Conducting air pollution and health studies in Colombia: Experience with local and global collaborations

HEI Annual Conference 2023 Panel
"Exploring the Link Between Air Pollution and Health in High Pollution Environments: Insights from Recent Research Studies"

Laura Andrea Rodríguez, MD, PhD
Department of Public Health - School of Medicine
Universidad Industrial de Santander
Bucaramanga, Colombia

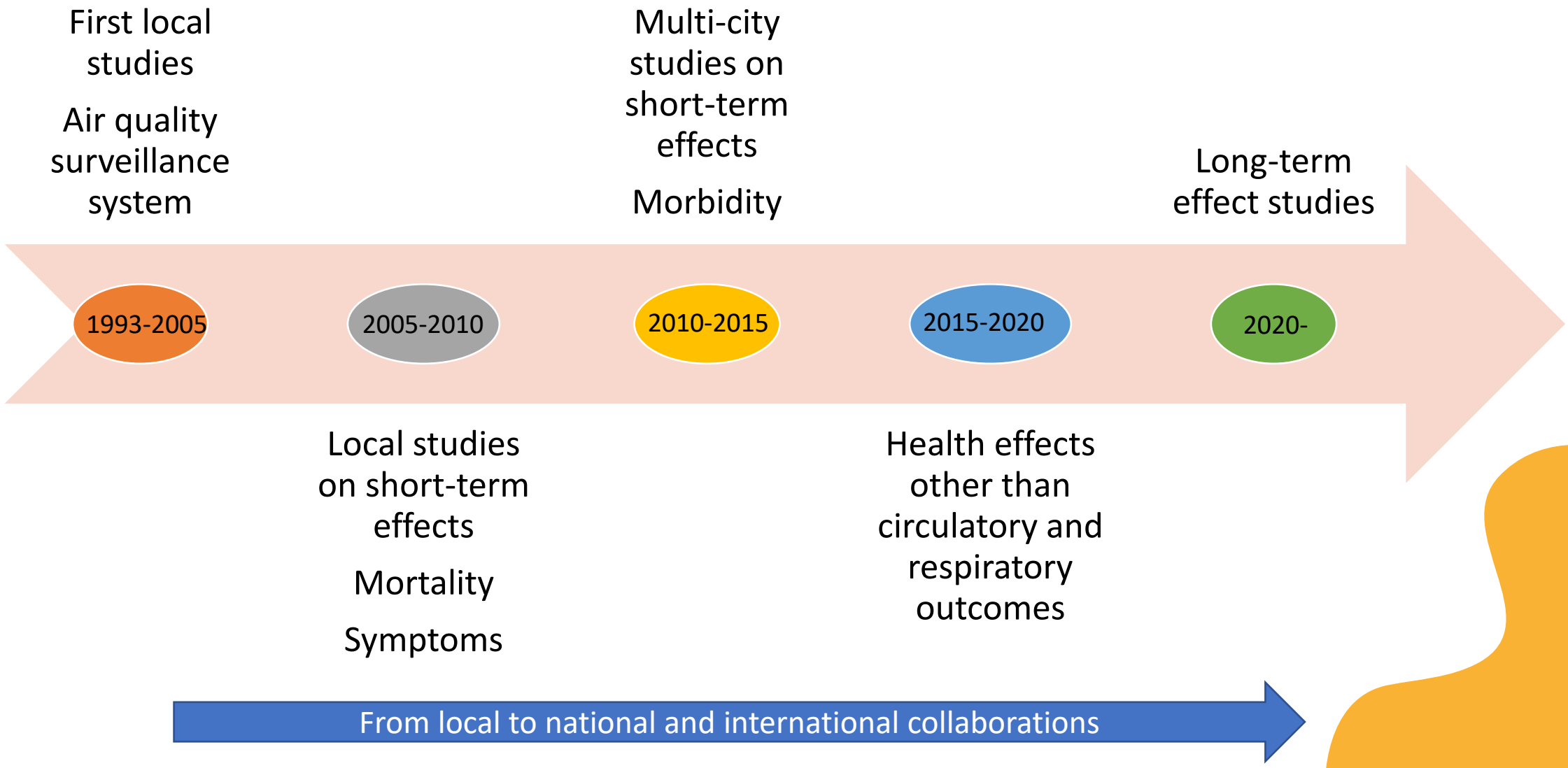
Universidad Industrial de Santander

Boston, May 2 2023

Outline

- ✓ Overview of the research work on air pollution and health in Colombia
- ✓ Key findings and policy applications
- ✓ From local to international collaborations
- ✓ Challenges, opportunities and lessons learnt
- ✓ Expectations and future work

Overview of the research work on air pollution and health in Colombia



Contents

- ✓ Overview of the research work on air pollution and health in Colombia
- ✓ Key findings and policy applications
- ✓ From local to international collaborations
- ✓ Challenges, opportunities and lessons learnt
- ✓ Expectations and future work

Local studies in cities

ARTÍCULO ORIGINAL

Effect of particulate matter less than 10μm (PM_{10}) on mortality in Bogota, Colombia: a time-series analysis, 1998-2006

Luis Camilo Blanco-Becerra, MC,[1] Víctor Miranda-Soberanis, MC,[2] Leticia Hernández-Cadena, DC,[2] Albino Barraza-Villarreal, DC,[2] Washington Junger, DC,[3] Magali Hurtado-Díaz, MC,[2] Isabelle Romieu MD, MPH, ScD.[2]

Supported by researchers from HEI-ESCALA Study

Factores de riesgo para enfermedad respiratoria en población de 5 a 14 años de una Localidad de Bogotá, 2012-2013

Respiratory disease risk factors in the 5-14 year-old population in an area of Bogota, 2012-2013

Natalia Rodríguez-Moreno[1], Viviana Martínez-Morales[2] Rodrigo Sarmiento-Suarez[1], Katalina Medina-Palacios[1] y Luis J. Hernández[3]

Contaminación por material particulado ($PM_{2,5}$ y PM_{10}) y consultas por enfermedades respiratorias en Medellín (2008-2009)

Particulate air pollution ($PM_{2.5}$ and PM_{10}) and medical consultations due to respiratory disease in Medellín (2008-2009)

Carlos F. Gaviria G[1]; Paula C. Benavides C[2]; Carolina A. Tangarife[3].

Incidencia de síntomas respiratorios y su asociación con contaminación atmosférica en preescolares: un análisis multinivel

Incidence of respiratory symptoms and the association with air pollution in preschoolers: a multilevel analysis

Laura Andrea Rodríguez Villamizar [1,2]
Astrid Berena Herrera López [2]
Henry Castro Ortiz [3]
Jurg Niederbacher Velázquez [2,4]
Lina María Vera Cala [2]

Policy application: local evidence to inform national air quality standards (air quality regulation 2010 updated in 2017)

National studies on short-term effects

Multi-city studies on short-term effects - Morbidity

Environmental Pollution 248 (2019) 380–387

International Journal of *Environmental Research and Public Health*

MDPI

Short-term joint effects of ambient air pollutants on emergency department visits for respiratory and circulatory diseases in Colombia, 2011–2014☆

Laura Andrea Rodríguez-Villamizar [a, *], Néstor Yezid Rojas-Roa [b], Julián Alfredo Fernández-Niño [c]

Ongoing:
Development of an Air Quality Health Index for Colombia

Instituto Nacional de Salud Pública

Universidad Industrial de Santander

idaea INSTITUTE OF ENVIRONMENTAL ASSESSMENT AND WATER RESEARCH

EXCELENCIA SEVERO OCHOA

Policy application: regulation need to include mixture effects of pollutants: Air Quality Health Index development (IBOCA)

