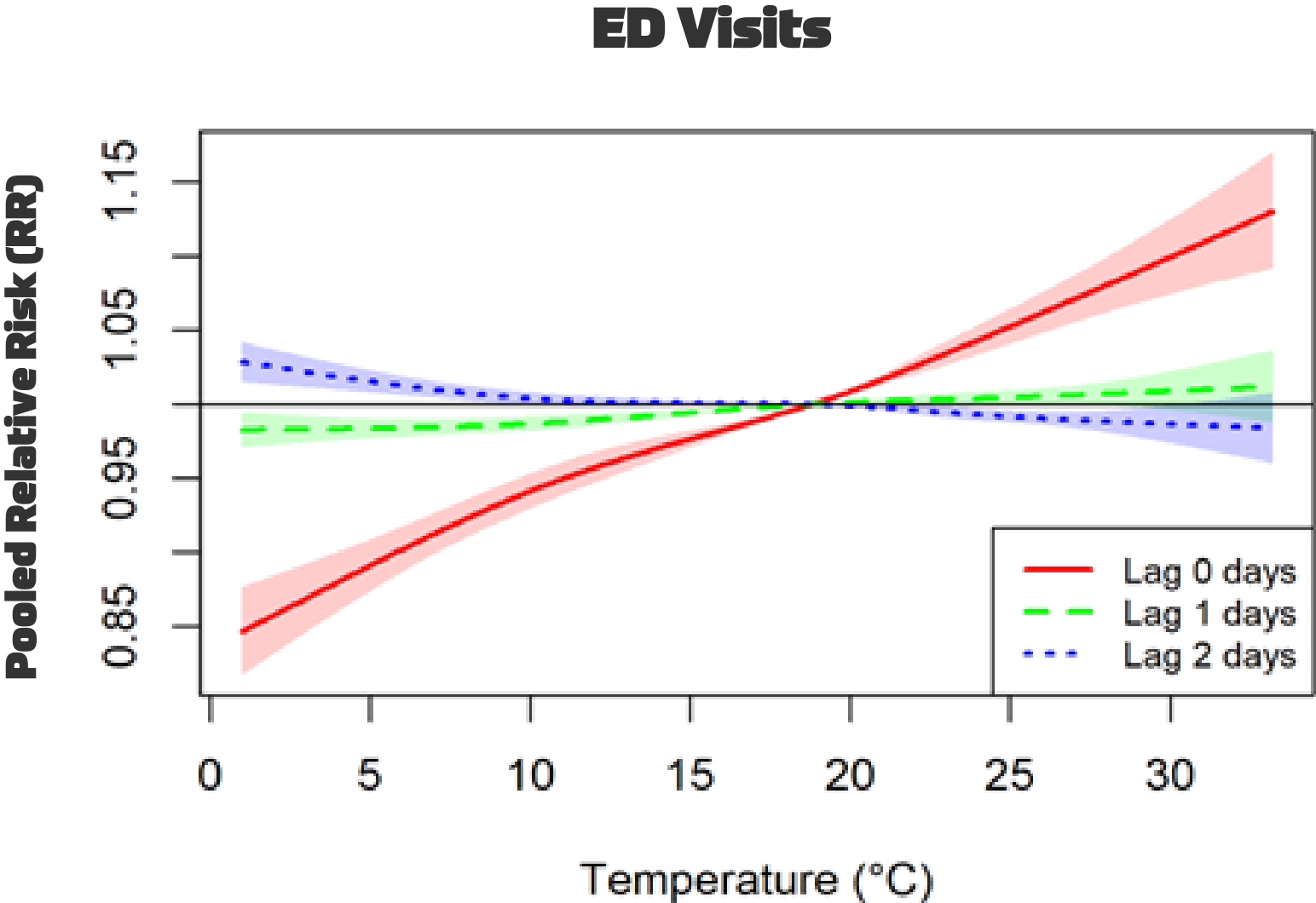
Casualty Visits

Lag 0 days
Lag 1 days
Lag 2 days

Temperature (°C)

