SALUD URBANA EN AMÉRICA LATINA

Temperature and birthweight in Latin American cities

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Urban Health Network for Latin America and the Caribbean

What we know about temperature and birthweight

- Reduced birthweight can be linked to intrauterine growth restriction
- Environmental factors such temperature and air pollution can lead to IUGR
- Physiological pathway between temperature and birthweight is not fully understood
- Virtually no studies from Latin America

Lower temperatures – lower birthweight (Elter et al. 2004; Murray et al. 2000)

No association (Diaz et al. 2016; Son et al. 2019)

Lower and higher temperatures – lower birthweight (Ha et al. 2017; Ngo & Horton 2016

Higher temperatures – lower birthweight (Kloog et al. 2015; Li et al. 2018; Sun et al. 2019; Yitshak-Sade et al. 2020)

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What we know about temperature and birthweight

- Reduced birthweight is a form of intrauterine growth restriction
- Physiological pathway between temperature and birthweight is not fully understood
- Virtually no studies from Latin America

- Inconsistent results potentially due to
  - Exposure windows (trimesters/months/weeks)
  - Exposure measured during entire pregnancy or only the last few weeks/last month
  - Modeling temperature-birthweight linearly vs. nonlinearly

Is there a relationship between temperature during pregnancy and child's birthweight in Latin American cities?

Data

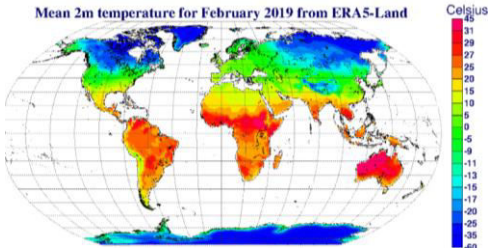
- Live births dataset from SALURBAL (Salud Urbana en America Latina)

- Outcome: Birth weight in grams for term births
  - Term births are based on the categorical variable of gestational age in weeks: 38-41 weeks of gestation

- Sample: live births from Brazil, Mexico, Chile 2010-2015
  - N = ~15 million births

Temperature data and exposure

- Data: daily mean temperature from ERA5-Land (9x9 km)
  - Population-weighted daily mean temperature for SALURBAL sub-cities
- Exposure: average temperature for every month of every individual pregnancy
- Term births: 40 weeks of gestation



Analysis

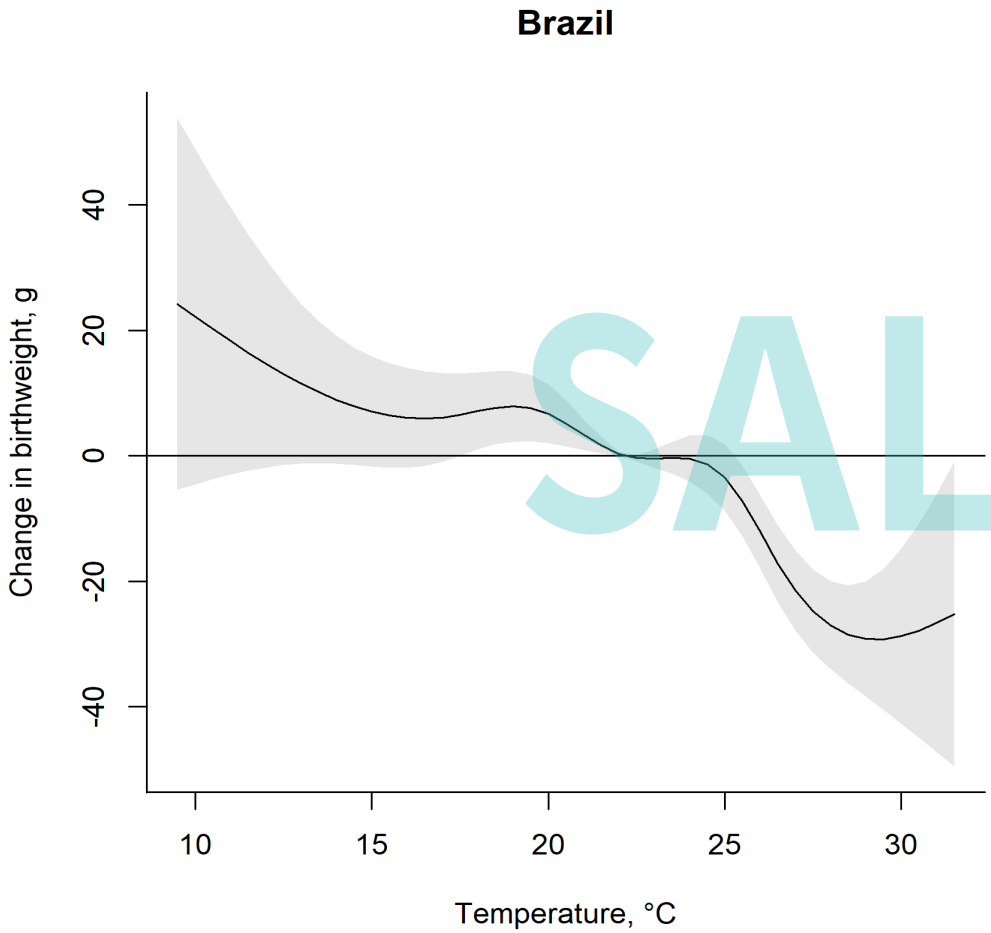
Distributed lag models

- A flexible framework to estimate an appropriate functional form of the exposure-response association (linear, non-linear, specific type of the nonlinear, etc.).
- Lagged response: modeling temperature in each exposure window that takes into account temperature exposure in the lag period
- Can naturally identify important exposure windows during pregnancy and estimate a cumulative “effect”

