SALUD URBANA EN AMÉRICA LATINA

Extreme heat and health in Latin American cities

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wellcome

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Salud Urbana en América Latina

LAC-URBAN HEALTH
Urban Health Network for Latin America and the Caribbean

A quintessential urban health challenge for the 21st century

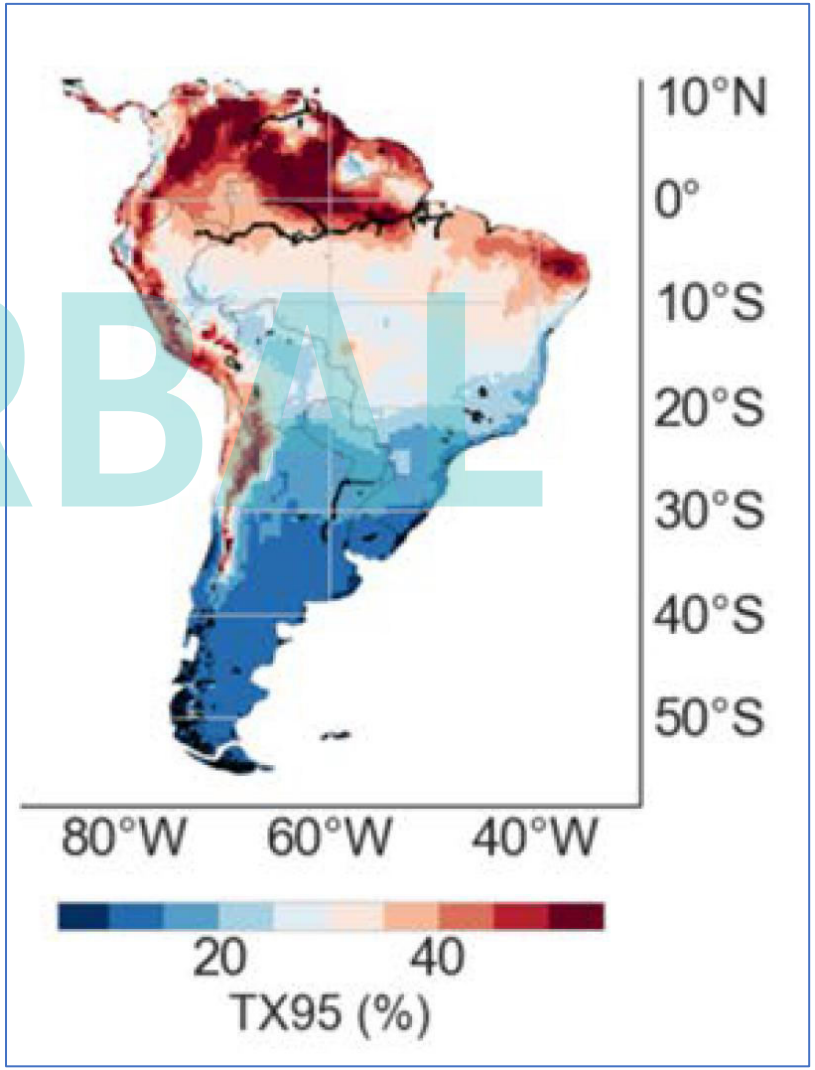
- Warming climate
- Increasing urbanization
- Heat island effect
- Social disparities
  - Exposure
  - Ability to cope

Heat is a growing concern in Latin America

- Most urbanized world region
- Continued urbanization

Feron et al, 2019, Scientific Reports

- Given a very hot day in 1961-1990… (95th percentile)
  - What % of days will be very hot in 2046-2055?
  - RCP4.5 climate scenario