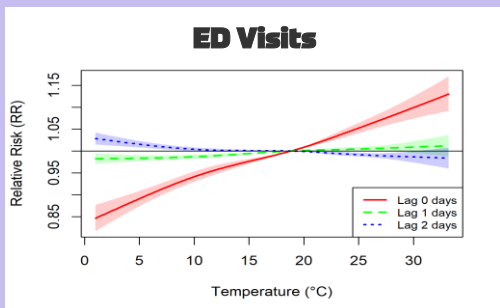
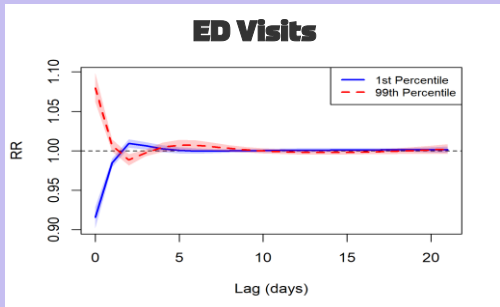
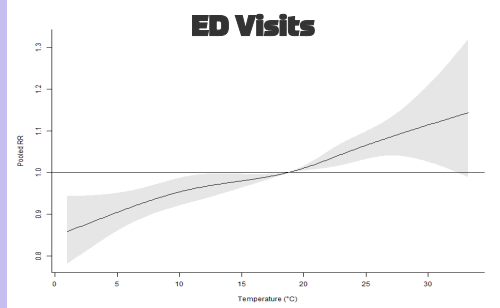
Effects at lag 0,1,2 temperatures

