Abstract: 7442

The effects of adverse environmental exposures on risk for congenital Chagas transmission and adverse birth outcomes in Santa Cruz, Bolivia.

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CONCLUSIONS & CLINICAL RELEVANCE

As global temperatures continue to rise and exposures to ambient air-pollution continue, the potential association between gestational PM2.5 and heat stressors and rates of congenital Chagas transmission need to be investigated further. The outcome of this study will aid physicians in advising women infected with *T. cruzi* on risk reduction during pregnancy. Results will shed light on the association of air pollution and heat exposures during pregnancy with adverse birth outcomes and congenital Chagas transmission in Santa Cruz, Bolivia. Additionally, the findings could have implications for other infections with similar mechanisms of congenital transmission as *T. cruzi*.

BACKGROUND

Little is known about the relationship between environmental stressors and congenital transmission of *Trypanosoma cruzi*, the etiologic agent of Chagas disease.

- Up to 30% of develop cardiac, digestive, and/or neurologic disease, resulting in significant morbidity and mortality.[1]
- 6 – 8 million people are infected globally.
- > half in the Southern - Cone region of Latin America and over 90% of new cases in this region occurring in Bolivia.[2, 3, 4]
- Adverse birth outcomes in infants born to infected mothers and can result in delayed childhood development.[3]
- Congenital transmission occurs in 5 - 10%

It is thought *T. cruzi* evades the immune system to establish congenital infection through a complex interaction between parasite, placenta, and inflammatory and oxidative stressors that weaken the placental barrier from repeated activation of the innate immune system.[5, 6]

Repeated gestational exposure to ambient PM2.5 also results in adverse birth outcomes due to oxidative and inflammatory stress and PM2.5 can cross the placental barrier and result in placental maladaptation with further deleterious effects on fetal development.[7,8]

Studies indicate that a 1°C increase in temperature correlates to double the risk for both pre-term and stillbirths.[9] Santa Cruz, Bolivia has highs in the 40 ºC range with summer PM2.5 exceeding the WHO's recommendation by as much as five - fold.

AIMS

Aim 1: Quantify associations of heat and $PM_{2.5}$ exposure with detectable maternal parasitemia during pregnancy and at delivery and examine effect modification by SES.
Aim 2: Quantify associations of heat and $PM_{2.5}$ exposure during critical periods of gestation with congenital Chagas transmission.
Aim 3: Quantify associations of heat and $PM_{2.5}$ exposures during infancy with clinical signs of congenital Chagas disease.