Analysis

- Multilevel distributed lag models
- Model temperature-birthweight association with natural cubic with inner knots at 10th, 25th, 50th, 75th, 90th percentiles
- Adjusted for infant's sex, mother's age, previous live births, education, partnership status, year and month of birth, climate zone; random intercept for sub-city of mother's residence at the time of birth
- Analysis was done for term births (40 week of gestation)

Results: Overall cumulative exposure



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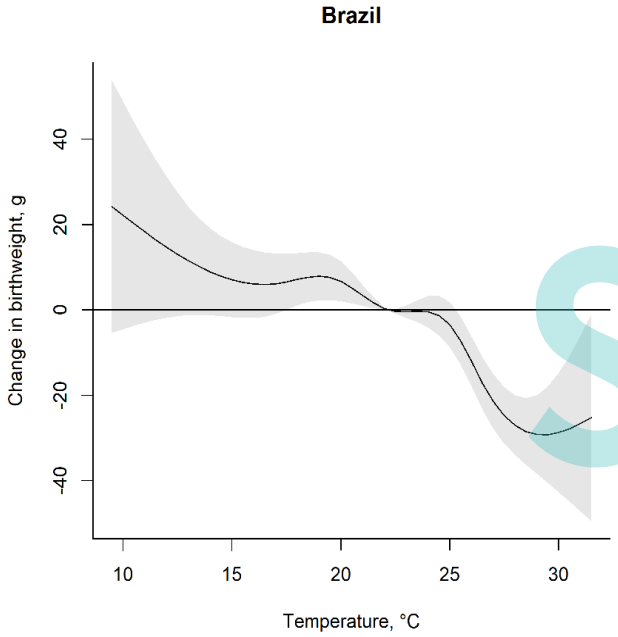