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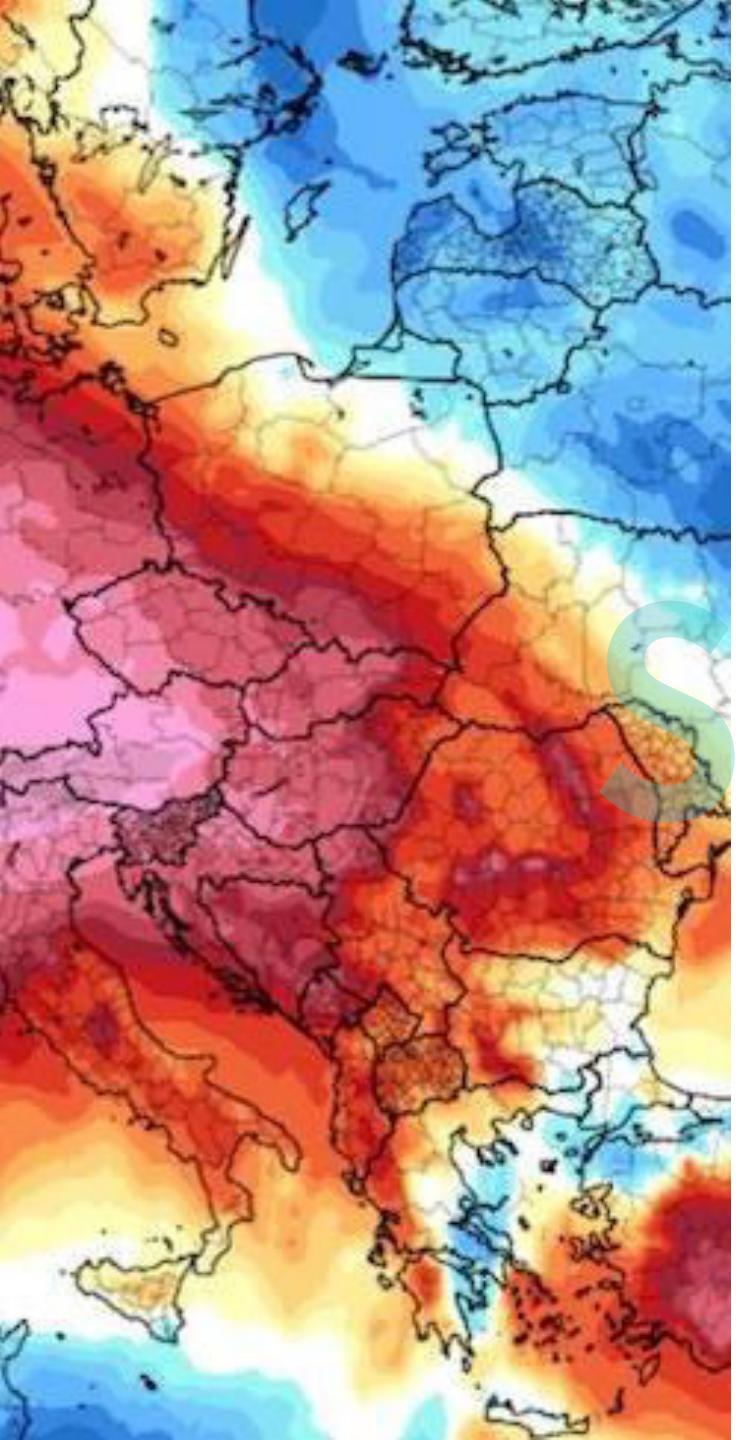

HEAT Project at SALURBAL

Temperature and mortality in Latin American Cities

- Phase 1: Recent (or current) climate
  - Relationship between temperature and mortality
  - How urban environment impacts vulnerability
    - Built environment
    - Natural environment
    - Social environment
- Phase 2: Mid-century climate
  - Project to climate change scenarios

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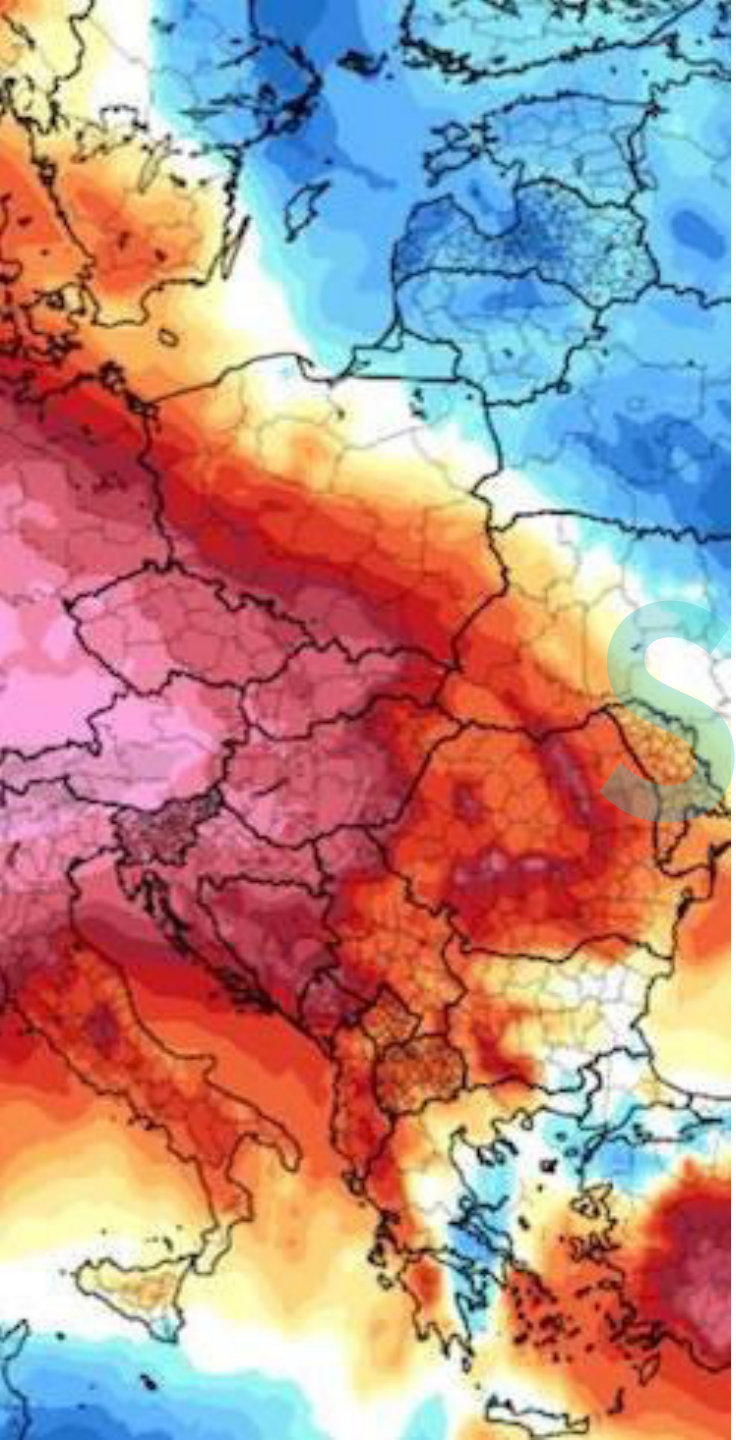

Goals of initial analysis

Across Latin America cities…

1) What is the relationship between **ambient temperature and all-cause mortality**?
   - All-ages, all-causes
2) Does this relationship vary by **age**?
   - < 65, 65+ years
3) Does this relationship vary by **cause of death**?
   - Cardiovascular
   - Respiratory
   - Non-injury