Lagged ED Visit Effect on Extreme Cold; Immediate on Hot



Complete 3D Temperature and Lag Effect

Combining these views into a single Three-Dimensional view



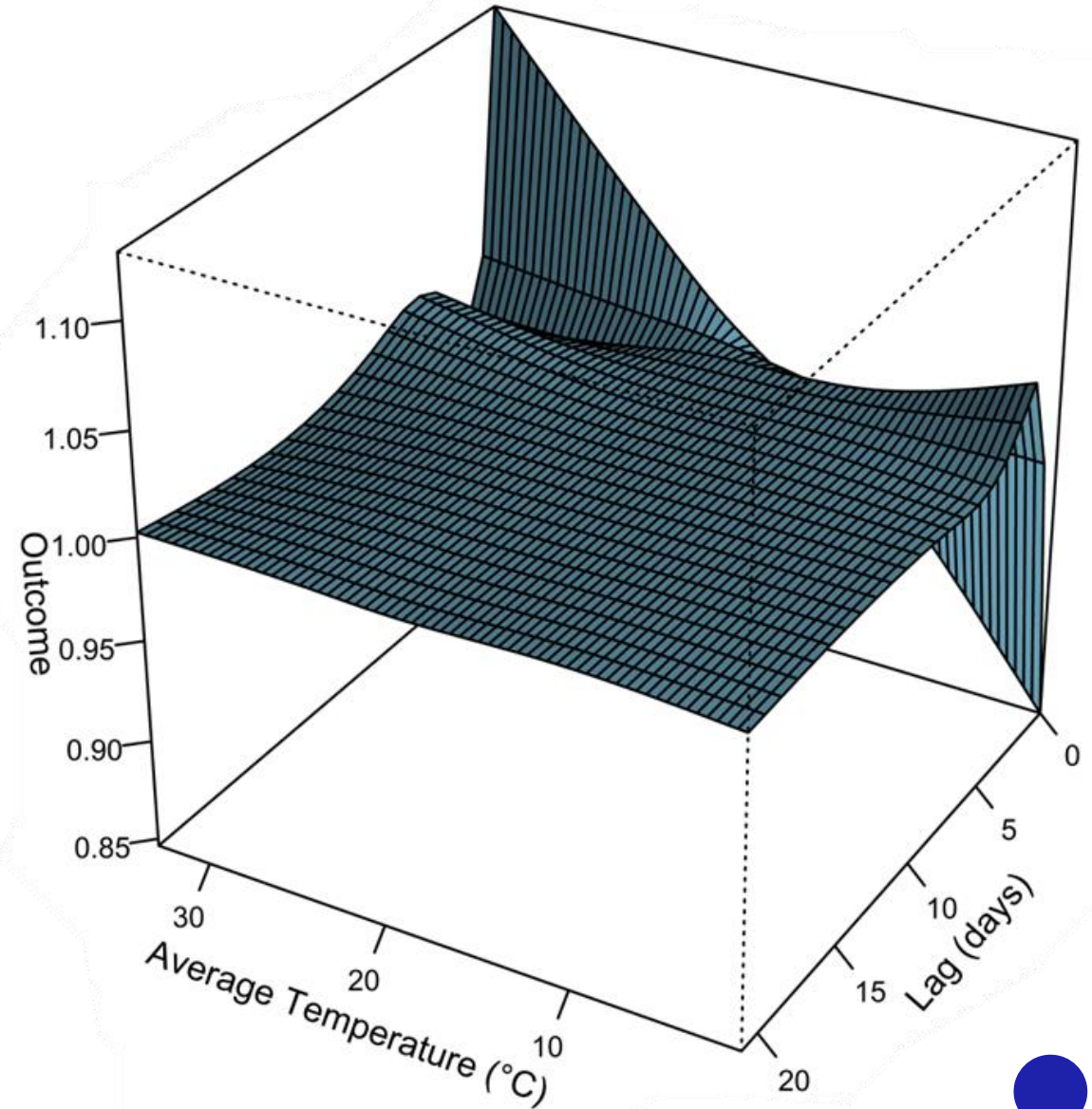
Overall Effects

X

Temperature-Response Effect