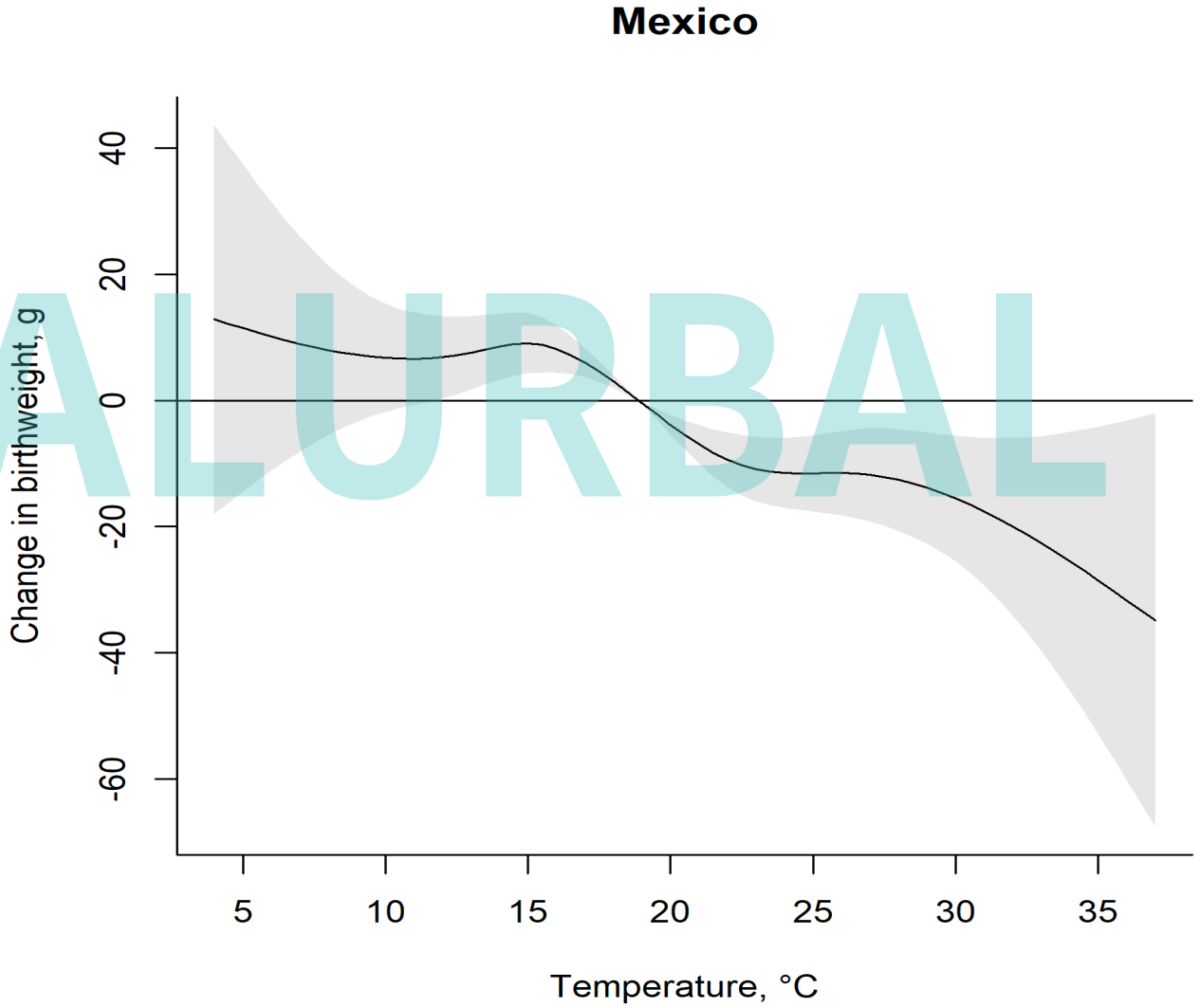

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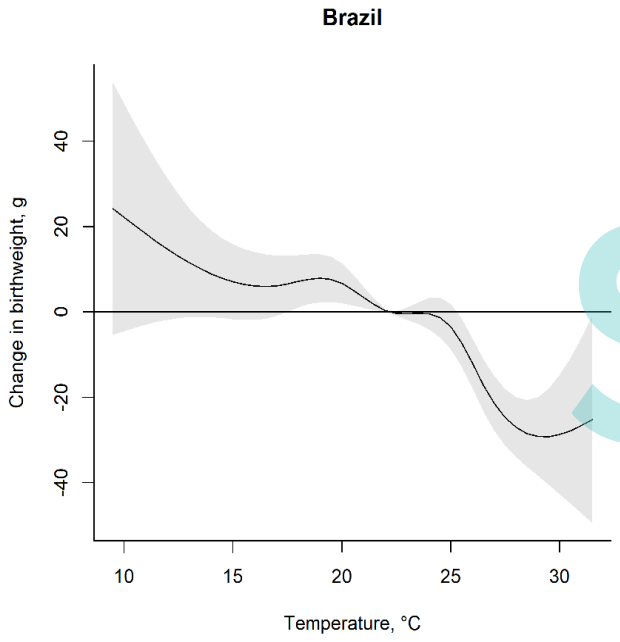