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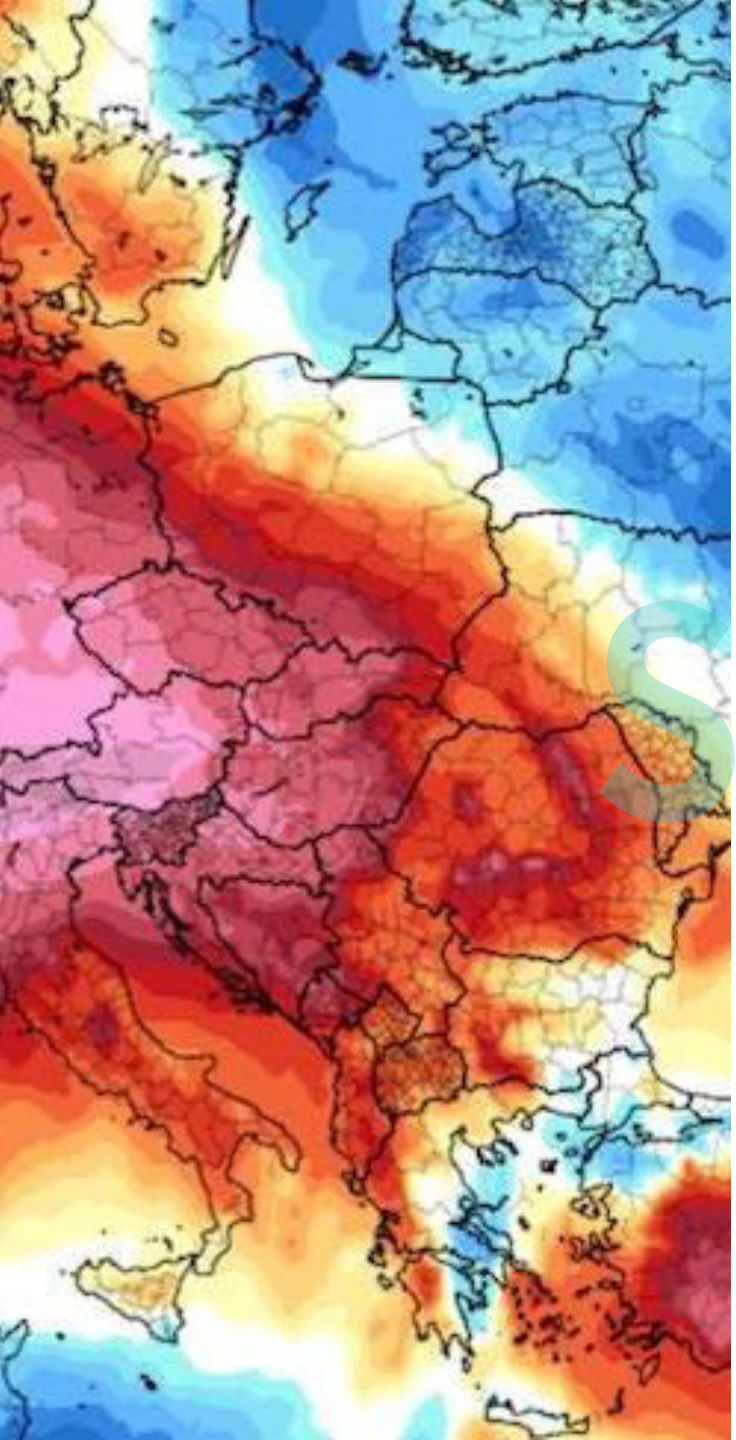


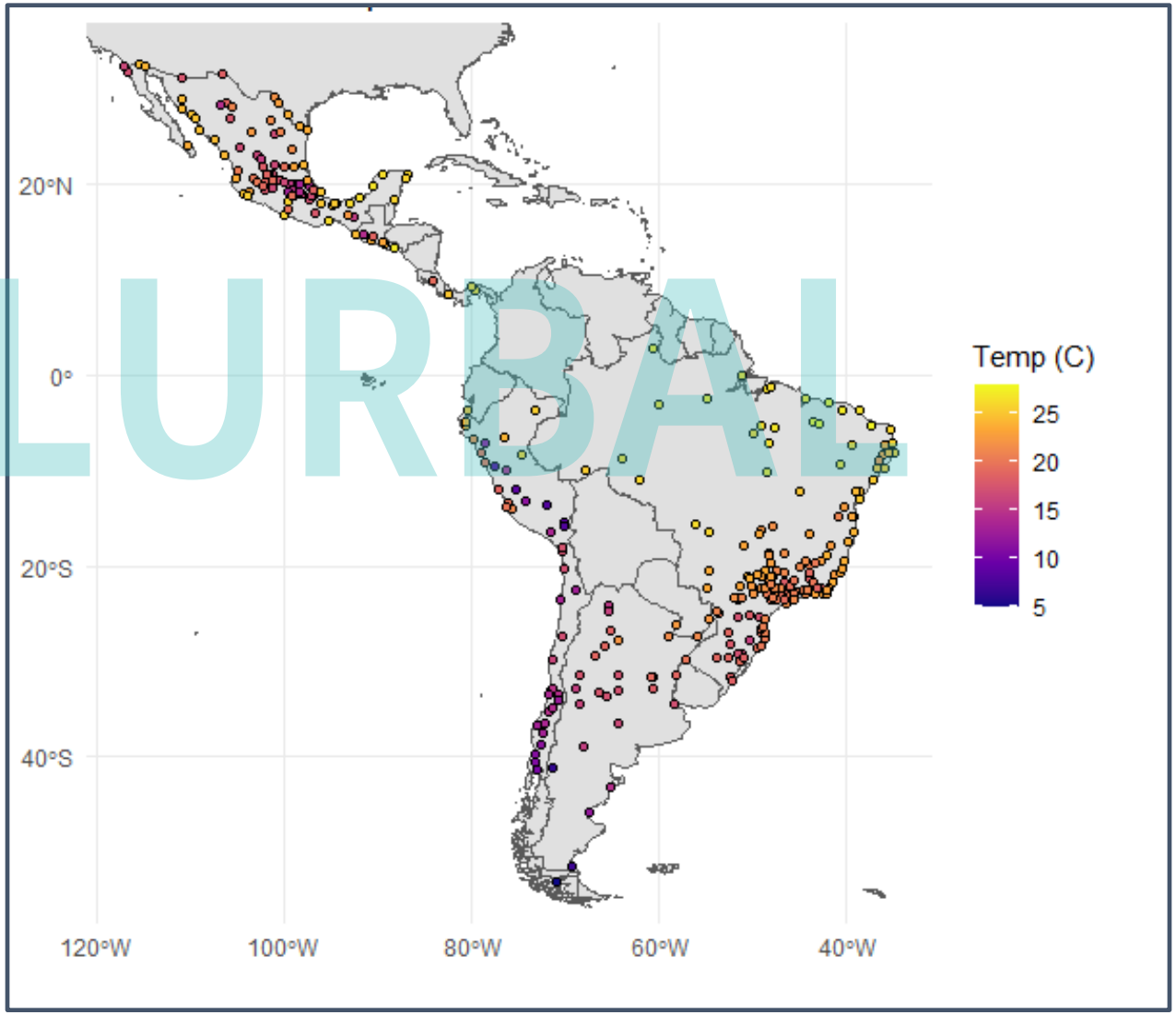
Study setting

- 326 cities from SALURBAL project
  - Population >100,000
  - Argentina, Brazil, Chile, Costa Rica, El Salvador, Guatemala, Mexico, Panama, Peru
- Exposure: Temperature
  - ERA5-Land, ~9km horizontal grid resolution
  - Population-weighted daily mean temperature
- Outcome: Mortality
  - Direct government sources
  - Individual-level age and cause of death as ICD-10 code

City locations and annual temperatures

Figure 1.

Annual mean temperature in 326 Latin American cities



City Characteristics

Country	Number of Cities	Study Period	Population (1K) Median (10th, 90th Percentiles)	Proportion Female Median (10th, 90th Percentiles)	Annual Deaths Median (10th, 90th Percentiles)	Proportion > Age 65 Median (10th, 90th Percentiles)	Annual Mean Temperature Median (10th, 90th Percentiles)
Total	326	2002-2015	3,043 (1,520, 13,604)	51.2 (49.9, 52.4)	1,454 (715, 6,825)	6.6 (4.6, 9.1)	21.3 (14.9, 25.9)
Argentina	28	2009-2015	2,341 (928, 9,785)	51.3 (50.3, 51.8)	2,234 (821, 12,028)	8.2 (7.0, 12.0)	17.5 (14.4, 21.6)
Brazil	152	2002-2015	3,092 (1,695, 18,086)	51.3 (50.3, 52.5)	1,443 (717, 6,279)	7.0 (4.8, 8.8)	22.2 (18.9, 26.4)
Central America	10	2009-2015	1,589 (883, 18,193)	51.4 (50.1, 53.9)	1,639 (1,085, 14,416)	7.2 (4.7, 8.4)	23.8 (14.4, 25.8)
Chile	21	2004-2015	2,522 (1,683, 11,041)	50.7 (49.3, 51.2)	1,088 (771, 5,215)	8.8 (7.0, 10.7)	13.7 (10.8, 17.0)
Mexico	92	2005-2015	3,876 (1,567, 11,976)	51.3 (49.8, 52.4)	1,825 (775, 5,272)	5.6 (4.4, 7.0)	20.3 (15.6, 25.8)
Peru	23	2008-2015	2,304 (1,048, 7,081)	50.7 (47.9, 51.7)	978 (442, 3,644)	5.3 (3.9, 6.8)	19.6 (8.0, 24.7)