National studies during COVID-19 pandemic

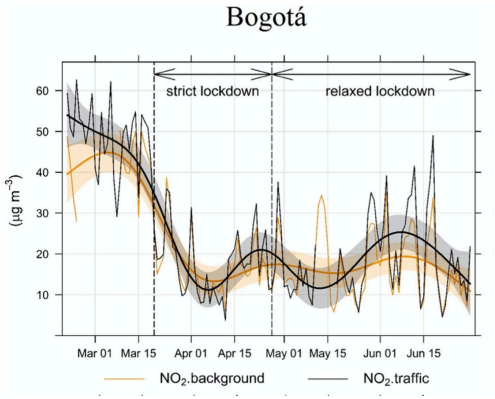
Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Air quality variations in Northern South America during the COVID-19 lockdown

Juan F. Mendez-Espinosa [a], Nestor Y. Rojas [b], Jorge Vargas [b], Jorge E. Pachón [c], Luis C. Belalcazar [b], Omar Ramírez [d,*]



Reduction in mobility decreased concentrations PM_{10}, $PM_{2.5}$ and NO_2

Biomass burning (fires) increased $PM_{2.5}$ by 20 ug/m^3
Saharan dust increased PM_{10} by 50 ug/m^3

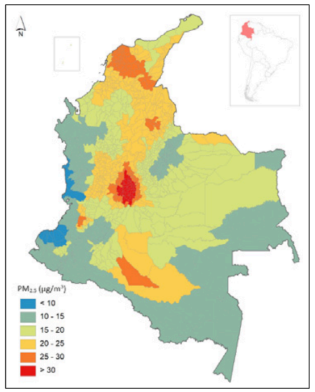
Contents lists available at ScienceDirect

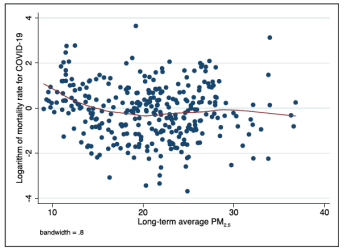
Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Air pollution, sociodemographic and health conditions effects on COVID-19 mortality in Colombia: An ecological study

Laura A. Rodriguez-Villamizar [a,*], Luis Carlos Belalcázar-Ceron [b], Julián Alfredo Fernández-Niño [c], Diana Marcela Marín-Pineda [d], Oscar Alberto Rojas-Sánchez [e], Lizbeth Alexandra Acuña-Merchán [f], Nathaly Ramírez-García [f], Sonia Cecilia Mangones-Matos [b], Jorge Mario Vargas-González [b], Julián Herrera-Torres [b], Dayana Milena Agudelo-Castañeda [g], Juan Gabriel Piñeros Jiménez [h], Néstor Y. Rojas-Roa [b], Victor Mauricio Herrera-Galindo [i]





No association of long-term $PM_{2.5}$ and early phase COVID-19 mortality. Social and geographical inequities associated with mortality

Lessons learnt for policy: reduction in vehicle emisions will help to achieve lower pollutant levels close to WHO guidelines

Assessment of long-term effects on health

Proyect “Air quality and urban environmental Health in five cities in Colombia”

First program in environmental health research funded in Colombia

MINISTERIO DE CIENCIA, TECNOLOGÍA E INNOVACIÓN

Laura A. Rodríguez
Yurley Rojas
Jhon J. Cáceres
Victor M. Herrera
Leandro López

Universidad Industrial de Santander

Nestor Y. Rojas
Sonia C. Mangones
Luis C. Belalcázar

UNIVERSIDAD NACIONAL DE COLOMBIA

Dayana M. Agudelo

UNIVERSIDAD DEL NORTE

Sara Grisales
Juan G. Piñeros

UNIVERSIDAD DE ANTIOQUIA

Diana Marín

Universidad Pontificia Bolivariana

Jonathan Ochoa

UNIVERSIDAD DE SAN BUENAVENTURA MEDELLÍN

Oscar A. Rojas

INSTITUTO NACIONAL DE SALUD

Scott Weichenthal
Jill Baumgartner

McGill

ALCALDÍA DE BARRANQUILLA Distrito Especial, Industrial y Portuario

BARRANQUILLA VERDE ESTABLECIMIENTO PÚBLICO AMBIENTAL

Ligia Oviedo
Sanint Castillo
Margarita Castillo

Alcaldía de Bucaramanga

CDMB

ÁREA METROPOLITANA DE BUCARAMANGA

Sec Salud Bga-Sder
Maria C. Vicini
Oscar M. Rojas

ALCALDÍA DE SANTIAGO DE CALI

DAGMA AUTORIDAD AMBIENTAL DE SANTIAGO DE CALI

Leonor Montes
Gisela Arizabaleta
Wilson Salas

Alcaldía de Medellín

Área Metropolitana Valle de Aburrá Futuro sostenible

Enrique Henao
Verónica Lopera
Ana Z. Orrego

ALCALDÍA MAYOR DE BOGOTÁ D.C.

BOGOTÁ

Katalina Medina
Hugo Sáenz
Luis Hernández

National studies on long-term effects

Rodriguez-Villamizar *et al.*
Environmental Health (2022) 21:137
https://doi.org/10.1186/s12940-022-00947-8

RESEARCH **Open Access**

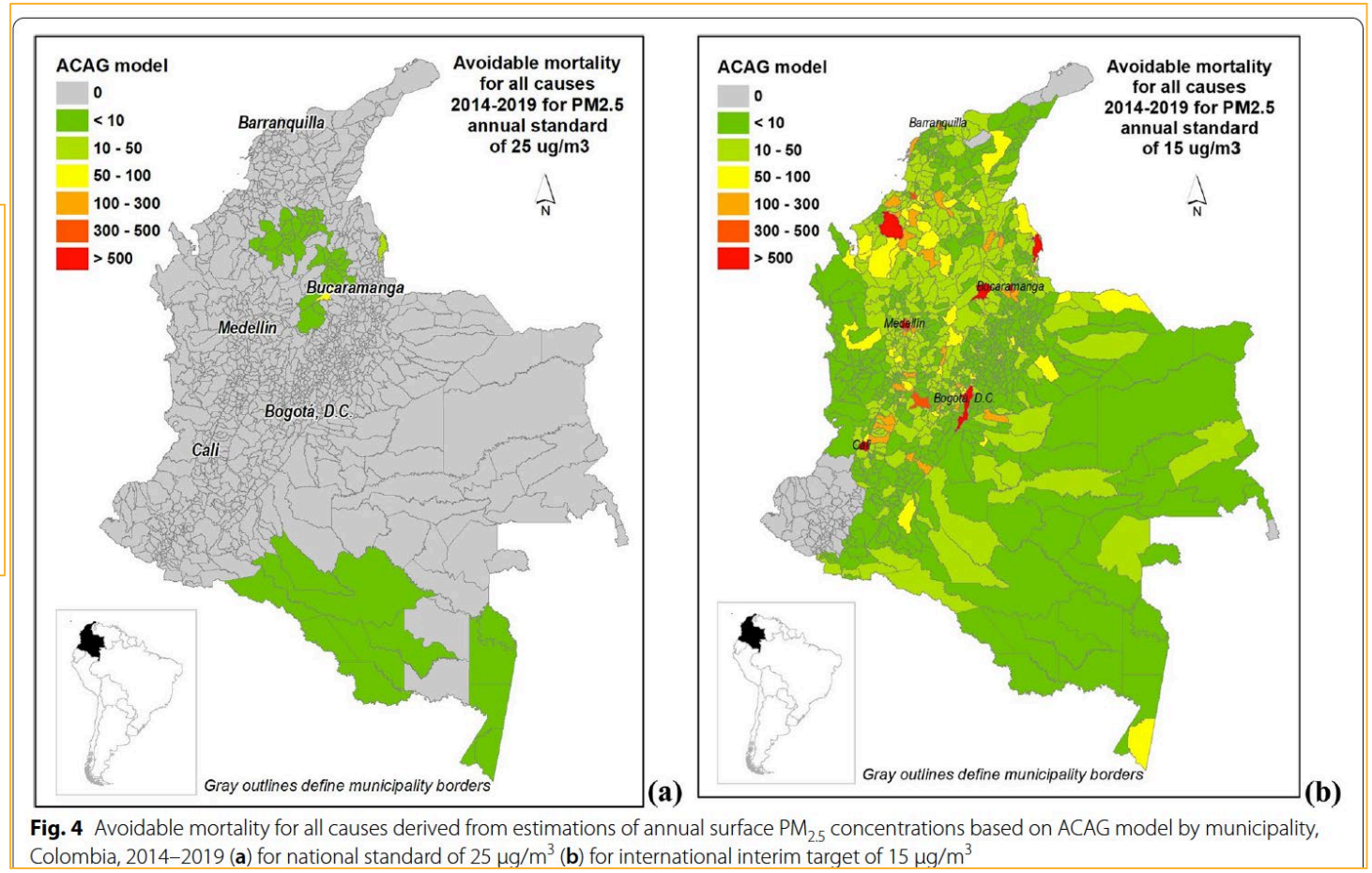


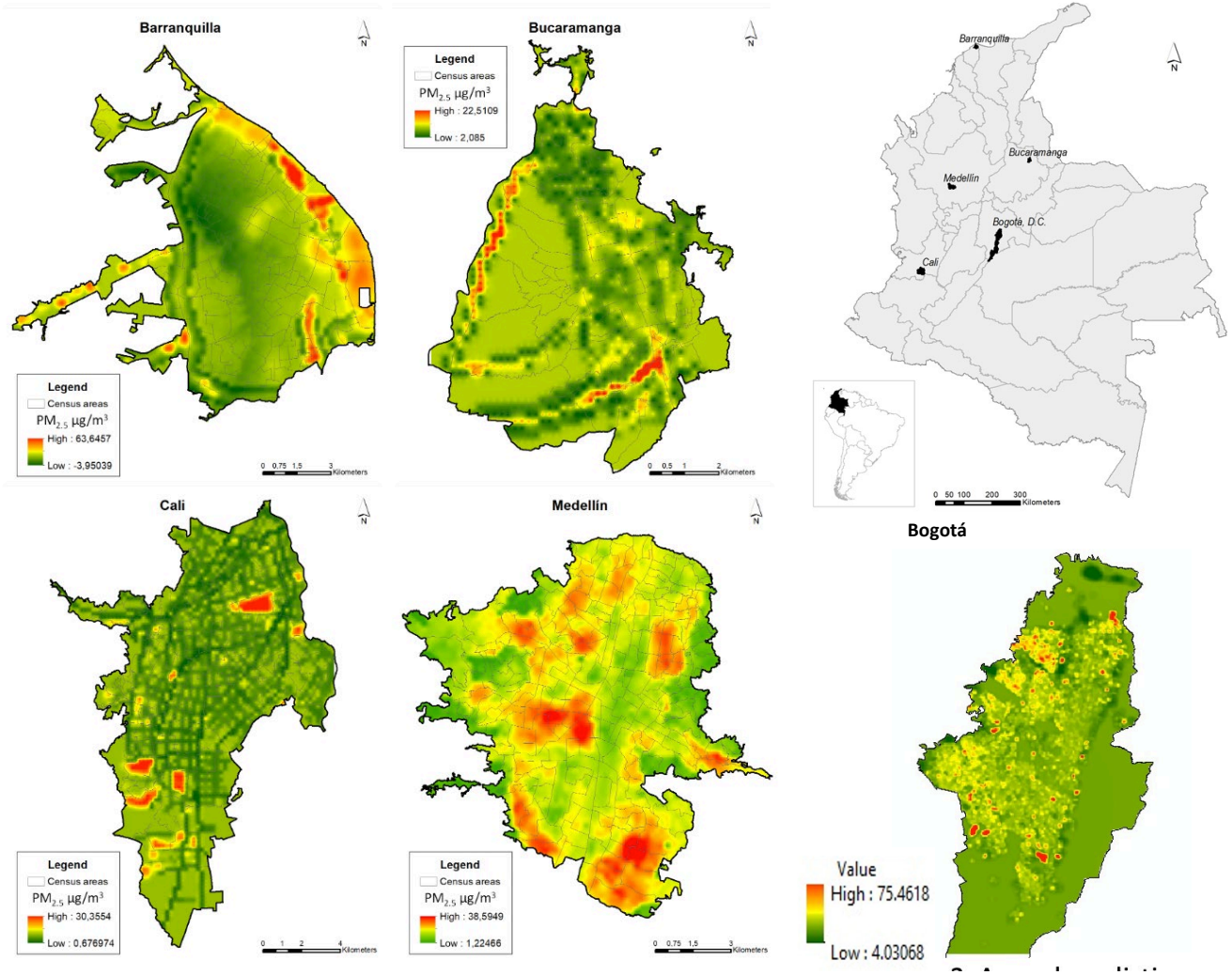
Fig. 4 Avoidable mortality for all causes derived from estimations of annual surface $PM_{2.5}$ concentrations based on ACAG model by municipality, Colombia, 2014–2019 (**a**) for national standard of 25 μg/m^3 (**b**) for international interim target of 15 μg/m^3

Application: To provide estimations of health benefits of reducing air pollution levels below current national standard.

LUR models developed for cities

City	LUR $PM_{2.5}$			LUR NO_2		
	N	R^2	RMSE	N	R^2	RMSE
Barranquilla	20	0.73	3.98	36	0.30	8.02
Bucaramanga	20	0.77	1.23	40	0.65	8.08
Cali	17	0.70	1.28	40	0.44	1.28
Medellín	19	0.82	1.71	34	0.57	5.53
Bogotá	40	0.44	1.39	73	0.40	1.26

RMSE= Root mean square error



Applications: collaborative work government-academia, detailed spatial characterizations of pollutants to inform local actions, Input for further exposure assessment in cohort studies.

Contents

- ✓ Overview of the research work on air pollution and health in Colombia
- ✓ Key findings and policy applications
- ✓ From local to international collaborations
- ✓ Challenges, opportunities and lessons learnt
- ✓ Expectations and future work

From local to national and international collaborations

US GEO Health Program NIH-Fogarty: GEOHealth Hub Colombia (2012-2015)

Environmental and occupational research and training needs: creation of national network

Biomédica 2015;35(Supl.2):58-65
doi: http://dx.doi.org/10.7705/biomedica.v35i0.2430

ARTÍCULO ORIGINAL

Environmental and occupational health research and training needs in Colombia: A Delphi study

Laura A. Rodríguez-Villamizar[1], Beatriz Elena González[1], Lina María Vera[1], Jonathan Patz[2], Leonelo E. Bautista[2]

[1] Departamento de Salud Pública, Escuela de Medicina, Universidad Industrial de Santander, Bucaramanga, Colombia
[2] Department of Population Health Sciences, School of Medicine and Public Health, University of Wisconsin-Madison, Madison, WI, USA

From local to national and international collaborations

International Journal of *Environmental Research and Public Health*

UNIVERSITY OF ALBERTA

Environmental Science & Technology

pubs.acs.org/est Article

Predicting Within-City Spatial Variations in Outdoor Ultrafine Particle and Black Carbon Concentrations in Bucaramanga, Colombia: A Hybrid Approach Using Open-Source Geographic Data and Digital Images

Marshall Lloyd, Ellison Carter, Florencio Guzman Diaz, Kento Taro Magara-Gomez, Kris Y. Hong, Jill Baumgartner, Víctor M. Herrera G,* and Scott Weichenthal*

Cite This: *Environ. Sci. Technol.* 2021, 55, 12483–12492 Read Online

McGill

ental Health (2018) 17:47
https://doi.org/10.1186/s12940-018-0390-1

GOBIERNO DE LA CIUDAD DE MÉXICO

RESEARCH Open Access

CrossMark

Association between air pollution and suicide: a time series analysis in four Colombian cities

Julián Alfredo Fernández-Niño[1], Claudia Iveth Astudillo-García[2*], Laura Andrea Rodríguez-Villamizar[3] and Víctor Alfonso Florez-Garcia[1]

Air Quality, Atmosphere & Health (2023) 16:745–764
https://doi.org/10.1007/s11869-023-01303-6

The Abdus Salam International Centre for Theoretical Physics

Surface, satellite ozone variations in Northern South America during low anthropogenic emission conditions: a machine learning approach

Alejandro Casallas[1,2] · Maria Paula Castillo-Camacho[3] · Edwin Ricardo Sanchez[3] · Yuri González[3] · Nathalia Celis[4] · Juan Felipe Mendez-Espinosa[5] · Luis Carlos Belalcazar[3] · Camilo Ferro[2]

From local to national and international collaborations

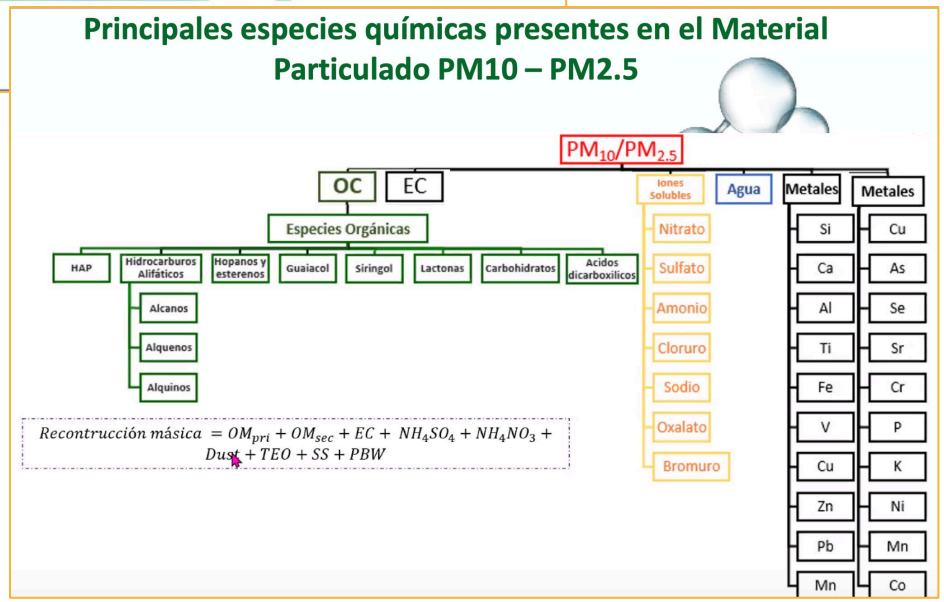
Funder:
IAEA: International Atomic Energy Agency

Results:
Characterization of key components of aerosols of the air pollution mixture in the Aburrá Valley (Medellín) and chemical speciation of $PM_{2.5}$ fractions with temporal resolution 2020-2022

Effects of sources such as dust, industry, diesel on $PM_{2.5}$ concentrations and variations over time including pandemic period

PI: Myriam Gómez

POLITÉCNICO COLOMBIANO
JAIME ISAZA CADAVID



Closing the gap:

We have achieved important developments in air pollution and health research, but we are about 10 years behind HIC in terms of research and policy implementation

Contents

- ