Health: Climate and Livable Cities
Scientific Session 2

What evidence exists on brain aging in a Livable City in Latin America?

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What evidence exists on brain aging in a Livable City in Latin America?

Given Latin America's aging population, the concept of a "livable city" clashes directly with the reality of our region.

Achieving sustainable, healthy brain aging in rapidly growing megacities such as São Paulo requires public policies that foster age-friendly environments, address social determinants of health, and sustain public education campaigns to mitigate individual risk factors. [1,2,3]

São Paulo, the largest financial center, experiences one of the highest aging growth rates. The elderly population grew by more than 50% over 12 years, and São Paulo has surpassed 2 million older adults. [4]

Although São Paulo incorporates the concepts of a "livable city" and urban resilience by aligning digital transformation, sustainability policies, and smart infrastructure to balance economic, social, and environmental development, much more work is needed in public health to make it a livable city for older adults.

1. CEPAL N. U., Aging in Latin America and the Caribbean: inclusion and rights of older persons.2022.
2. World Health Organization. National programmes for age-friendly cities and communities: a guide. 2023.
3.Greenwood-Hickman MA et al., J Aging Phys Act. 2022.

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What about public policies to create age-friendly environments that encourage healthy behaviors in São Paulo?

This challenging scenario calls for innovative research at multiple levels, offering new perspectives on how cities can adapt their infrastructure and healthcare (preventive care) to support the demographic shift toward older adults in Latin America and promote healthy aging.

Evidence from longitudinal cohorts in São Paulo offers crucial insights into how urban governance and healthcare systems must adapt to protect neurological health, especially given the city's rapid population aging.

What evidence exists on brain aging in a Livable City in Latin America?

Preliminary data from two projects funded by FAPESP on the following themes
(Climate, Sustainable Mobility, Inclusion and Accessibility) :

1. Urban environmental stressors and acute stroke risk (EMMA Study)

2. Cardiovascular health, lifestyle habits (LE8, mainly physical activity), and Cerebral Small Vessel Disease (ELSA-Brasil).

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FAPESPWeek NETHERLANDS
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CLIMATE AND HEALTH BRAIN IN SÃO PAULO EVIDENCE FROM...

EMMA

Estudo de mortalidade e morbidade do acidente vascular cerebral

Study of Stroke Mortality and Morbidity

2011-2020

What evidence exists on brain aging in a Livable City in Latin America?

Heatwaves, air pollution, and stroke risk in São Paulo, Brazil: a time-stratified case-crossover study in the Study of Stroke Mortality and Morbidity (EMMA) (preliminary data)

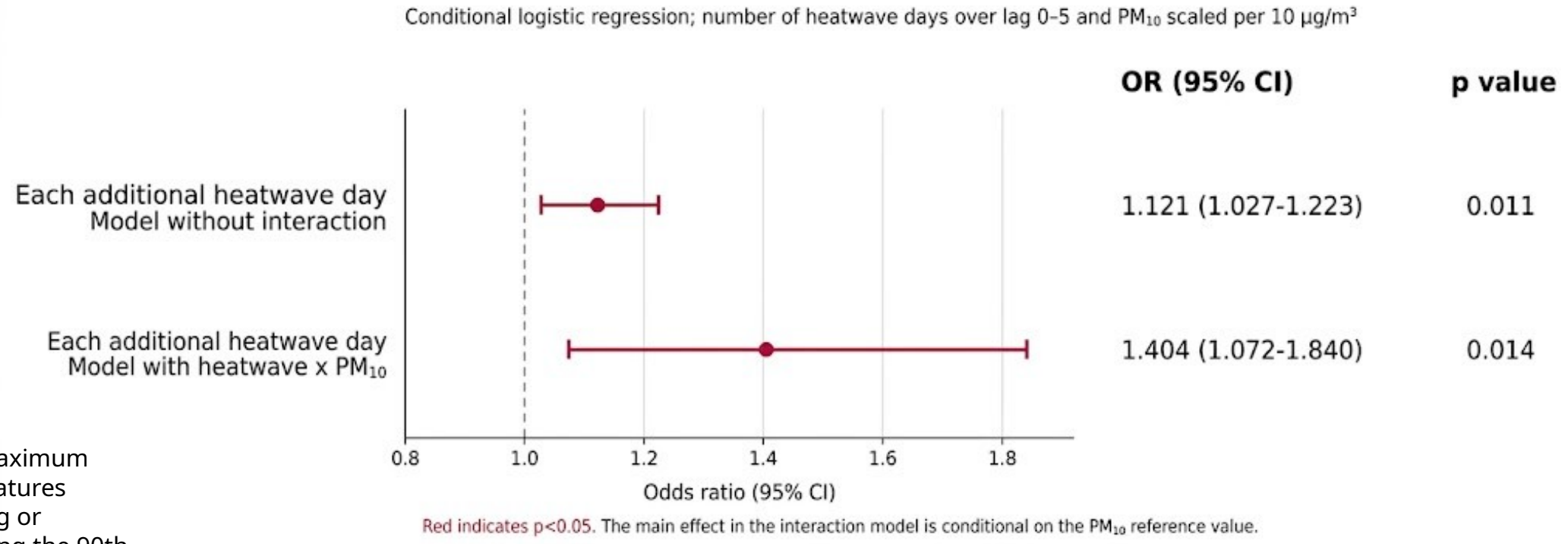
Climate change (heat waves) and air pollution are important urban environmental exposures that affect brain health. Particularly, heat exposure can cause dehydration, reduced plasma volume, haemoconcentration, increased blood viscosity, and changes in thermoregulation and cardiovascular function.[1,2]