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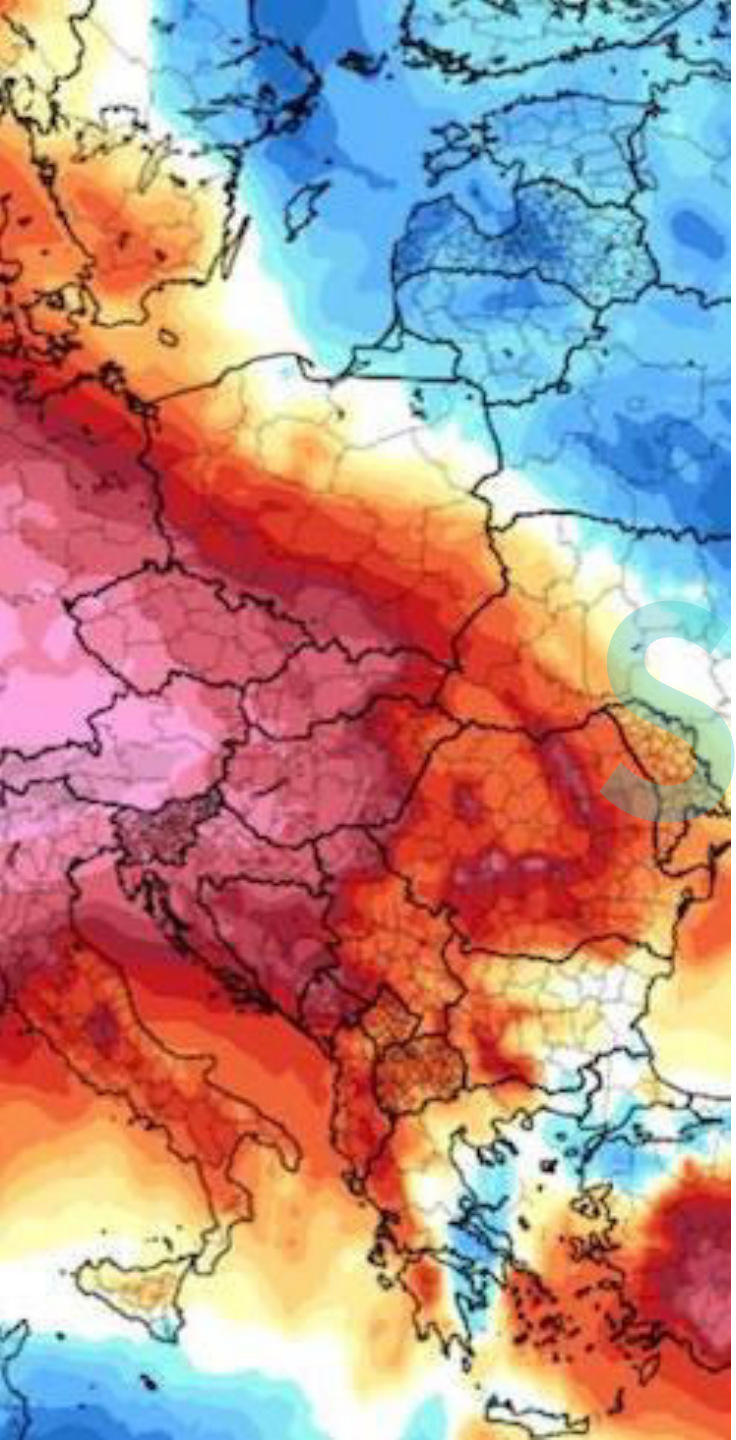

Methods: Statistical analysis

- City-specific estimates
  - Daily city-wide mean temperature
  - Daily city-wide death count, by age and cause
  - Conditional Poisson models
  - Distributed lags (0-21 days)
  - Nonlinear (knots at 10, 75, 90%ile, min, max)
- Combine city-specific associations
  - Random effects meta-analysis
  - Attributable fraction of deaths

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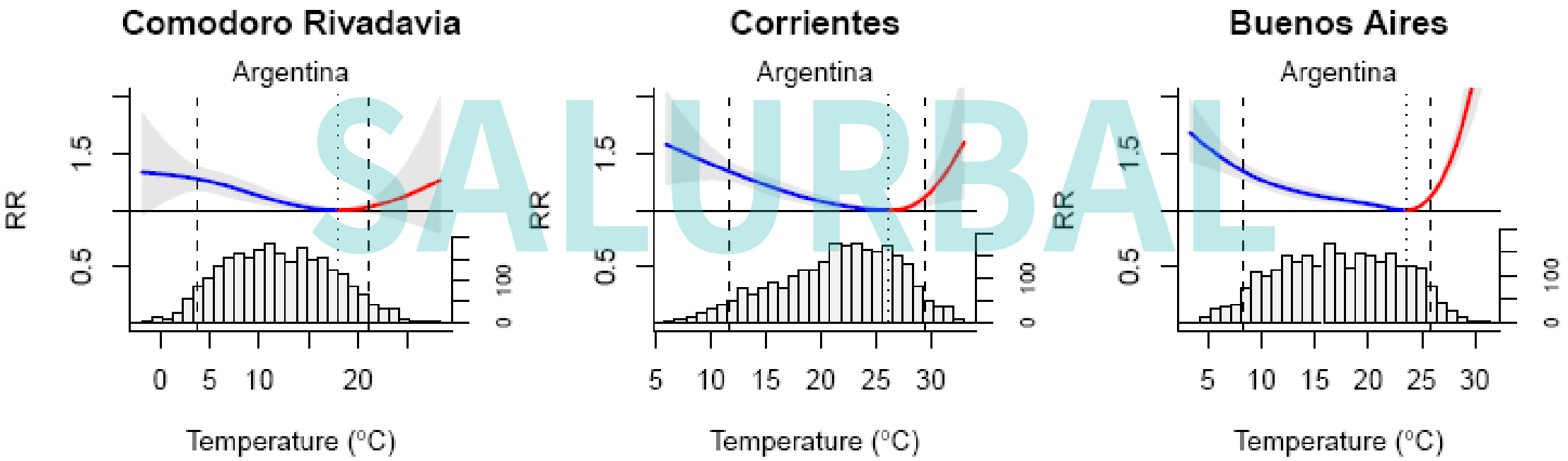
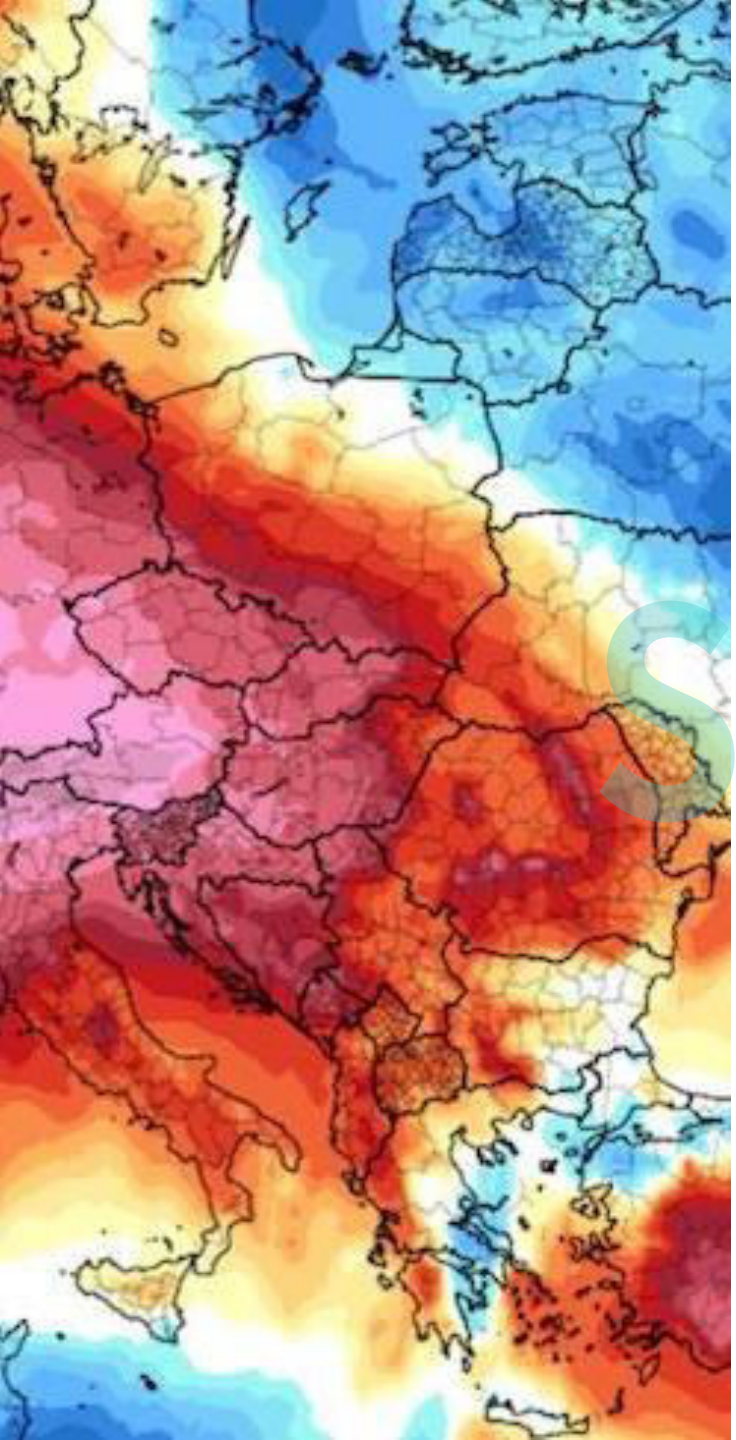
Results: City-specific associations, all-age/all-cause



Results: attributable fractions (%)

	Total	All heat	Extreme heat (95th %ile)	All cold	Extreme cold (5th %ile)
All-cause					
All ages	5.75 (5.32 to 6.10)	0.67 (0.59 to 0.73)	**0.42 (0.38 to 0.45)**	5.09 (4.65 to 5.46)	**1.03 (0.99 to 1.06)**
Ages 65+	7.63 (7.20 to 7.94)	0.81 (0.75 to 0.87)	**0.55 (0.50 to 0.59)**	6.82 (6.40 to 7.18)	**1.36 (1.32 to 1.39)**
Ages < 65	4.17 (3.33 to 4.82)	0.74 (0.43 to 1.01)	**0.27 (0.22 to 0.31)**	3.43 (2.74 to 4.02)	**0.65 (0.58 to 0.70)**
Cause-specific, all-ages					
Respiratory	-	-	-	-	-
Cardiovascular	-	-	-	-	-
Non-injury	-	-	-	-	-



Conclusions

- Ambient temperature is a major driver of mortality in Latin American cities
- Older individuals are especially vulnerable to temperature-related mortality
- Heat-related mortality is primarily driven by extreme heat days, while cold-related mortality is primarily driven by moderately cold days
- An increase in the number of extreme heat days (as predicted in CC literature) would likely have a substantial impact on mortality, particularly among older individuals.

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Next steps at SALURBAL…

- Landcover determinants of heat vulnerability
- Socioeconomic modification of heat vulnerability
- Exposure to high temperature and birth weight

- Mid-century projections under climate scenarios

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