

WELCOME

AIR POLLUTION AND HEALTH IN LATIN
AMERICAN CITIES

WEBINAR

SEPTEMBER 9, 2020
11:00 AM ET



DREXEL UNIVERSITY
Urban Health
Collaborative
Dornsife School of Public Health

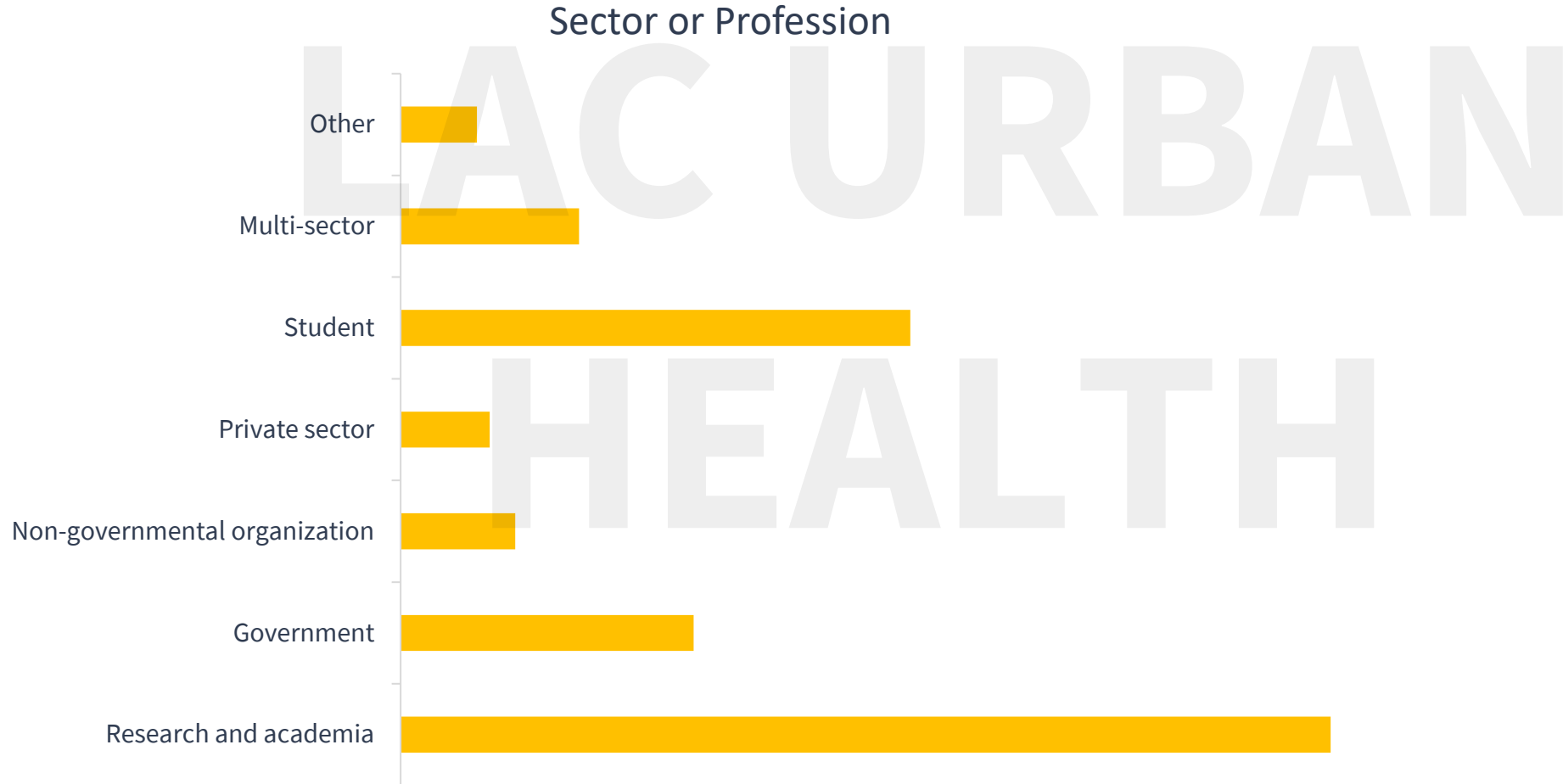
LAC-URBAN HEALTH
Urban Health Network for Latin America and the Caribbean



OUR AUDIENCE TODAY



OUR AUDIENCE TODAY



THE SALURBAL PROJECT

Salud Urbana en América Latina – Urban Health in Latin America

Drexel University, Philadelphia, Pennsylvania, USA

National University of Lanus, Buenos Aires, Argentina

Federal University of Minas Gerais, Belo Horizonte, Brazil

Universidade de Sao Paulo, Sao Paulo, Brazil

Oswaldo Cruz Foundation, Salvador Bahia, Brazil

Oswaldo Cruz Foundation, Rio de Janeiro, Brazil

Universidad de Chile, Santiago, Chile

Pontífica Universidad Católica de Chile, Santiago, Chile

Universidad de los Andes, Bogotá, Colombia

Instituto Nacional de Salud Pública, Mexico City, Mexico

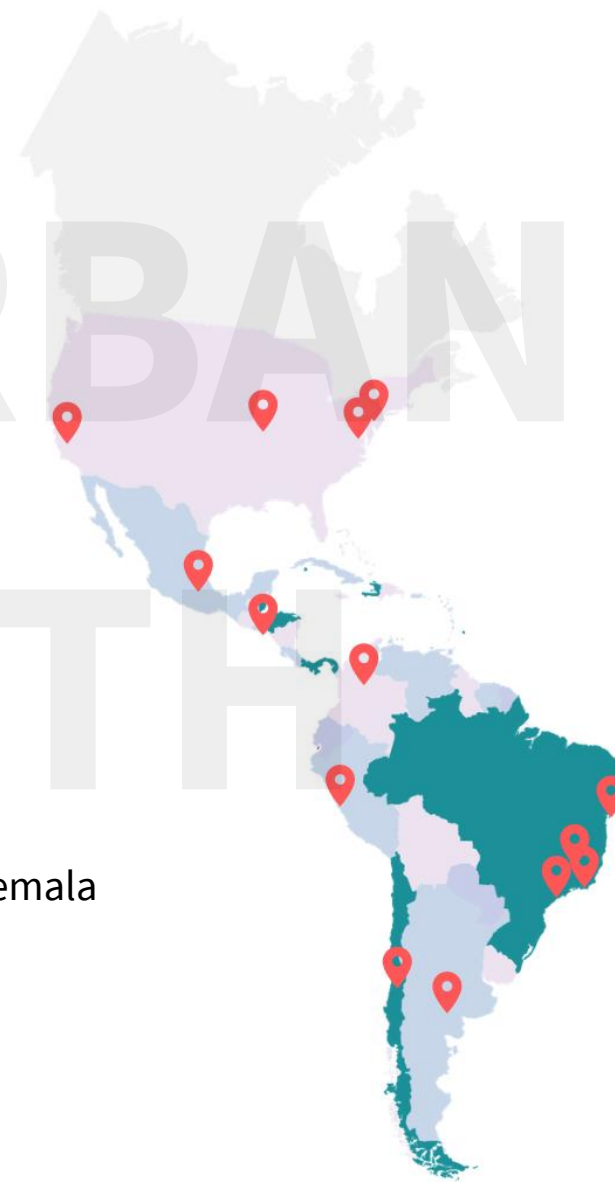
Universidad Peruana Cayetano Heredia, Lima, Peru

Institute of Nutrition of Central America and Panama (INCAP), Guatemala City, Guatemala

Pan American Health Organization, Washington, D.C., USA

University of California at Berkeley, Berkeley, California, USA

Washington University in St Louis, St Louis, Missouri, USA



SALURBAL'S RESEARCH

How do urban policies impact urban built and natural environments?