METHODS

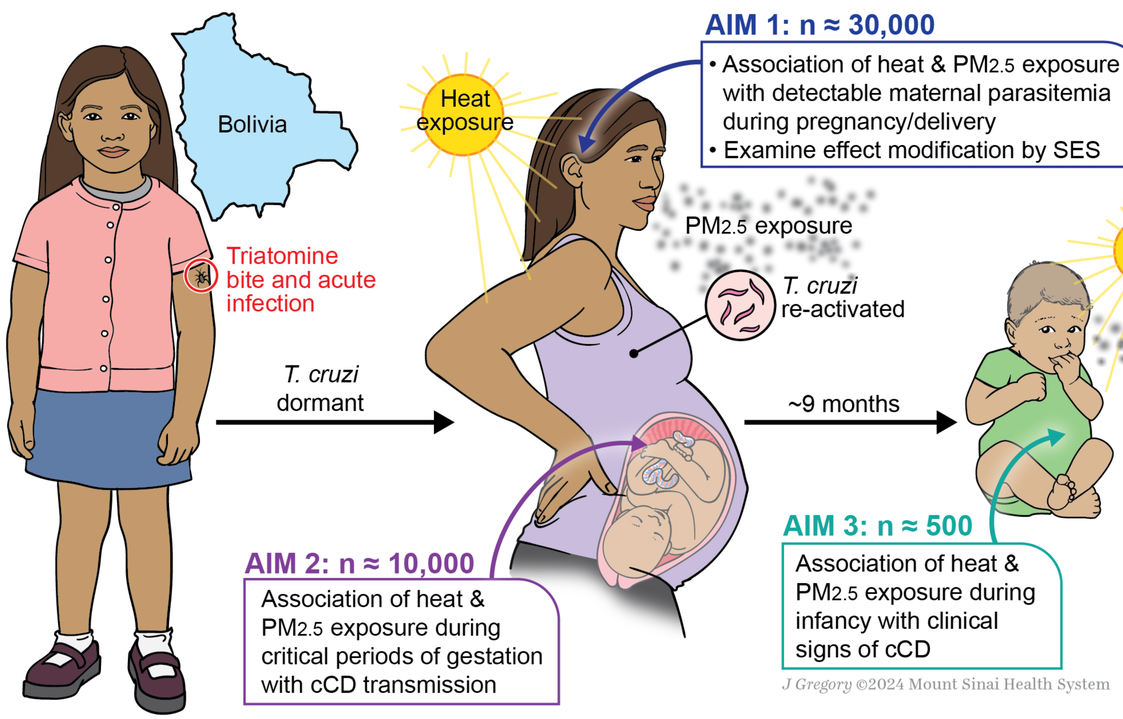

Figure 1. Study overview.

Table 1. Currently identified data sources for environment and socioeconomic status in Santa Cruz, Bolivia.

Variable	Platform	Source	Spatial Resolution	Temporal Resolution
Surface Temp Wet Bulb Temp Precipitation Humidity	CHC-CMIP6	Climate Hazards Center[18]	0.05 º	Daily, 1981 - present
Surface PM2.5	ACAG	Atmospheric Composition Analysis Group[19]	~ 1 km	Monthly, 1998 - present
Health, Demographic & SES Data	Cohort	Questionnaire*	Dyad - Neighborhood	Enrolment

*Includes data on housing size, type, and occupancy, as well as household education levels and occupations.

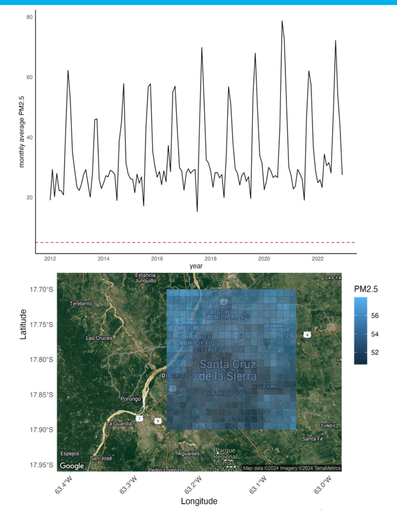

Figure 2. Top: Monthly average $PM_{2.5}$ ($\mu g/m^3$), 2012 – 2022. Bottom: ~1 km (0.01º) grids of mean $PM_{2.5}$ during October between 2012 – 2022 in Santa Cruz, Bolivia.

Aim 1. Regression models will quantify associations of heat and $PM_{2.5}$ exposure during pregnancy with detectable parasitemia at multiple time points. Effect measure modification by SES will be assessed. Hypothesis: High levels of heat and $PM_{2.5}$ exposure will be associated with parasitemia in pregnancy and associations will be stronger among individuals of low SES.

Aim 2. Distributed lag models will characterize association of time-varying exposures with cCD transmission. Hypothesis: Pregnancies with high levels of heat and $PM_{2.5}$ during critical periods of gestation will have increased rates cCD transmission.

Aim 3. We will analyze associations of heat and $PM_{2.5}$ exposure with symptoms of cCD with a focus on neurodevelopmental delays. Hypothesis: Infants with cCD exposed to higher levels of heat and $PM_{2.5}$ will have lower APGAR scores and delays assessed by physical exam.

REFERENCES

Please see attached flyer or scan the QR code.

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