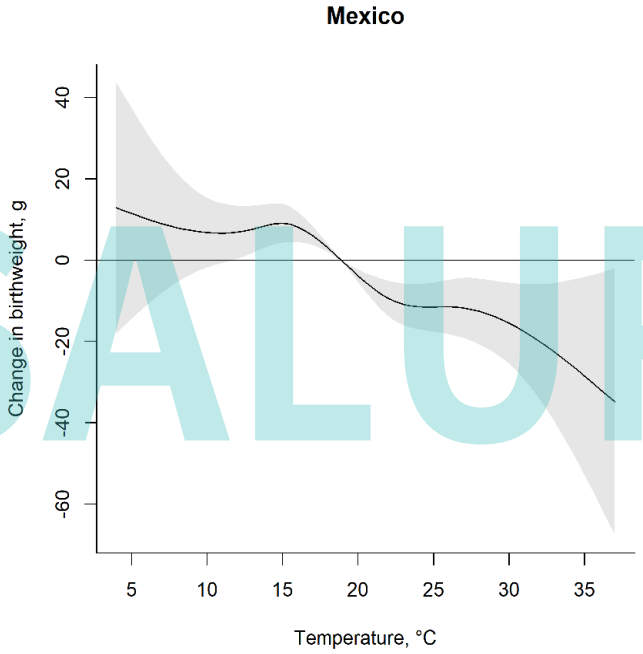

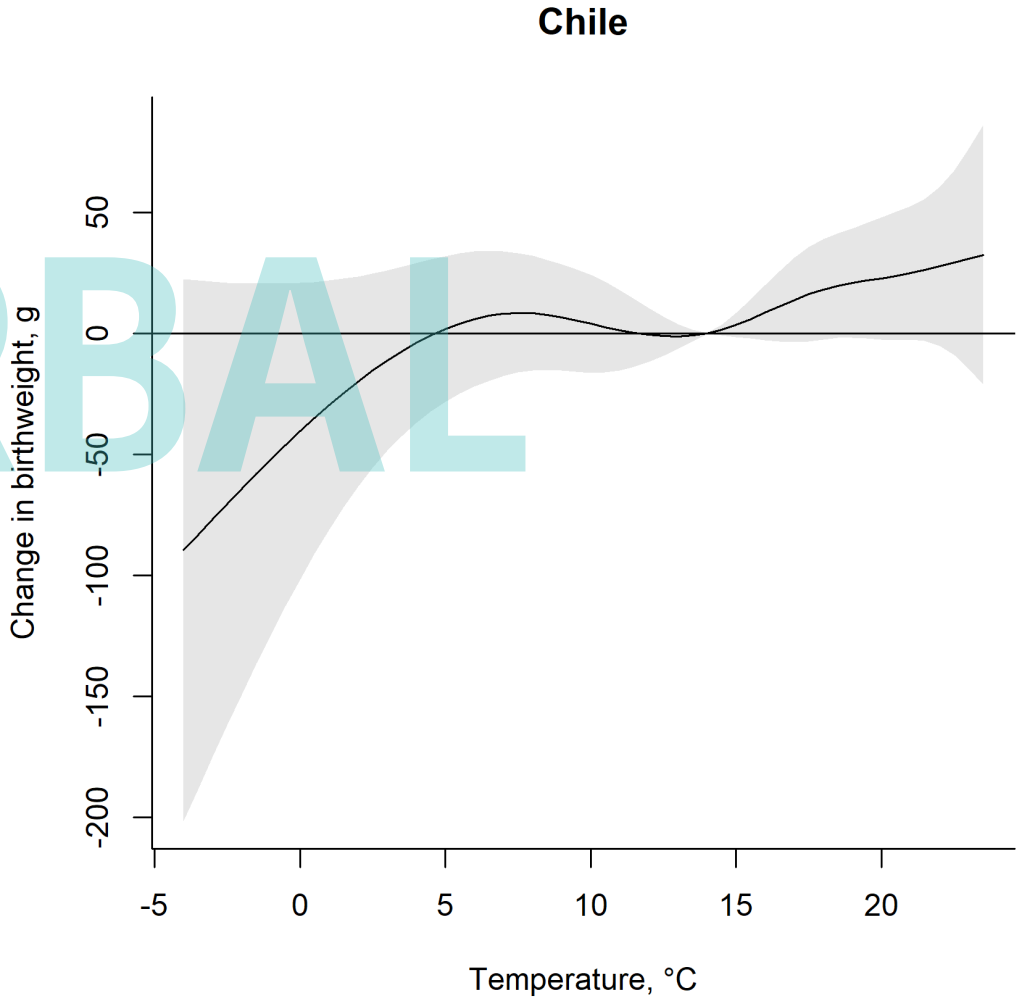

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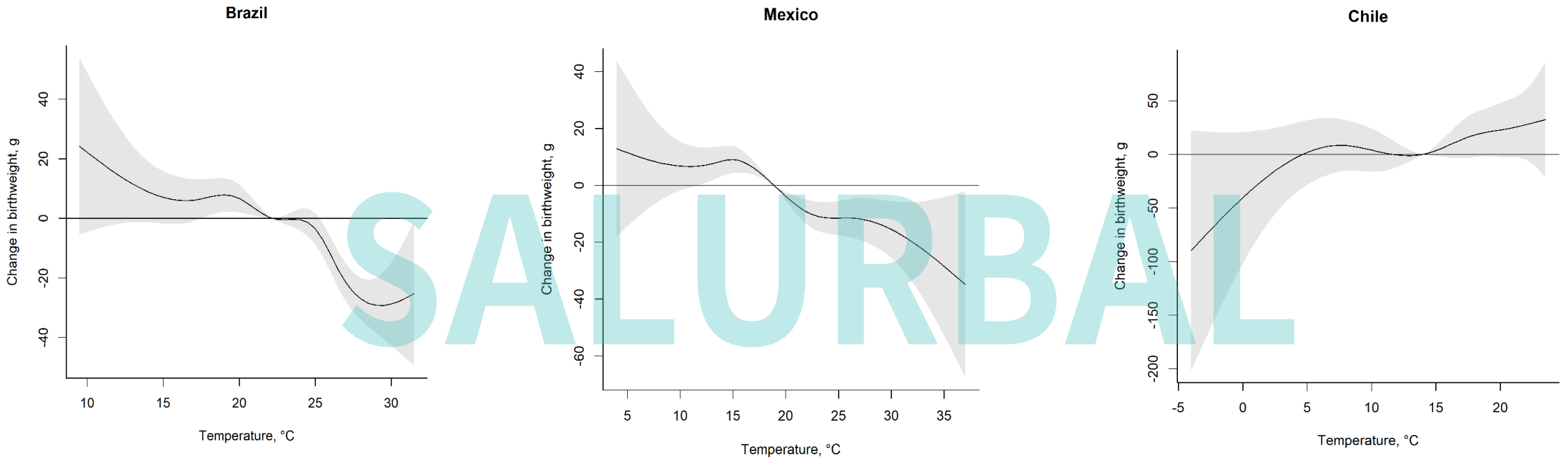

Country	5th %ile	50th %ile	95th %ile
Brazil	6.09 (-1.86; 14.03)	-0.37 (-0.90; 1.17)	**-24.74 (-31.39; -18.09)**
Mexico	**8.86 (0.32; 13.39)**	**2.98 (1.99; 3.96)**	**-12.61 (-20.67; -4.54)**
Chile	7.23 (-19.60; 34.07)	-0.07 (-0.21; 0.07)	24.84 (-2.73; 52.42)

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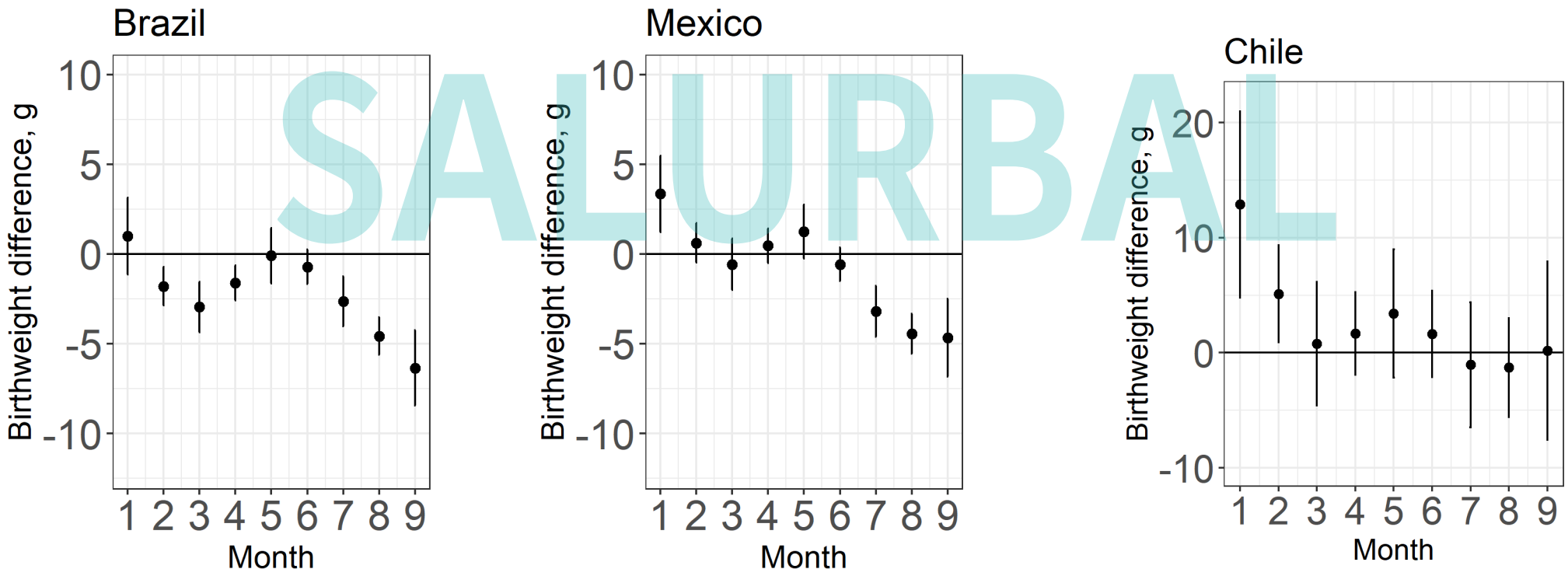
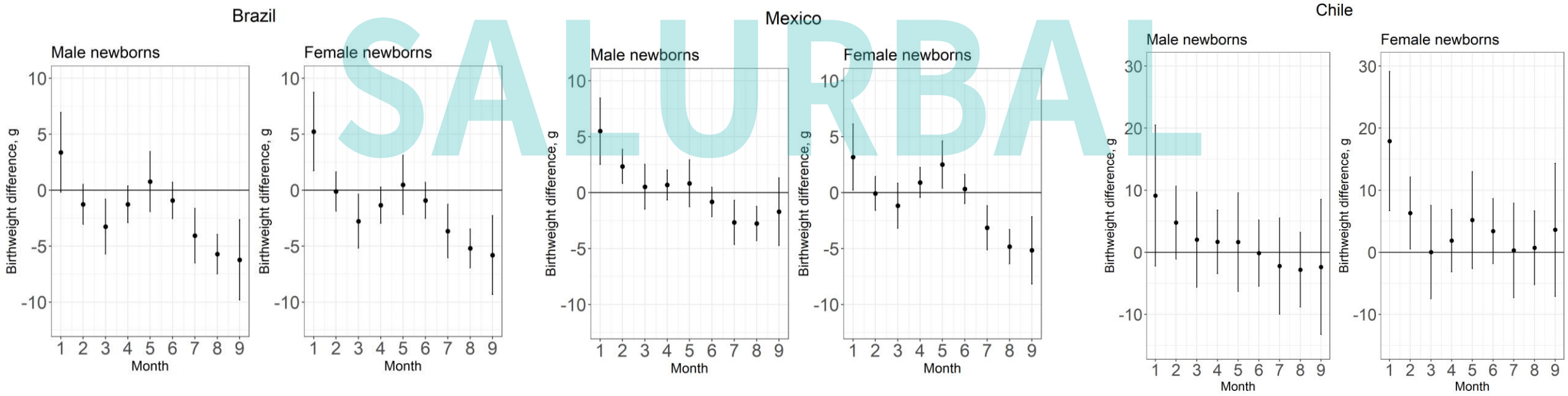
Results: Monthly exposure

Difference in birthweight associated with a 5°C higher temperature in every month of pregnancy, relative to the average monthly temperate for each country

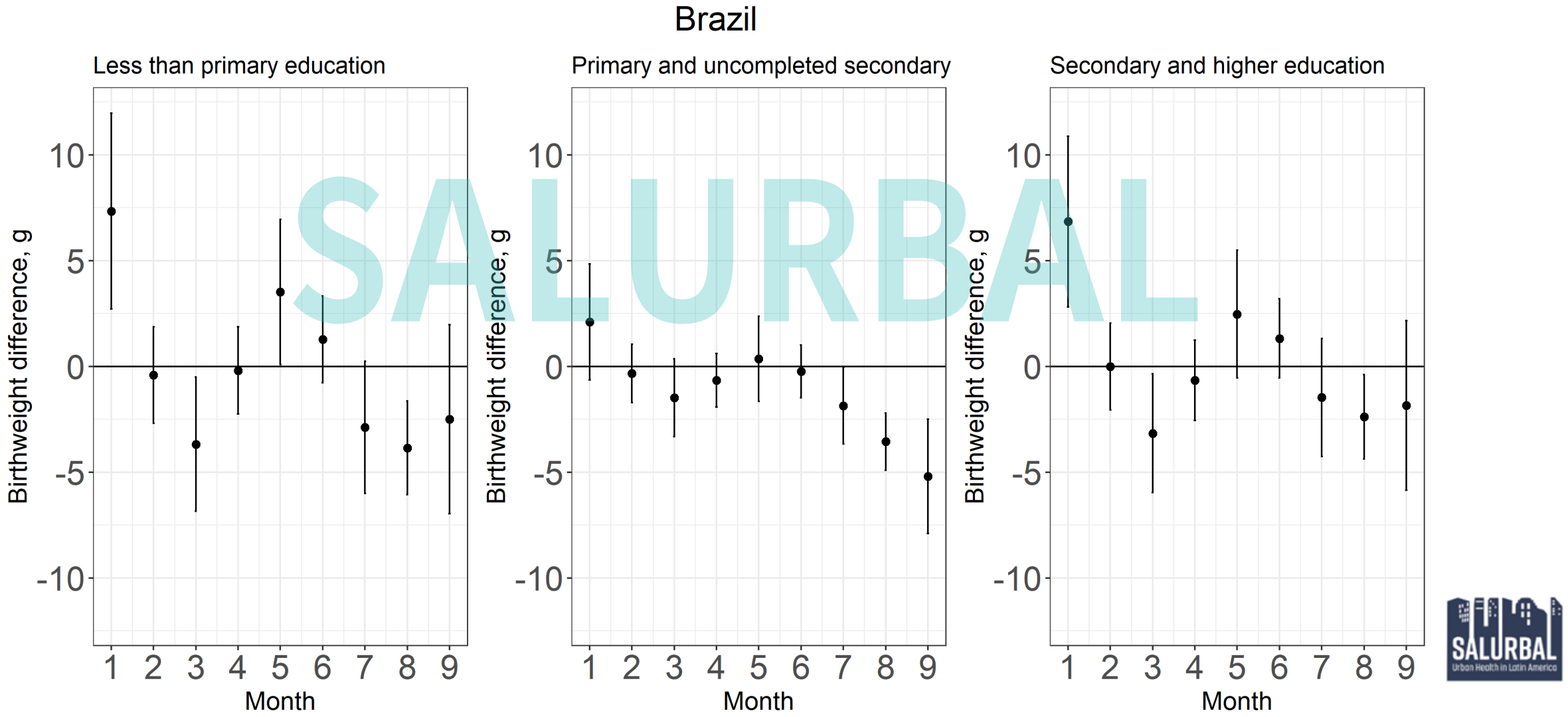


Results: Stratified by newborn's sex

Difference in birthweight associated with a 5°C higher temperature in every month of pregnancy, relative to the average monthly temperate for each country



Results: Stratified by mother's education



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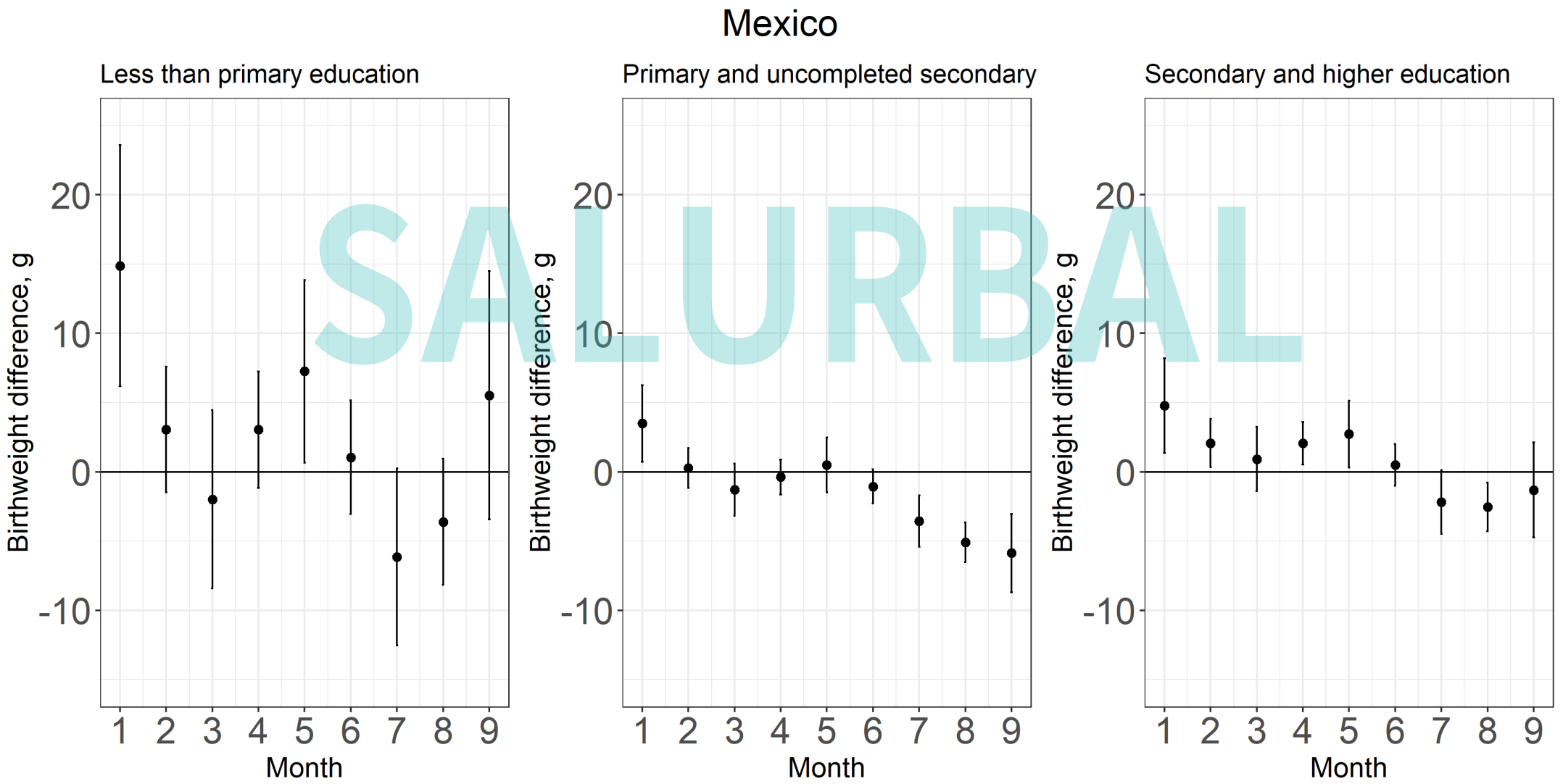

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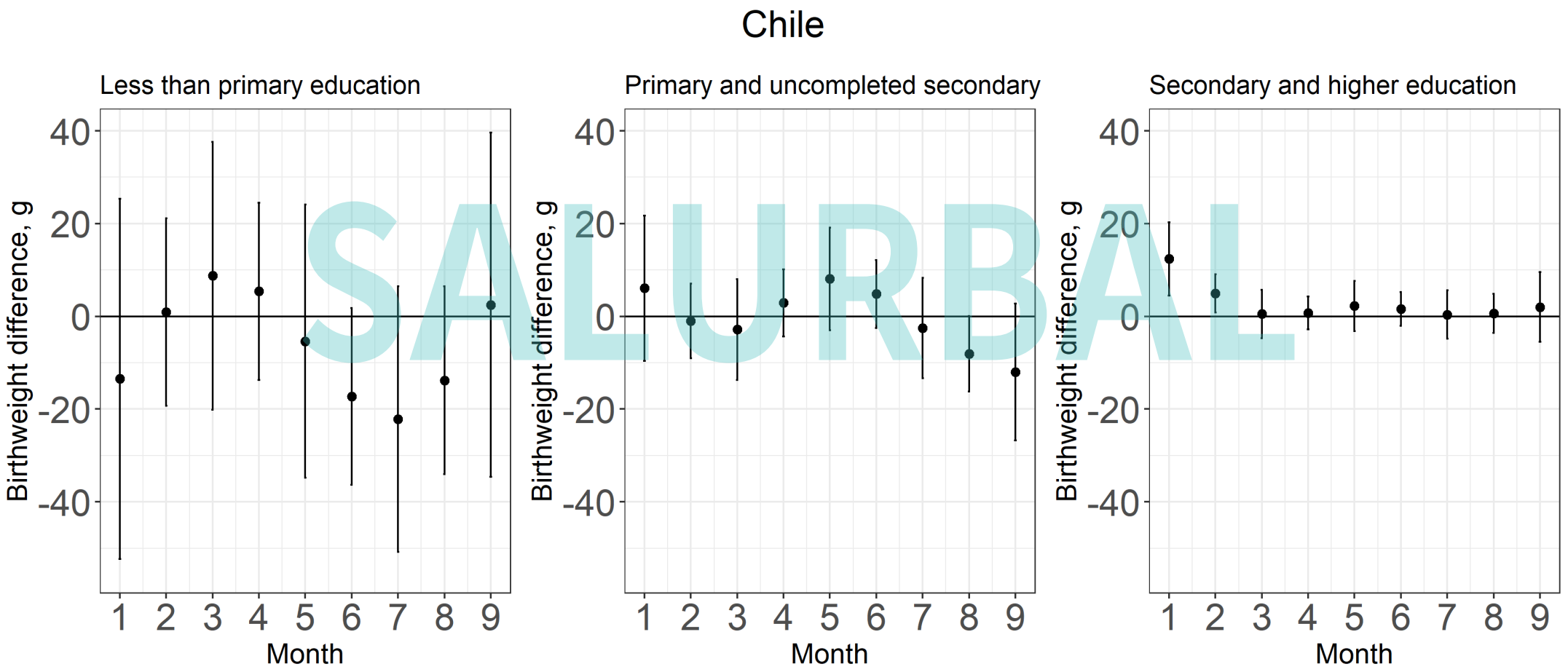