1. Basu, 2009
2. Hajat and Kosatky, 2010

What evidence exists on brain aging in a Livable City in Latin America?

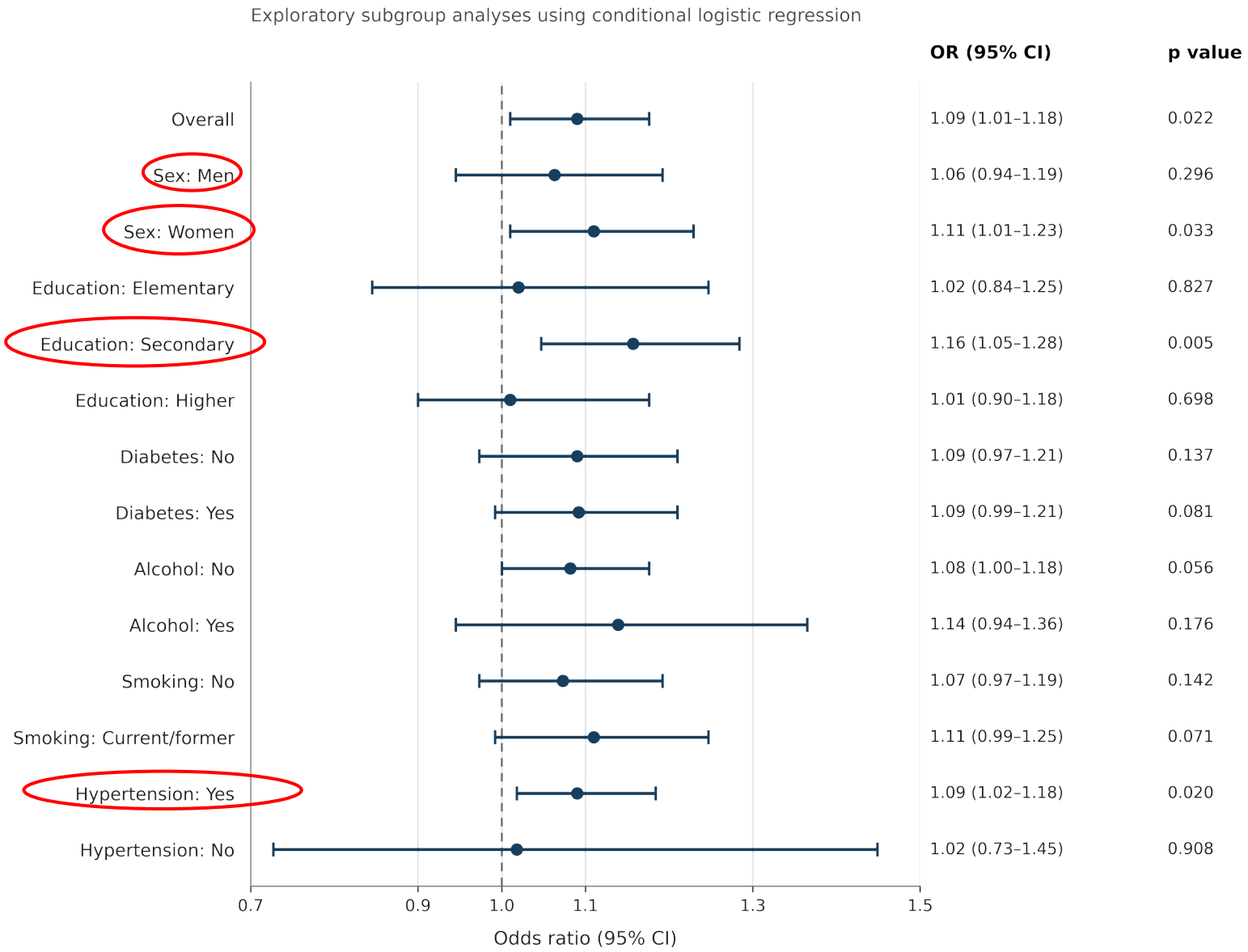
Cumulative heatwave exposure (Tmáx P90 = 33.10 °C*) and effect modification by PM_{10} and stroke incidence