X

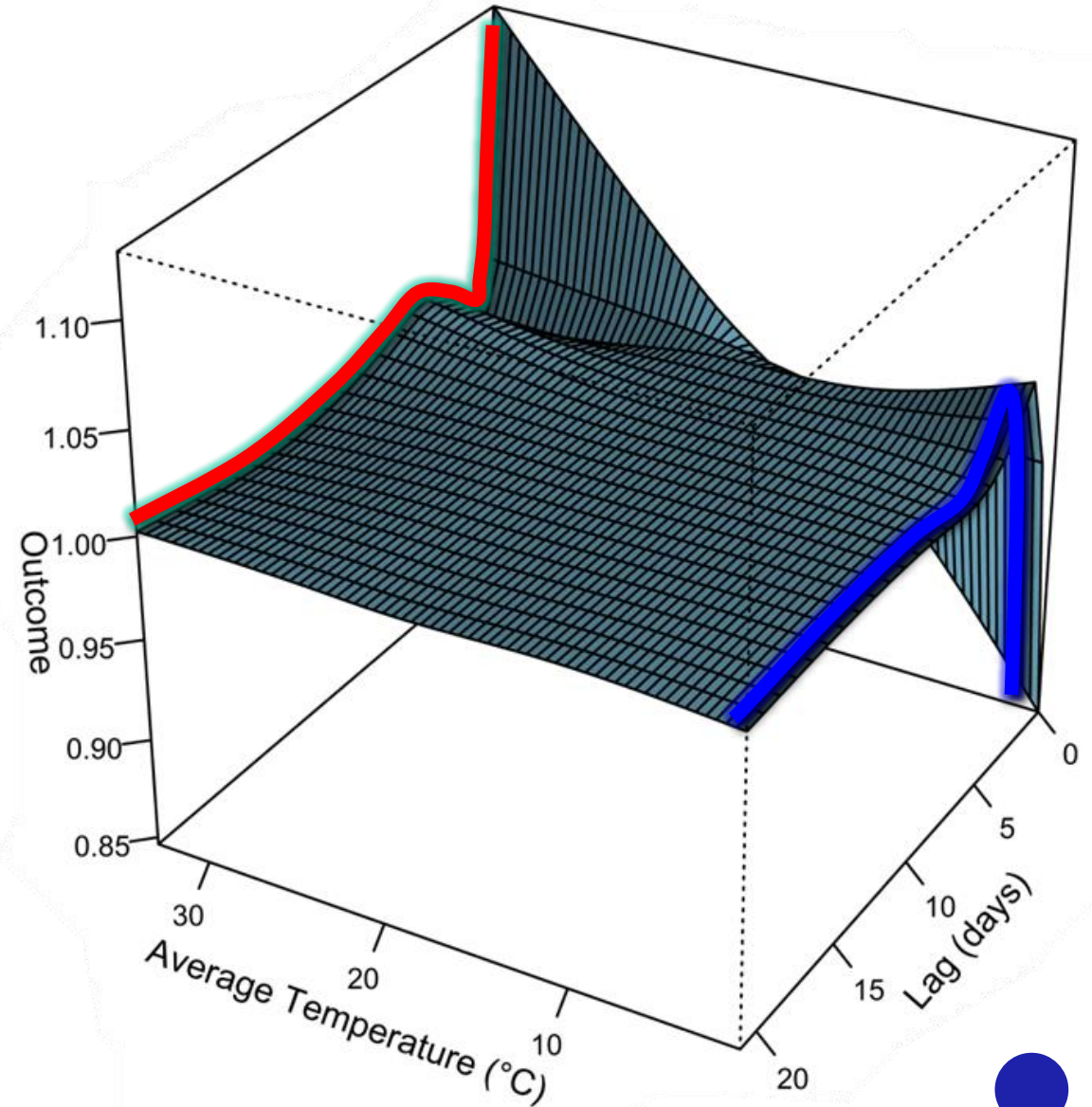
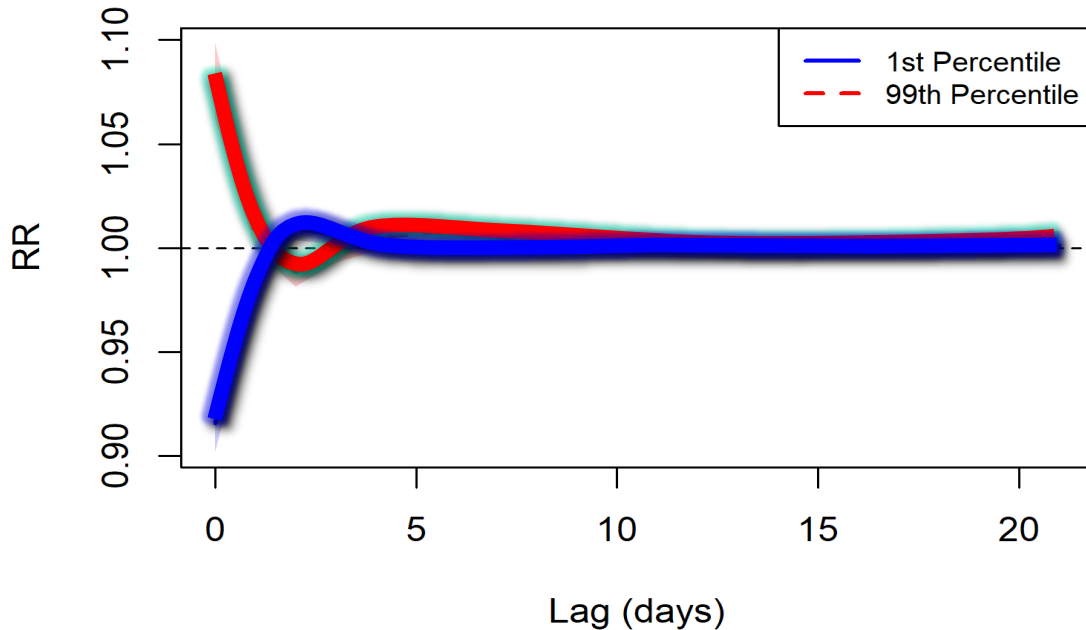
Lag-Response Effect



Complete 3D Temperature and Lag Effect

Combining these views into a single Three-Dimensional view

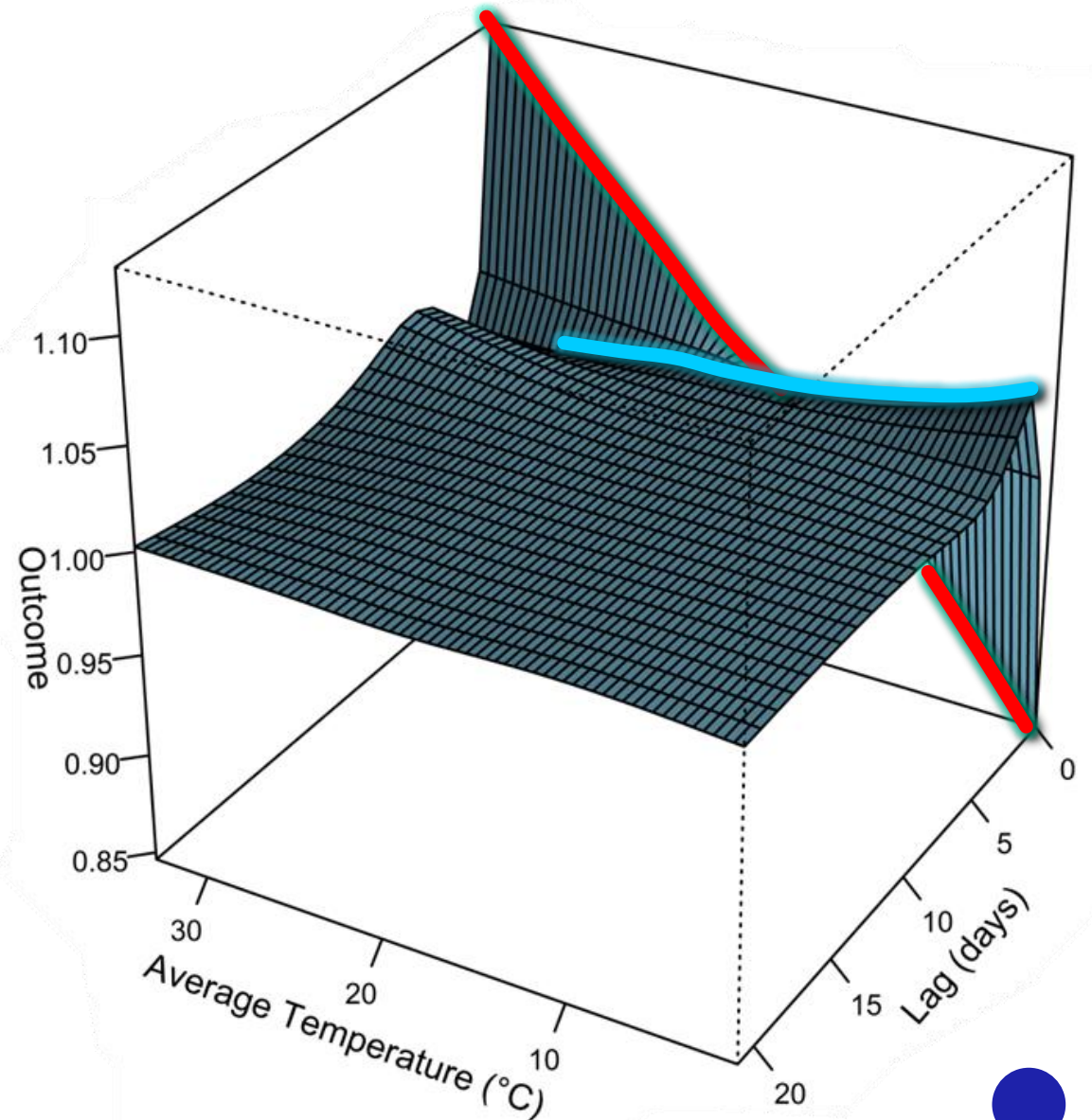
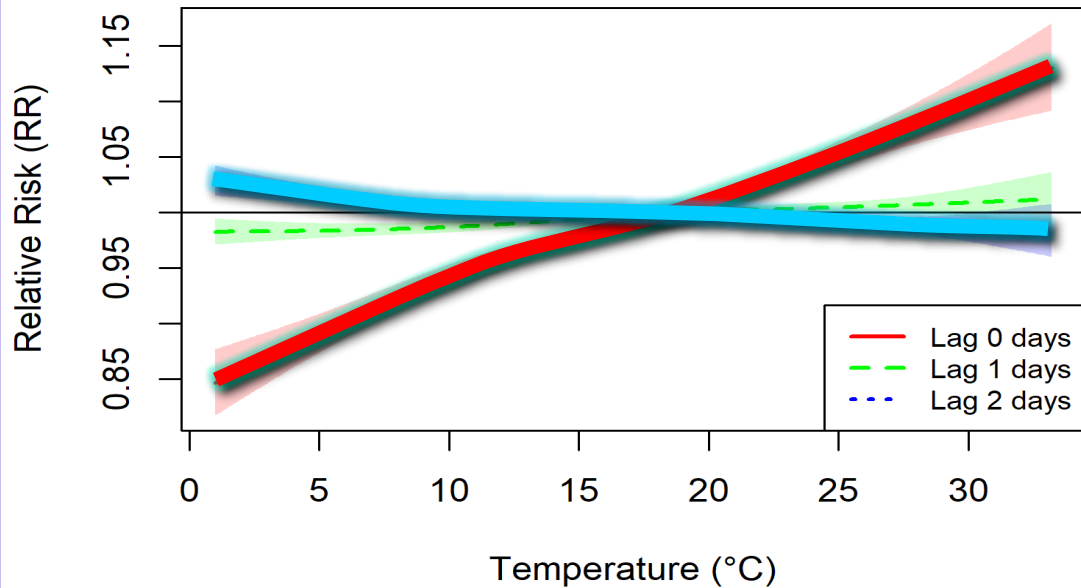
ED Visits



Complete 3D Temperature and Lag Effect

Combining these views into a single Three-Dimensional view

ED Visits

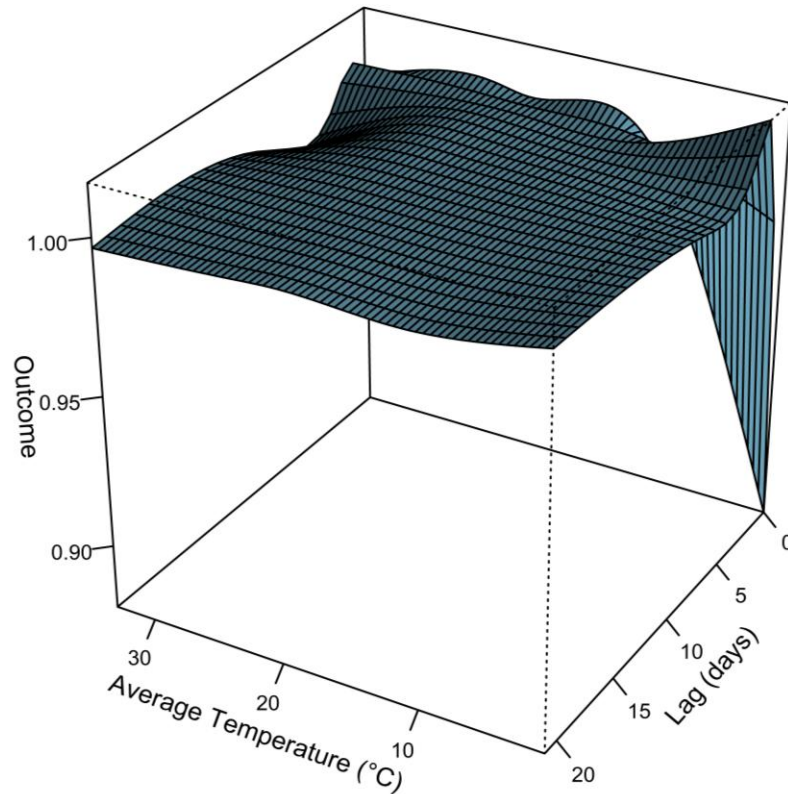


Complete 3D Temperature and Lag Effect

All Healthcare Visits

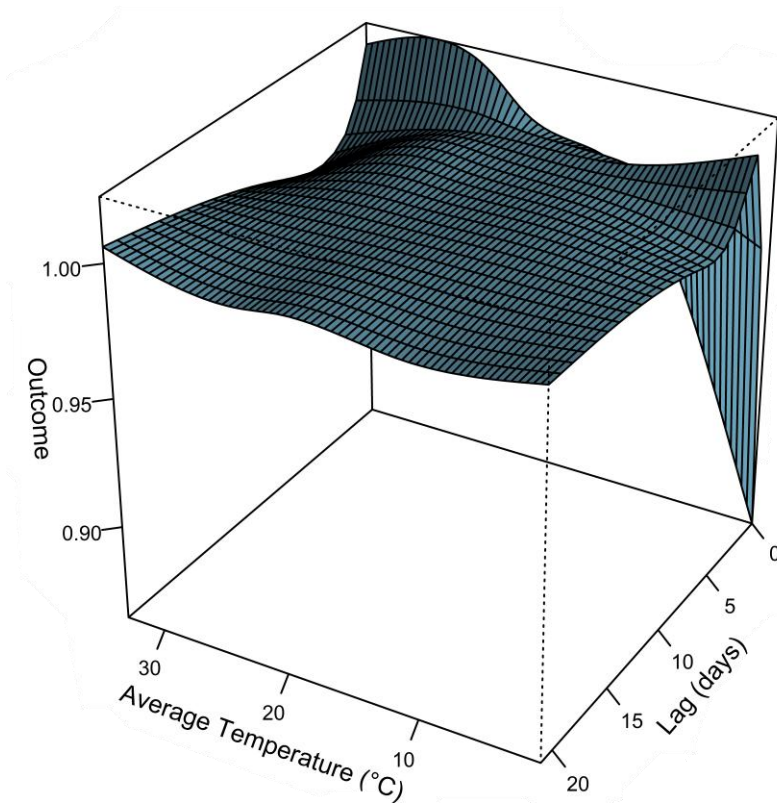
Extreme low temperatures reduce healthcare visits at lag 0

Slight increased relative risk at lag 2



All Hospital Admissions

Extreme low temperatures = Reduced relative risk
Extreme high temperatures = Increased relative risk



Impact of flooding on health care utilisation

SATURDAY STAR

Times LIVE



Scientists say the April 2022 floods in KZN are the most catastrophic natural disaster recorded in province

Mail & Guardian



KZN

2022 FLOODS



The Citizen



news24



DAILY MAVERICK

Healthcare disruption during flood, partial recovery post

Healthcare utilisation declines following flood, with lingering effects

Before floods (1-7 April):

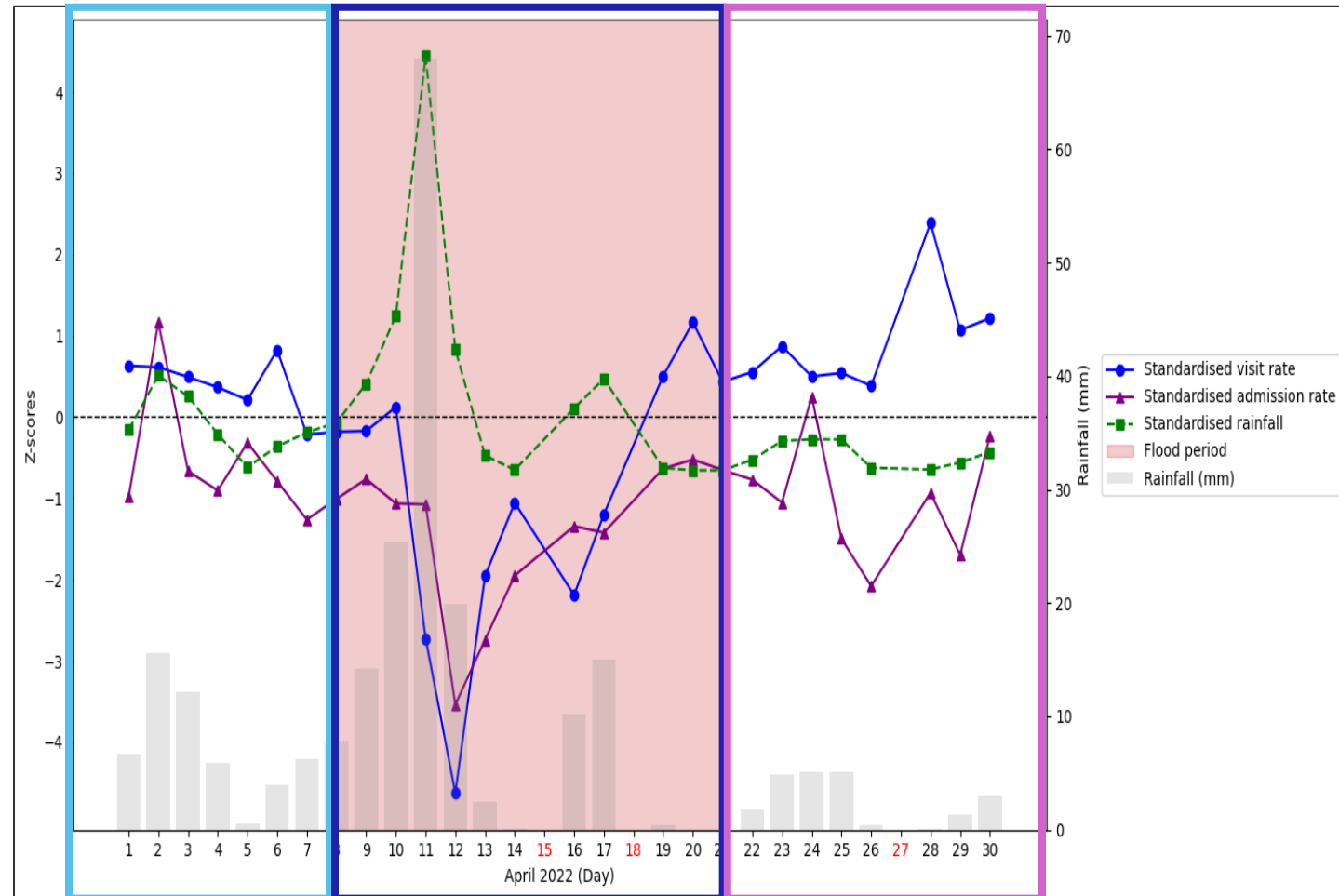
- Visit Rate, Admission Rate & Rainfall at stable levels

During floods (8-21 April):

- Peak rainfall (11 April) >4 Std. Deviations above expected.
- Total visits >4 Std. Deviations below expected.
- Admissions >3 Std. Deviations below expected.
- Lowest utilisation recorded the day after peak rainfall (lagged effect).
- Severe disruption to access, mobility & healthcare services.

Post flood-surge (22-30 April):

- Visits rebounded above expected (deferred demand).
- Admissions recovered partially but remained below baseline



*Analysis focused on provincial averages; may mask local variation. Looked at overall visits/admissions, condition-specific impacts may differ



Conclusion

Conclusion

Implication

- High-risk conditions
- Vulnerable groups
- Monetary impact

Extension

- Heatwaves & prolonged cold spells
- Broaden to other environmental contributors
- Health system planning

Collaboration

Collaboration with South African universities



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Thank you

Scan to read full paper