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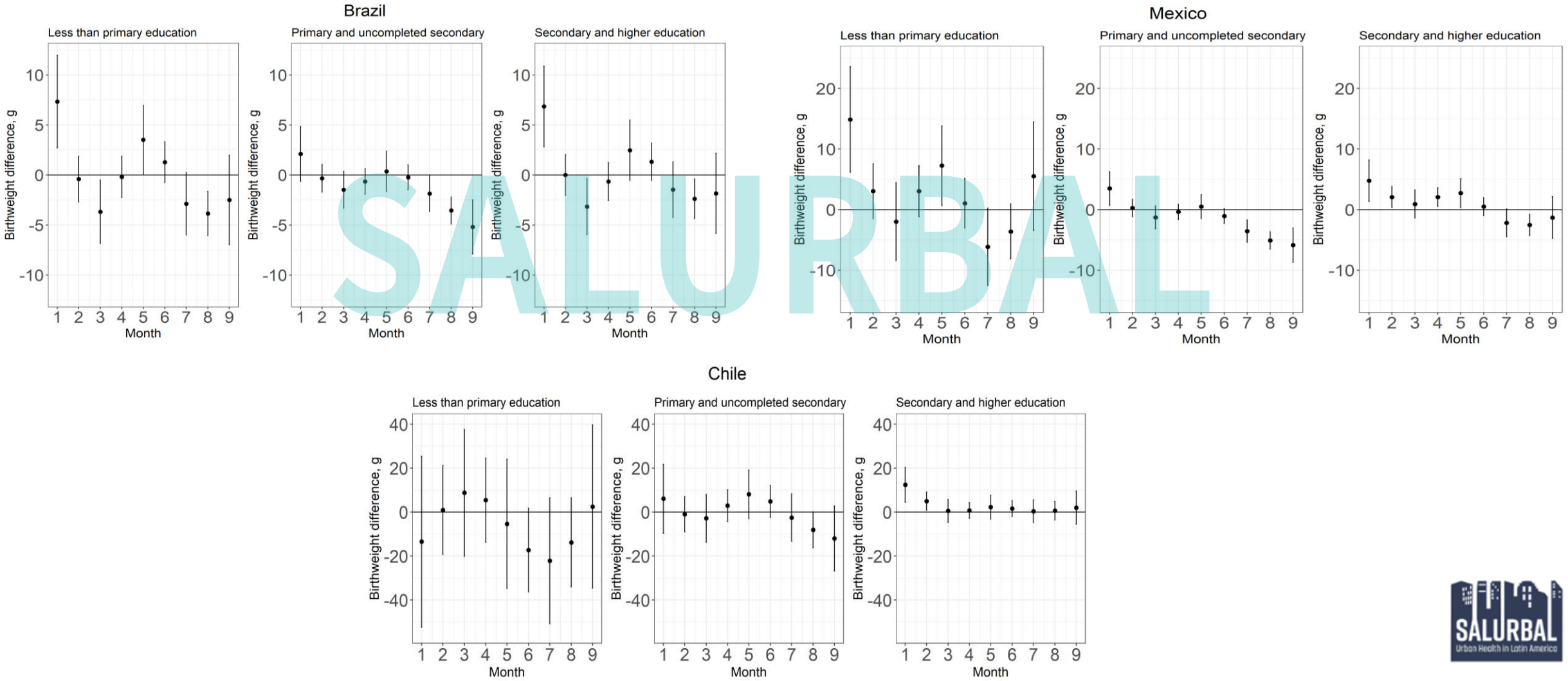

Conclusion

- Overall association between temperature and birthweight
  - Non-linear for Brazil and Mexico
  - Cooler temperatures are associated with increases or no change in birthweight
  - Higher temperatures are associated with decreases in birthweight
- Temporal pattern in the association
  - Higher temperatures in the last three to four months of pregnancy are associated with decreases in birthweight
  - Higher temperatures in mid-pregnancy are associated with no change in birthweight.
- The negative association between temperature and birthweight appears to be partially alleviated in highly educated mothers

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