Population: 769 stroke participants (54.2% women) aged 65 years or older (65.5%)



***two maximum temperatures reaching or exceeding the 90th percentile (33.10 °C) over at least 2 consecutive days**

Cumulative heatwave (Tmáx P90 = 33.10 °C) exposure lag 0-5 by subgroup



What evidence exists on brain aging in a Livable City in Latin America?

CARDIOVASCULAR HEALTH AND CEREBRAL SMALL VESSEL DISEASE IN SÃO PAULO

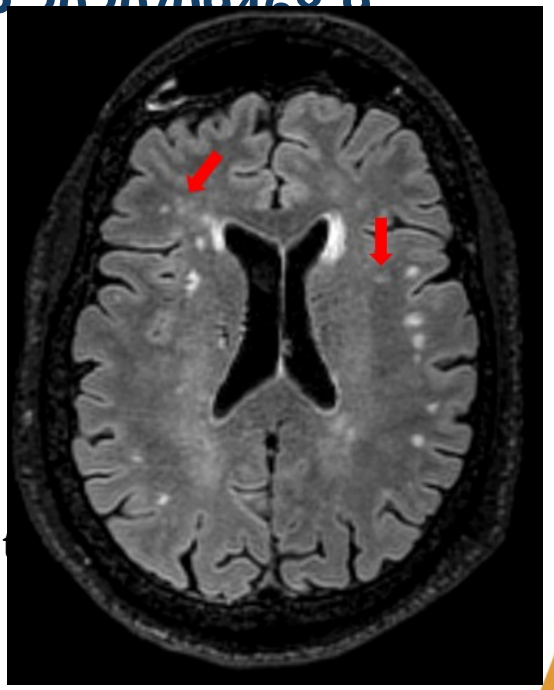
EVIDENCE FROM
The determinants of healthy brain aging in the Brazilian Longitudinal Study of Adult Health (ELSA-Brasil): Thematic project FAPESP 2020/09468-9



ELSA BRASIL

- High: ≥ 80 points
- Moderate: 50 to 79 points
- Low: < 50 points

White matter Hyperintensit
(WMH) in 3T MRI in ELSA participant



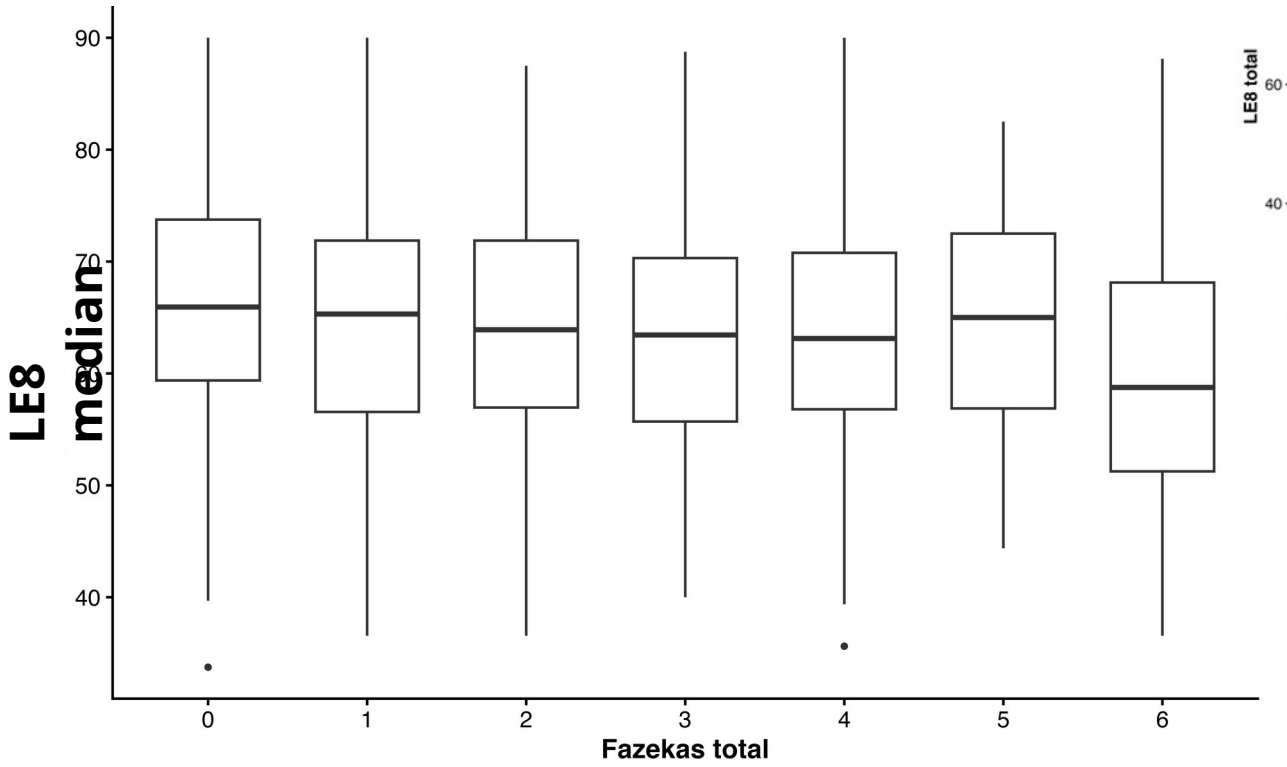
*** Fazekas score (0-6) ≥ 3**

What evidence exists on brain aging in a Livable City in Latin America?

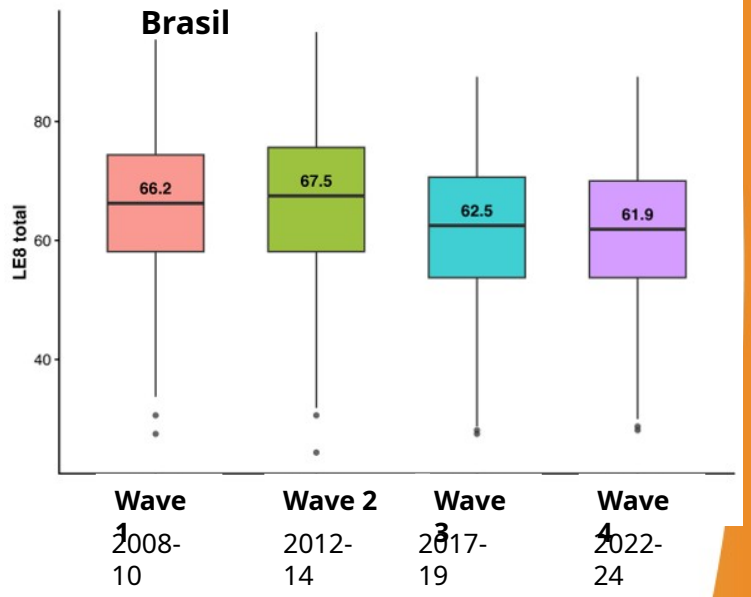
Relationship between “Life’s Essential 8 (LE8)” and cerebral small vessel disease in the ELSA-Brasil study (preliminary data)

Population: 1,285 ELSA participants (61.2% women aged 66 years (IQR: 60-85)

LE8 by Fazekas score (marker WMH)



LE8 across 4 waves in ELSA-Brasil

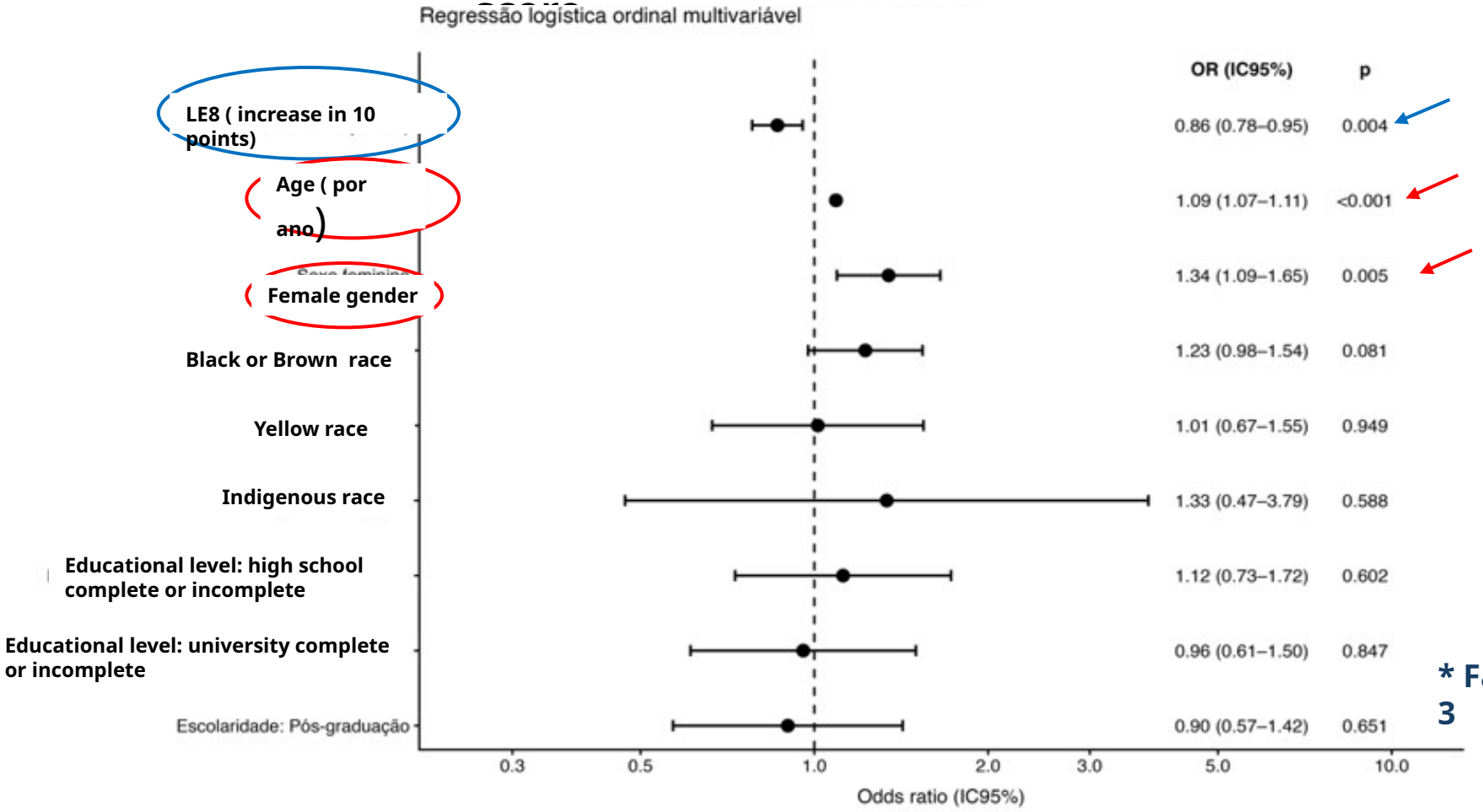


Overall, moderate cardiovascular health

What evidence exists on brain aging in a Livable City in Latin America?

More adherence to “Life’s Essential 8 (LE8)” metrics and higher reduction of cerebral small vessel disease* in the ELSA-Brasil study (preliminary data)

Risk factors associated with a higher Fazekas score



REDUCTION 14% in small vessel disease by Fazekas score

*** Fazekas score (0-6) ≥ 3**

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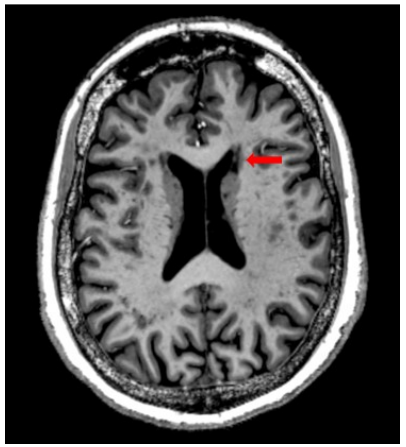
PHYSICAL ACTIVITY AND CEREBRAL SMALL VESSEL DISEASE IN SÃO PAULO

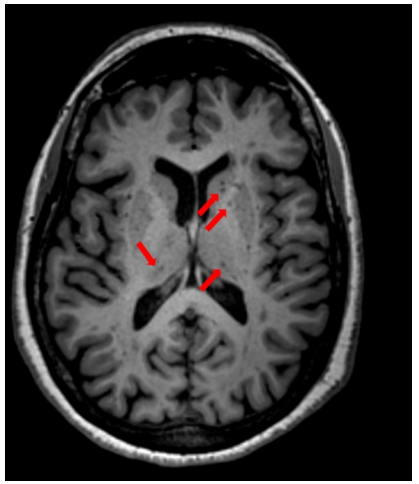
EVIDENCE FROM
The determinants of healthy brain aging in the Brazilian Longitudinal Study of Adult Health (ELSA-Brasil): Thematic project FAPESP 2020/09468-9



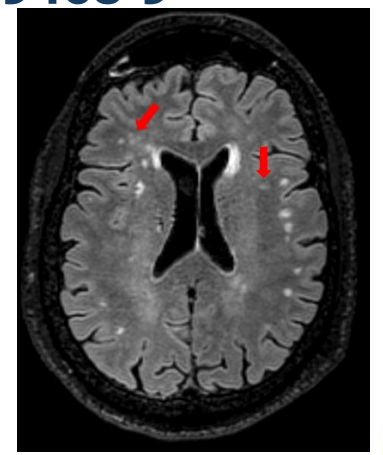
ELSA BRASIL



Ischemic lacunes
in 7T MRI



Perivascular space
in 3T MRI

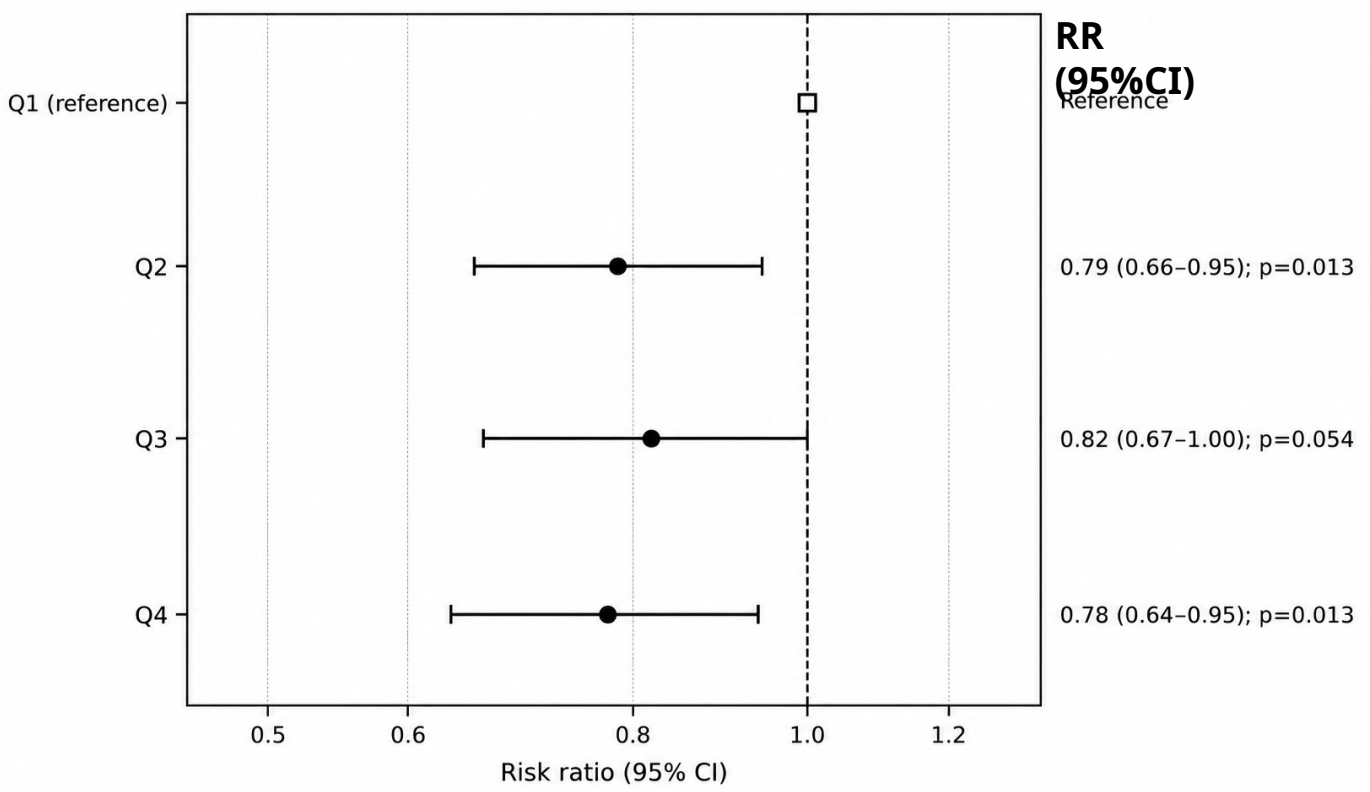


White matter
Hyperintensity
(WMH) in 3T MRI

What evidence exists on brain aging in a Livable City in Latin America?

Relationship between moderate-vigorous physical activity (actigraphy) wave 3 (2017-2019) and cerebral small vessel disease* (2023-ongoing) in the ELSA-Brasil study (preliminary data)

Population: 1,200 ELSA participants (59.2% women aged 66± 8.0 years (mean age, SD)



*** Cerebral small vessel diseases: at least ≥ 1 marker was considered: WMH Fazekas total score ≥ 3, lacunes (unilateral or bilateral), microhemorrhages/calcification (semioval center), enlarged perivascular space (Virchow-Robin ≥10).**

N = 1,200 participants. Adjusted for the effects of sex, age, race, per capita income, education, marital status, smoking, alcohol consumption, BMI , presence of diabetes, and arterial hypertension.

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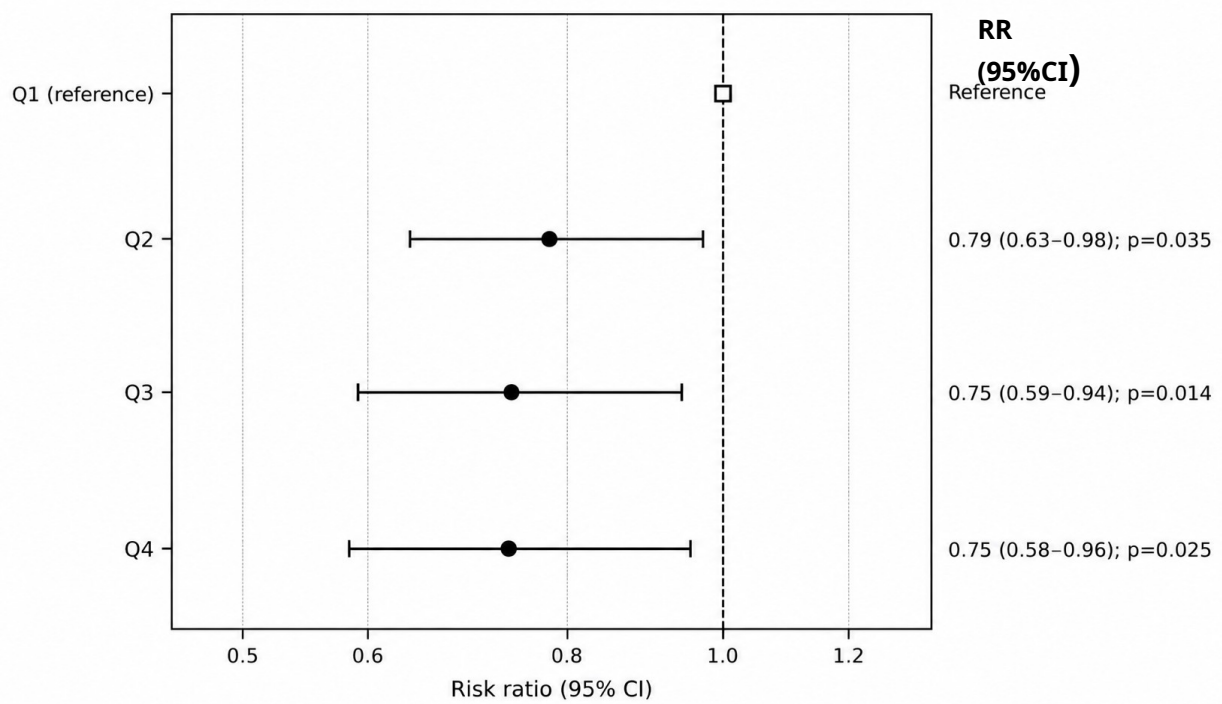
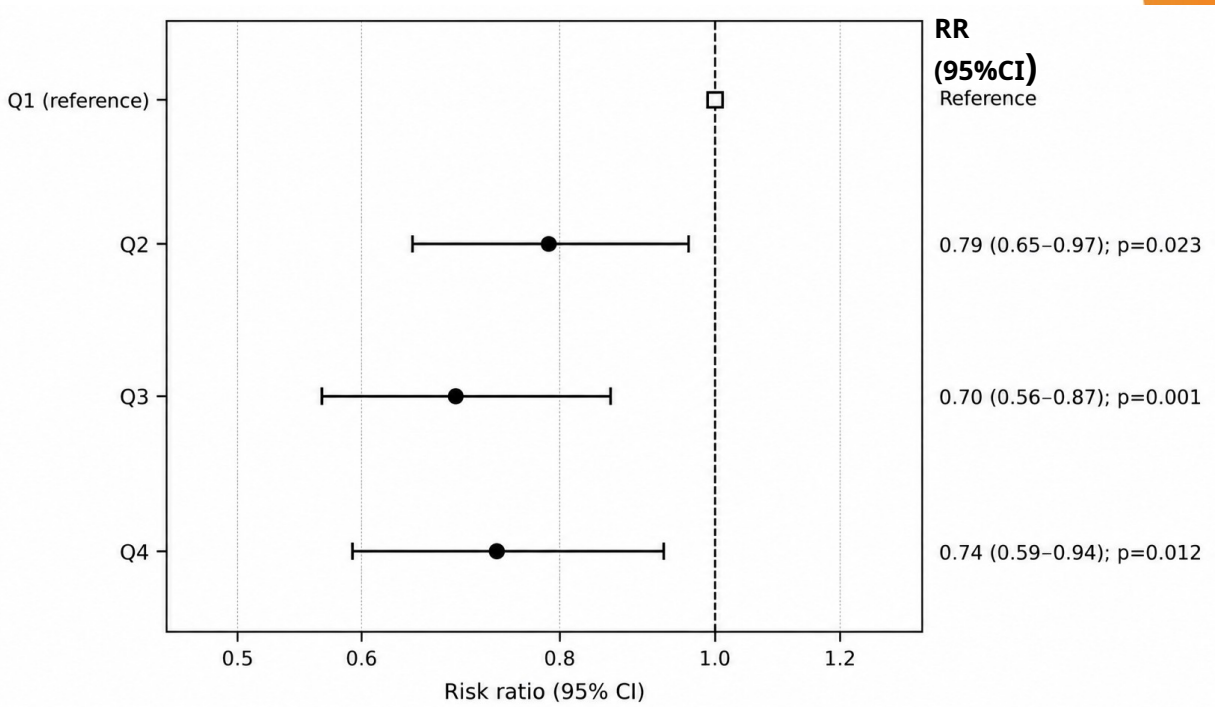
Relationship between moderate-vigorous physical activity (actigraphy) wave 3 (2017-2019) and entorhinal cortical atrophy scores (ERICA, 2023-ongoing) in the ELSA-Brasil study (preliminary data)

Left Hemisphere



Right Hemisphere



N = 1,200 participants. Adjusted for the effects of sex, age, race, per capita income, education, marital status, smoking, alcohol consumption, BMI , presence of diabetes, and arterial hypertension.

Conclusions

These findings suggest that protecting brain health and longevity in rapidly aging cities requires a dual strategy: promote individual health care and adapt urban climates.

Aligning urban policy with the UN Sustainable Development Goals (SDGs), particularly **SDG 3 (Good Health and Well-Being), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action**), is critical to fostering resilient, age-friendly environments that sustain cognitive health in later life.



Institutional support:

School of Public, Universidade de São Paulo: https://www.fsp.usp.br/site/







FAPESPWeek NETHERLANDS
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FAPESP SÃO PAULO RESEARCH FOUNDATION

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Institutional support:

Universiteit Leiden

200YEARS OF FRIENDSHIP Brazil – the Netherlands

EMBASSY OF BRAZIL THE HAGUE

Innovation Diplomacy Program