How do urban built and natural environments impact urban health outcomes, disparities, and factors related environmental sustainability?

How can cities act to improve health, reduce disparities, and support environmental sustainability?



SALURBAL DATA

- SALURBAL has compiled data for 371 cities of 100,000 people or more in 11 countries.
- This data has been linked to sub-city units and neighborhoods in these cities.

Health	Built Environments	Social Equity
<ul style="list-style-type: none"> • Deaths and causes of death • Life expectancy • Health risk factors • Health-related behaviors • Violence 	<ul style="list-style-type: none"> • Land use and urban form • Transit options • Traffic congestion • <u>Air pollution</u> • Walkability • Green space • Water and sanitation • Housing 	<ul style="list-style-type: none"> • Poverty • Income inequality • Housing conditions • Education • Employment



WEBINAR SPEAKERS



DR. NELSON GOUVEIA

Levels of air pollution and urban environment characteristics linked to higher levels of pollution in Latin American cities



DR. ANA ORTIGOZA

Air pollution and infant and child mortality in Latin American cities



DR. JOSIAH KEPHART

COVID-19, air pollution, and environmental health inequities in Latin American cities



AIR POLLUTION (PM_{2.5}) IN LATIN AMERICAN CITIES:

LEVELS, POPULATION EXPOSURE, INEQUALITIES, AND ASSOCIATED CITY CHARACTERISTICS

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University of São
Paulo Medical
School



AIR POLLUTION

One important type of air pollution is **particulate matter (PM)**, some smaller than 2.5 micrometers in width, which can go deep into the lungs when breathed in.

PM 2.5
Soot or smoke

PM 10
Dust, pollen

PM 50-70
Human hair

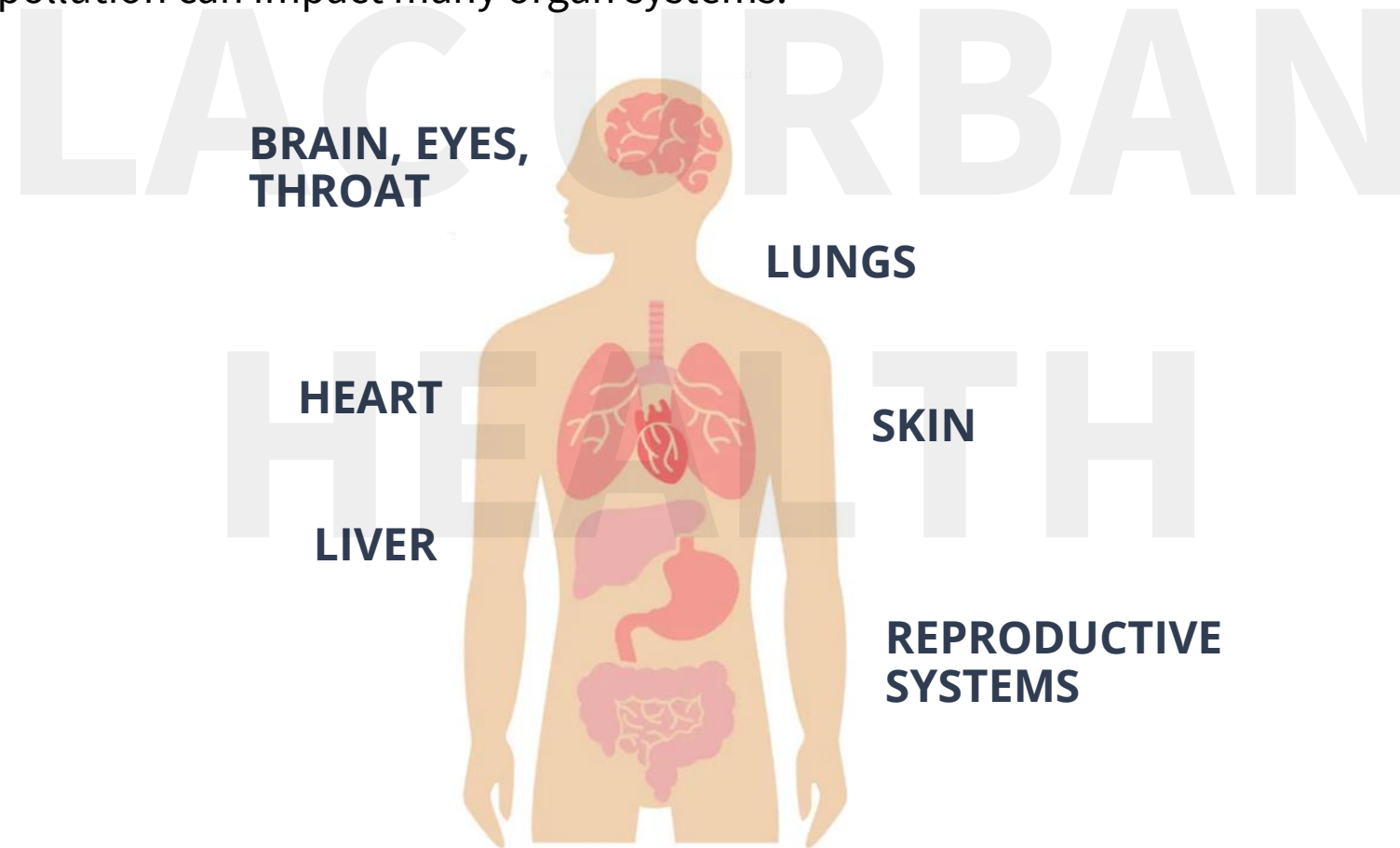
PM 90
Fine beach sand

Sources of particulate matter air pollution:

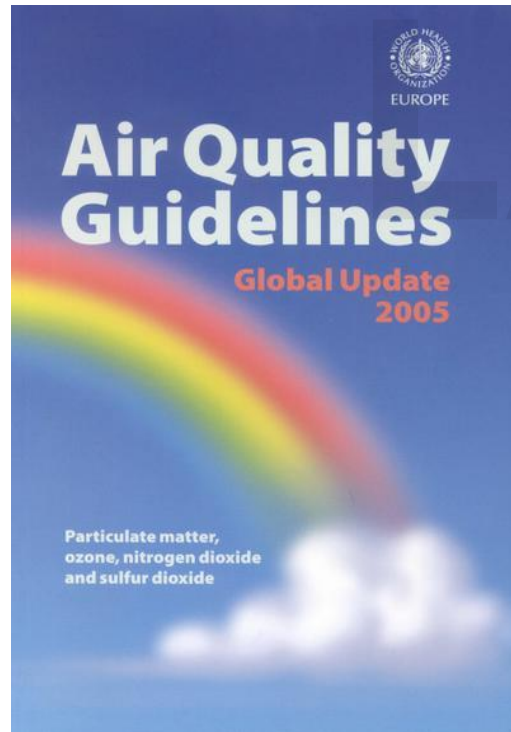


HOW DOES AIR POLLUTION AFFECT THE HUMAN BODY?

Breathing in air pollution can impact many organ systems:

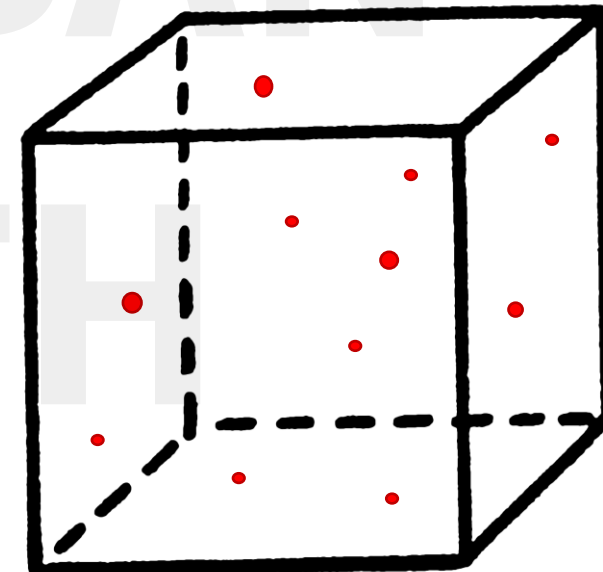


WORLD HEALTH ORGANIZATION AIR QUALITY GUIDELINES



The World Health Organizations recommend that air pollution levels be maintained below a certain threshold to prevent negative health outcomes:

	Maximum number of micrograms of pollutant per cubic meter of air on average during the course of 1 year
PM_{2.5}	10 micrograms per m³



UNHEALTHY LEVELS OF AIR POLLUTION



GLOBALLY



LATIN AMERICA

PEOPLE EXPOSED TO
UNHEALTHY LEVELS
OF AIR POLLUTION

9 out of 10
people

Over 110
million people

DEATHS PER YEAR
ATTRIBUTABLE TO
UNHEALTHY LEVELS OF
AIR POLLUTION

4.2 million
deaths

58,000
deaths



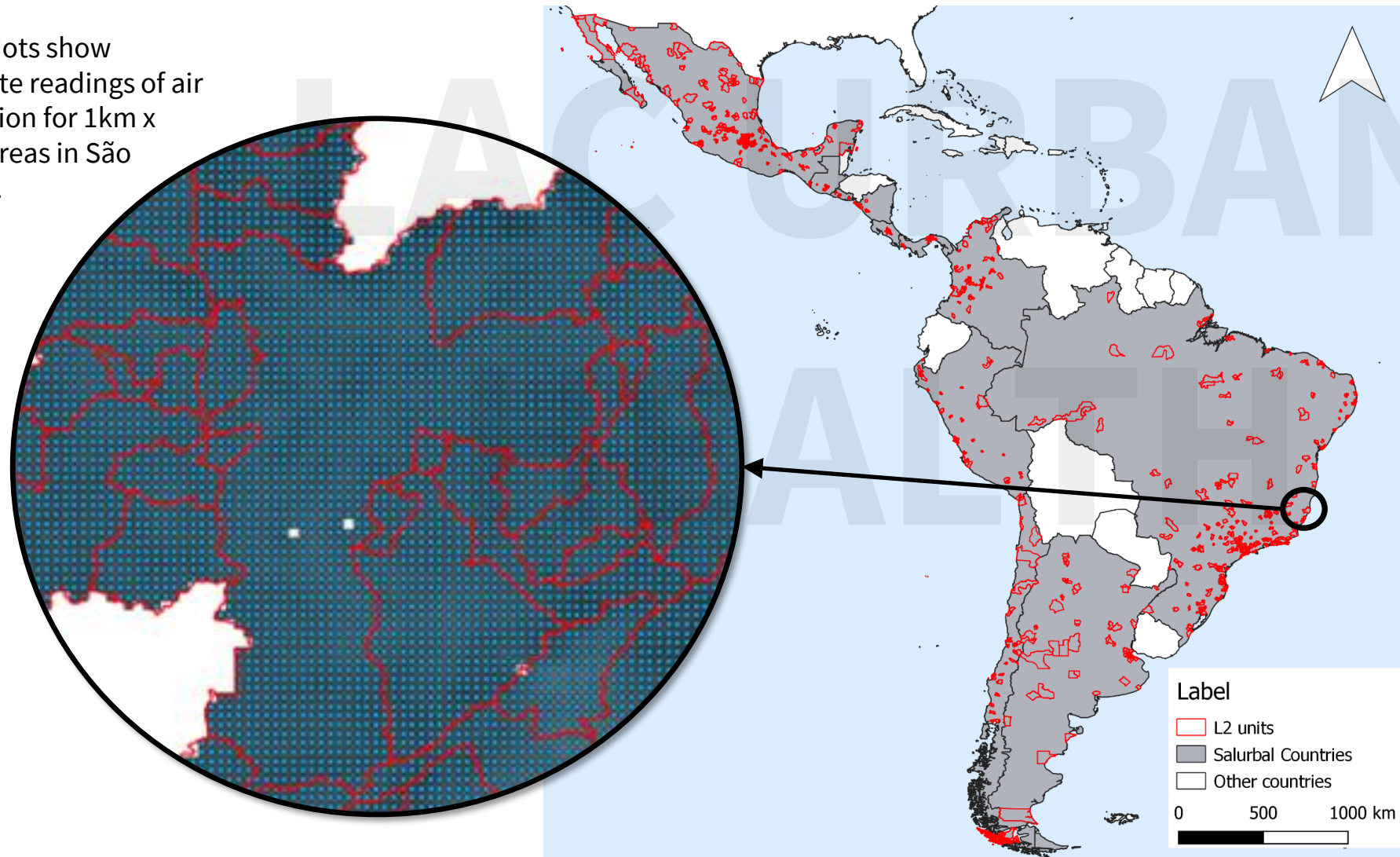
SALURBAL'S RESEARCH QUESTIONS: AIR POLLUTION IN LATIN AMERICAN CITIES

- **What are the levels of air pollution** in Latin American cities?
- Are air pollution levels in Latin American cities **meeting the WHO's air quality guidelines**?
- Are **characteristics of cities** linked to their air pollution levels?

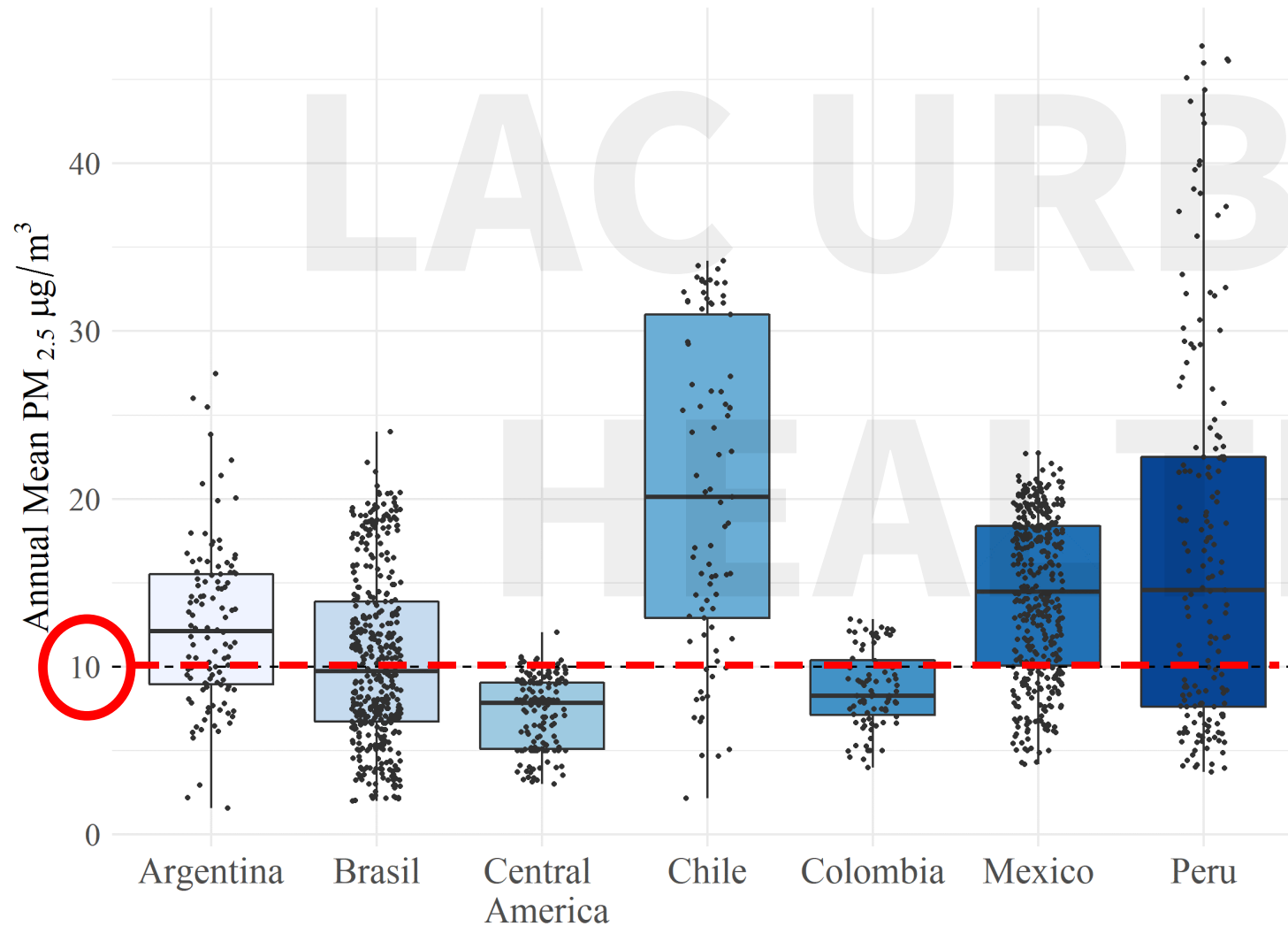


AIR POLLUTION DATA FROM SATELLITE READINGS (2015)

Blue dots show satellite readings of air pollution for 1km x 1km areas in São Paulo.



LEVELS OF PM_{2.5} IN LATIN AMERICAN CITIES IN 2015



- Each dot represents one sub-city.
- Air pollution levels vary greatly across different cities within each country, and across countries.
- Almost 40% of cities and 55% of sub-cities experience air pollution levels above the WHO's air quality guideline of 10 micrograms per cubic meter of air.



AIR POLLUTION EXPOSURE

Exposed to unhealthy levels of air pollution:

- 38.5% of cities
- 55% of sub-cities
- 171.1 million people total
- 12.3 million children ages under 5 years of age
- 14.1 million adults over age 65

Country	Proportion of urban population exposed to unhealthy levels of air pollution
Argentina	71% (21,227,417 people)
Brazil	53% (62,236,144 people)
Central America	10% (1,139,304 people)
Chile	86% (10,968,452 people)
Colombia	38% (10,965,939 people)
Mexico	67% (51,444,741 people)
Peru	74% (13,160,574 people)



INEQUITIES IN AIR POLLUTION EXPOSURE

- No difference by gender
- No difference by socioeconomic status
- In Argentina, Brazil, Chile, Mexico, and Peru: the **elderly** are more exposed to unhealthy levels of air pollution
- In Colombia and Central America, the **younger population** is more exposed to unhealthy levels of air pollution



CITY CHARACTERISTICS AND AIR POLLUTION LEVELS

- Larger cities
- **Higher per capita gross domestic product**
- Higher motorization rate
- Higher traffic congestion
- **Higher street intersection density**

HIGHER POLLUTION



- **Higher population density**
- More green space
- Presence of mass transit

LOWER POLLUTION

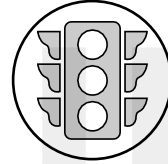


POLICY IMPLICATIONS: WHAT CAN CITIES DO?



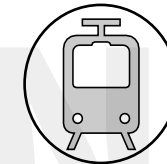
Green spaces

Urban gardens
Tree lines
Superblocks



Traffic congestion

Unique lanes for public transport
Bike lanes
Pedestrian paths
Street improvements



Mass Transit

Network expansion
Accessible & affordable public transportation
Public safety

Better air quality monitoring

Environmental protection policies
at national levels



EFFECT OF AIR POLLUTION ON UNDER-5 MORTALITY IN LATIN AMERICAN CITIES



Ana Ortigoza

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WHY IS THIS IMPORTANT IN LATIN AMERICA?

- Almost 10% of the population in Latin America is under five years of age.
- More than 80% of Latin Americans live in cities, where air pollution levels are among the highest in the world
- Limited evidence on the effect of air pollution on infant and child health in the region, especially in small and medium-sized cities.



CHILDREN ARE MORE VULNERABLE TO AIR POLLUTION



- Immature airways and lungs



- Immature kidneys and liver less ability to filter toxins



- High breathe rate



- Mouth breathing



- Lots of time outside



RESEARCH QUESTIONS

- Are increases in air pollution (PM2.5) over time linked with mortality among children under 5 years of age?
- Is this association different for infants (less than one year) compared to young children (1-4 years)?
- What are the potential actions at the local level that could be motivated by our research findings?



TECHNICAL NOTES

Setting

- 337 cities in Argentina, Brazil, Chile, Colombia, Costa Rica, Guatemala, and Mexico
- 1,152 sub-city units in these cities
- Study period 2010 -2015

Air pollution exposure

- Average annual levels of air pollution (micrograms of PM2.5 per cubic meter of air) for each sub-city unit

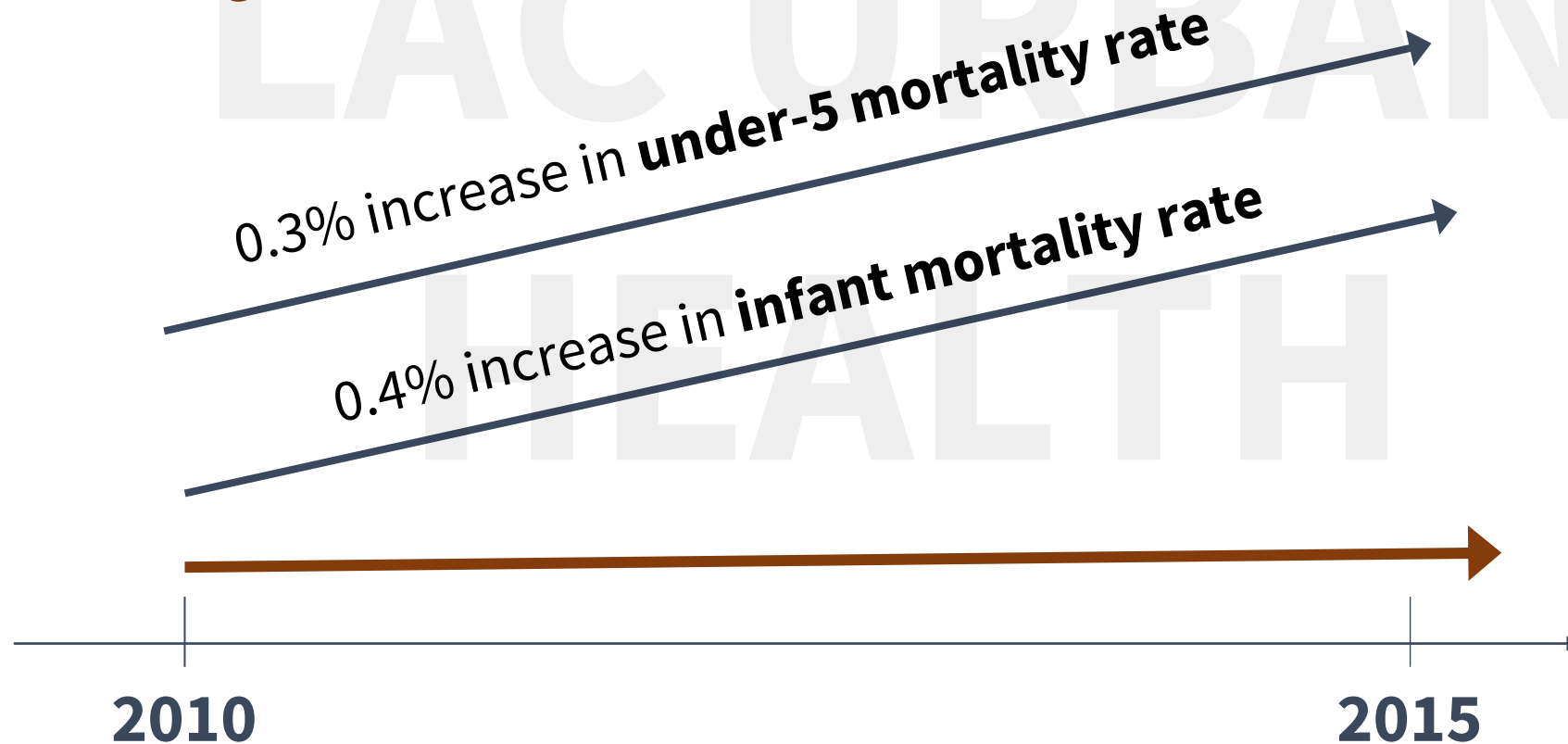
Outcomes

- **Under 5** mortality rate: Number of deaths before the fifth year of life for every 1,000 live births
- **Infant** mortality rate: Number of deaths during the first year of life for every 1,000 live births
- **Child** mortality rate: Number of deaths of children between 1-4 years of age per 10,000 children in that age group



INCREASES IN AIR POLLUTION OVER TIME ARE ASSOCIATED WITH INCREASES IN UNDER-5 AND INFANT MORTALITY IN LATIN AMERICAN CITIES

Each increase in 1 $\mu\text{gr}/\text{m}^3$ in PM_{2.5} is linked to:



If cities with the lowest levels of air pollution in our sample ($4.5 \mu\text{g}/\text{m}^3$) became similar to those at the highest levels ($24.0 \mu\text{g}/\text{m}^3$) we would observe

Under-five mortality

- ~ 6% increase in U5MR
- **9.4** additional deaths per 1,000 live births to the mean U5MR (15.7 deaths/ 1,000 live births)

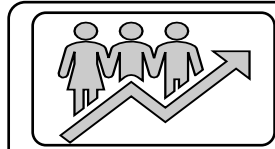
Infant mortality

- ~ 8% increase in IMR
- **10.8** additional death per 1,000 live births to the mean IMR (13.6 deaths/ 1,000 live births)

Note: $4.5 \mu\text{g}/\text{m}^3$ corresponds to the 5th percentile and $24 \mu\text{g}/\text{m}^3$ corresponds to the 95th percentile of sub-city level exposure that we observed

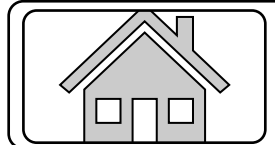


THESE ASSOCIATIONS OVER TIME ARE INDEPENDENT OF THESE OTHER URBAN CHARACTERISTICS



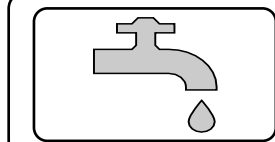
Population size and growth

City population size 2010-2015



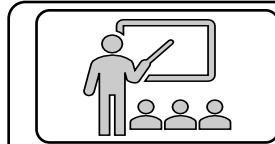
Housing and living conditions

- % households with piped water in the house
- % of households with overcrowding conditions (3+/room)
- % population 15-17 age attending school



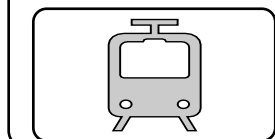
Service provision

- % of households with water connected to municipal network
- % of households with sewage system connected to municipal network



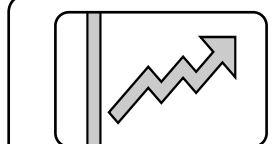
Population education

- % population 25+≥ high school level
- % population 25+≥ university level



Mass transit availability

Presence of either subway or bus rapid transit (BRT) networks



GDP per capita

Yearly Gross Domestic Product per capita for each city

CONCLUSIONS

Increases in air pollution (PM_{2.5}) are associated with increased under-5 mortality



Infant population most vulnerable to effects of PM_{2.5} exposure



Urban interventions along with environmental protection and air quality policies are key to reduce preventable deaths among infants and children



COVID-19 AND AIR POLLUTION IN LATIN AMERICAN CITIES

Josiah Kephart

Twitter: @JLASHK

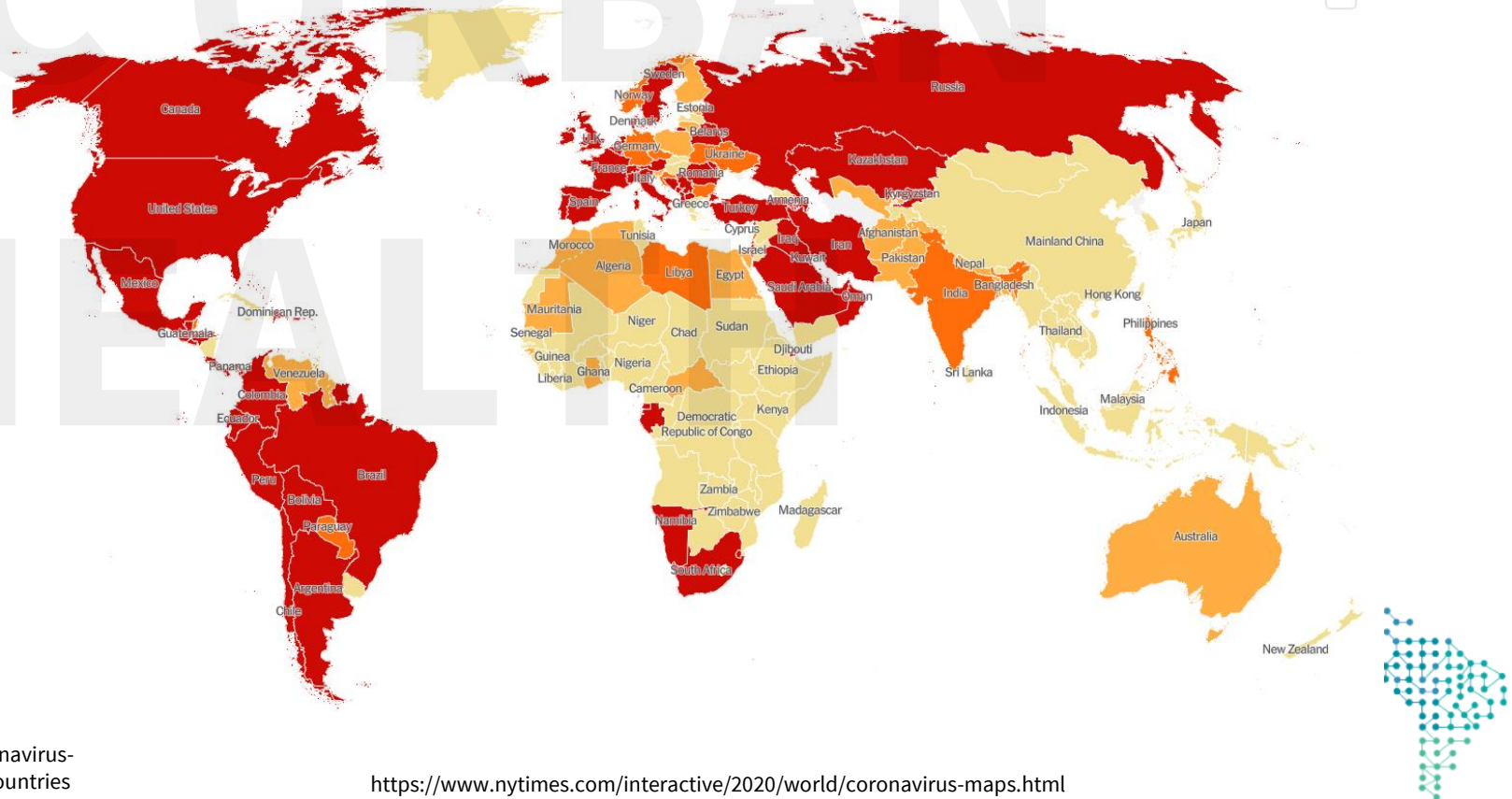
Post-Doctoral Research Fellow, SALURBAL



LATIN AMERICA IS THE GLOBAL EPICENTER OF COVID-19

Share of population with confirmed COVID-19 case

- 7 of the top 20 countries with highest % of the population with a confirmed COVID-19 case are in Latin America and the Caribbean
- Within last 7 days, 10 of top 20 countries are in Latin American and the Caribbean

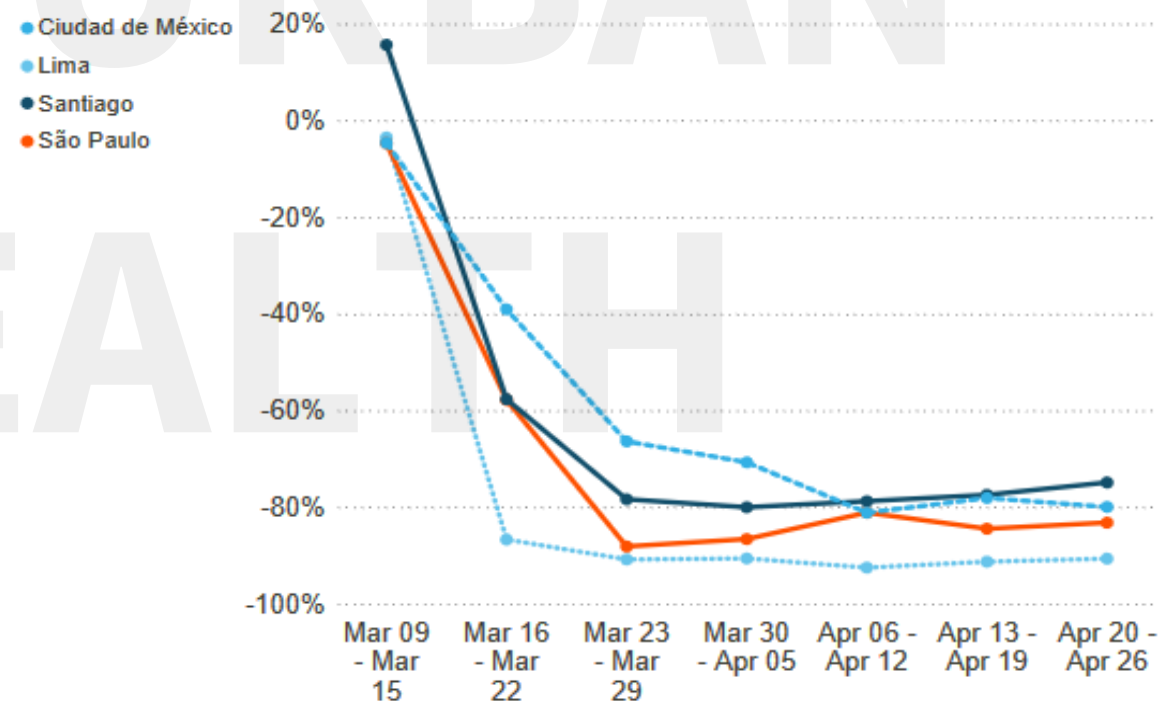


COVID-19 RESTRICTIONS HAVE LED TO SHARP TRAFFIC REDUCTIONS

Many countries and cities in Latin America have implemented “lockdowns” and/or stay-at-home orders to slow the spread of COVID-19

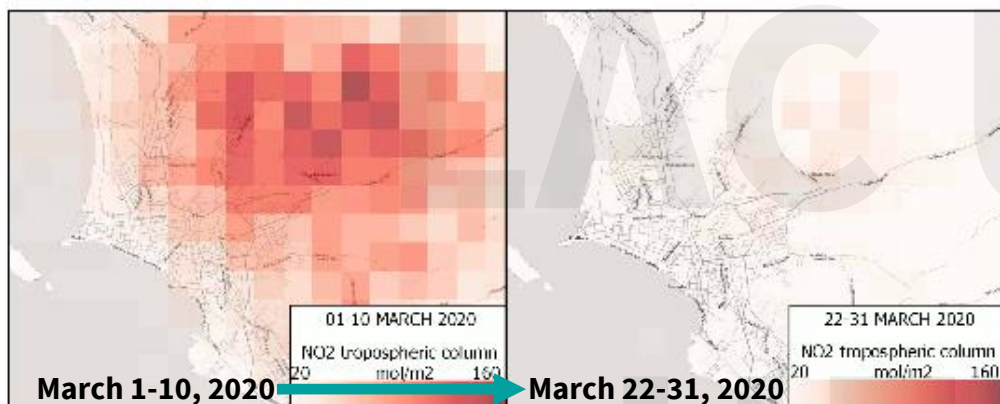


Reductions in traffic congestion in four Latin American cities, compared to pre-lockdown levels

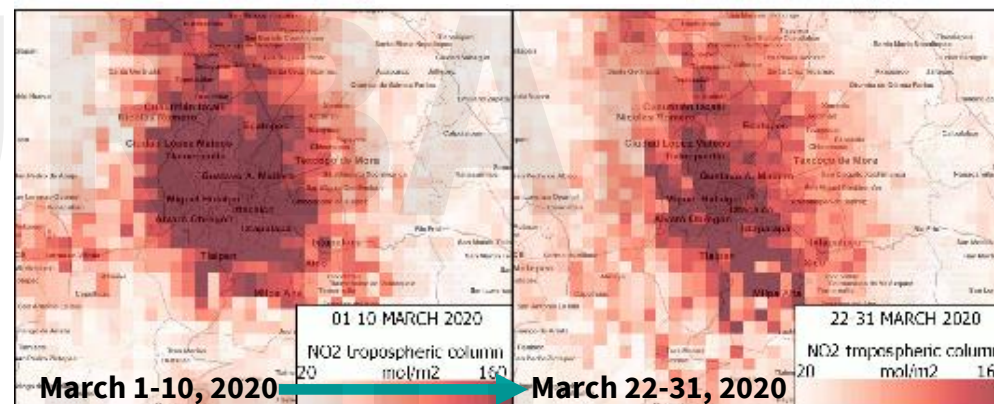


AIR POLLUTION HAS DROPPED DURING COVID-19 RESTRICTIONS

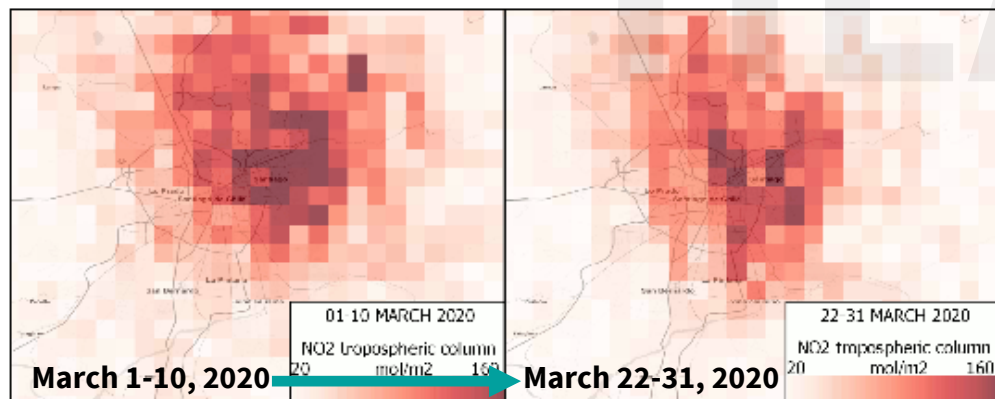
LIMA, PERU



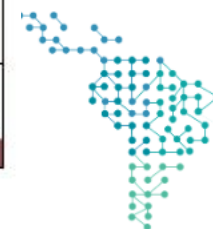
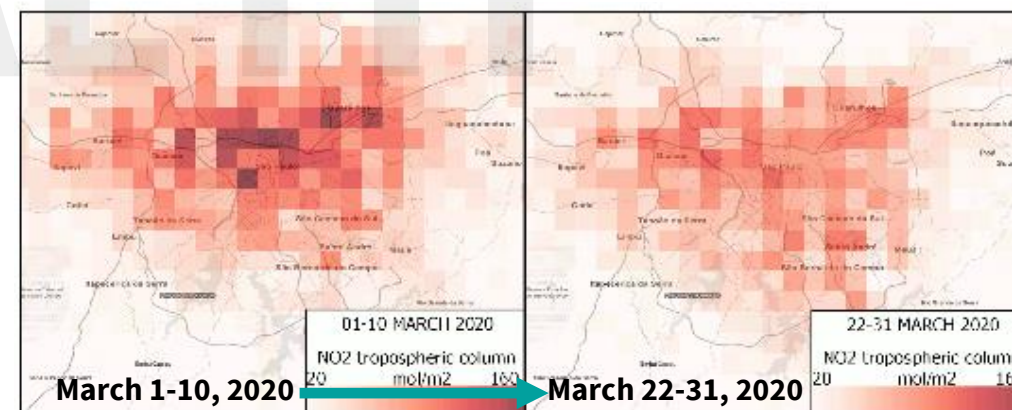
MEXICO CITY



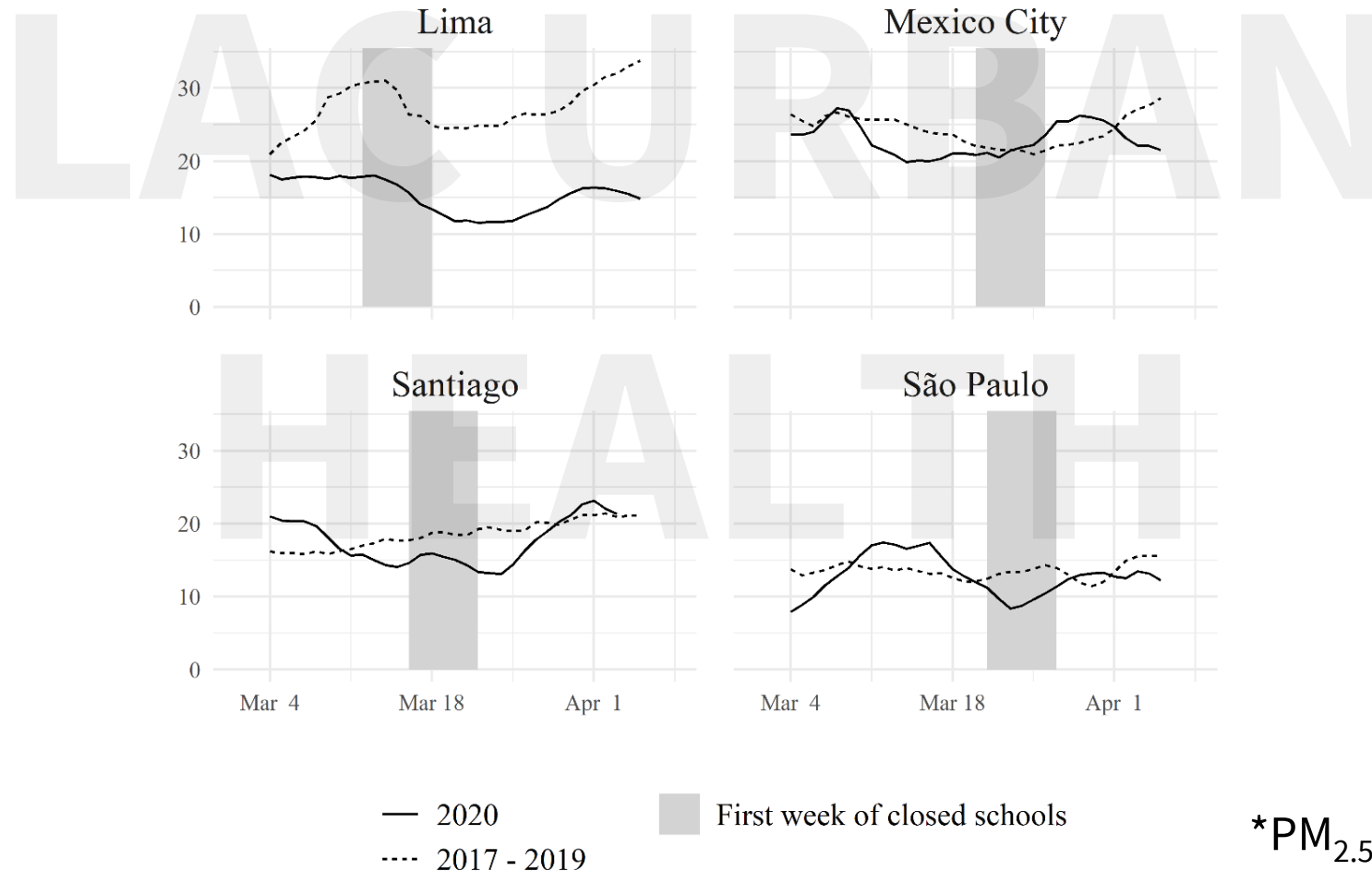
SANTIAGO, CHILE



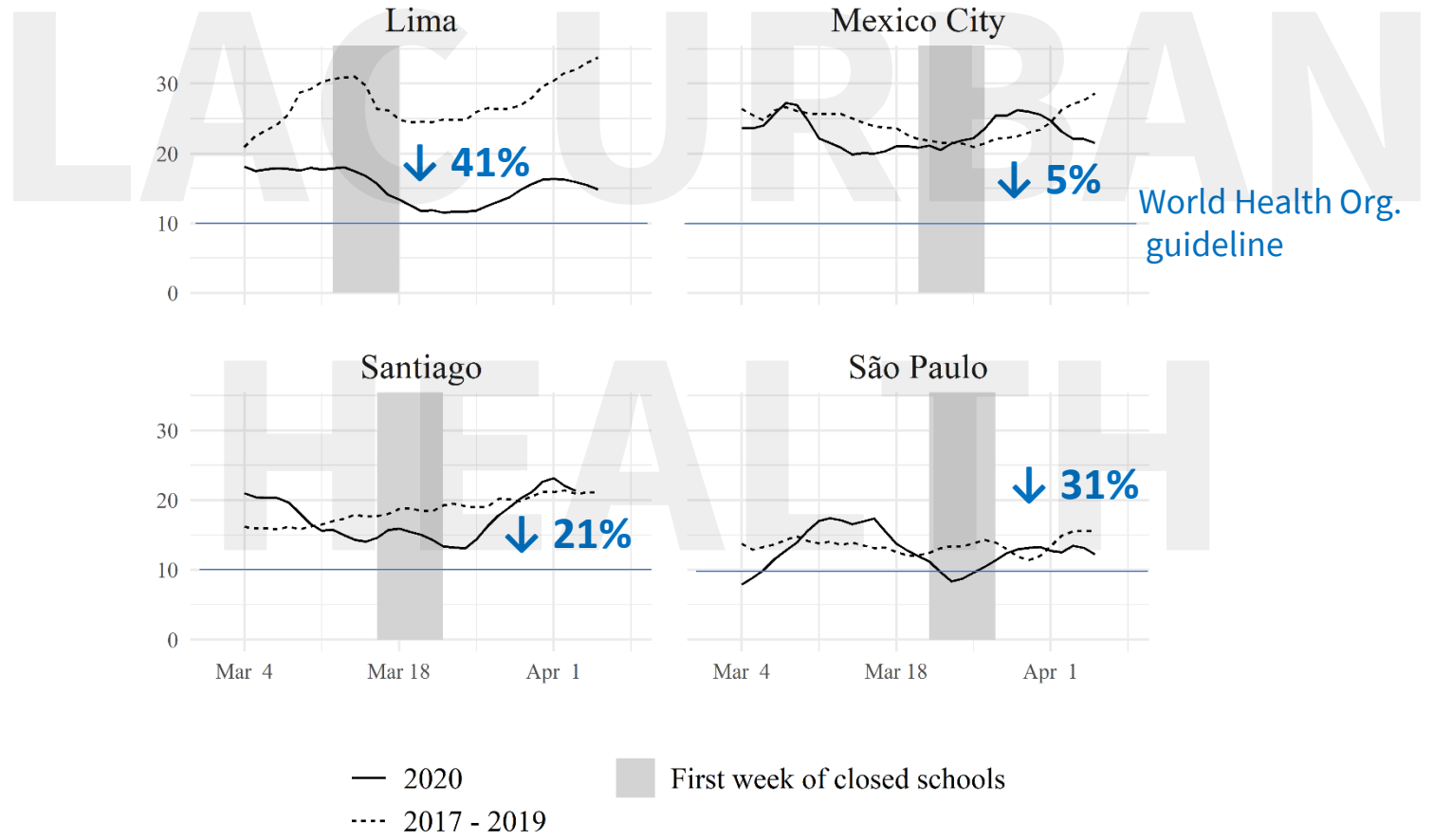
SÃO PAULO, BRAZIL



WE COMPARED AIR POLLUTION* LEVELS DURING COVID-19 LOCKDOWNS WITH PREVIOUS YEARS



SOME CITIES HAD MAJOR REDUCTIONS IN AIR POLLUTION COMPARED TO PREVIOUS YEARS, WHICH BROUGHT LEVELS MUCH CLOSER TO GUIDELINES



WHY DOES THIS MATTER?

- Pervasive pessimism about reducing air pollution
 - “Nothing we can do about climate, geography, etc.”
- COVID-19 lockdown reductions are unintended
- Long-term goal is efficient, targeted policies that reduce air pollution while:
 - Prioritizing equity
 - Limiting economic cost
- **Are real-life air pollution reductions in 2020 enough to impact public health?**



HYPOTHETICAL SCENARIO: AIR POLLUTION IS REDUCED LONG-TERM

- How would deaths in each city change if current reductions of a major air pollutant (PM_{2.5}) were maintained long-term?
 - Assuming...
 - No changes in other air pollutants (outdoor or indoor)
 - Only looking at adults aged 30+ years
 - Deaths from any cause

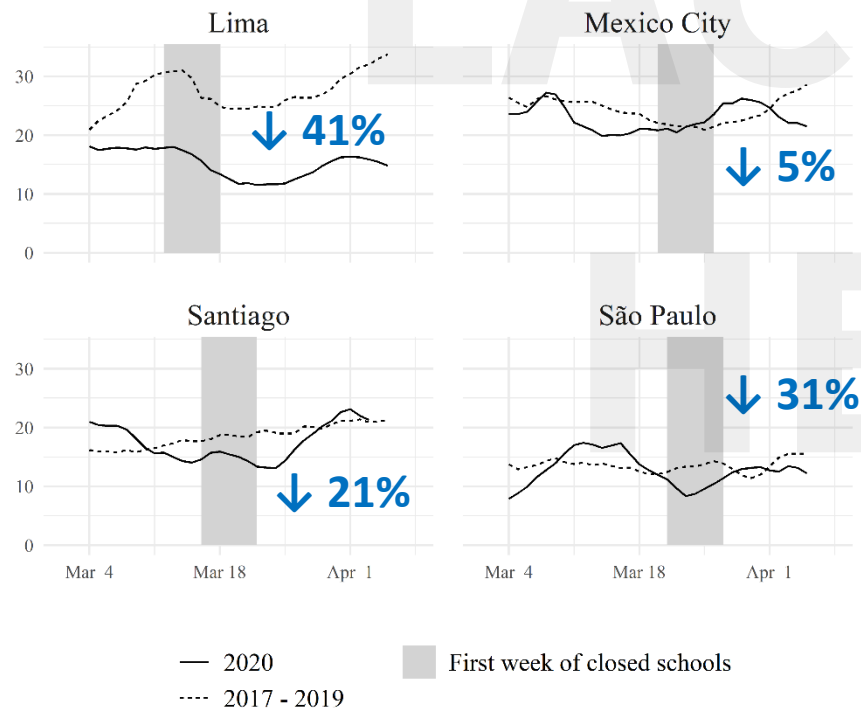


<https://cdn.citylab.com/media/img/citylab/2017/05/mexicocity/original.jpg>



REDUCING AIR POLLUTION COULD LEAD TO LARGE REDUCTIONS IN DEATH

Air pollution reductions during COVID-19



City	Change in death rate per year	Fewer deaths per year
Lima	↓ 7%	↓ 2,522
Mexico City	↓ 0.6%	↓ 730
Santiago	↓ 3%	↓ 930
Sao Paulo	↓ 3%	↓ 3,573



CRUCIAL OPPORTUNITY TO RETHINK LONG-TERM AIR POLLUTION

- Current levels of ambient air pollution cause 145,000 non-Covid-19 deaths in Latin America and the Caribbean every year
- May get worse with a return to car-based transit
- Covid-19 reopening: critical opportunity for policies and structural changes which reduce air pollution, prevent chronic diseases, and promote health equity



https://upload.wikimedia.org/wikipedia/commons/4/4f/Guatemala_City_%28663%29.jpg



Q&A

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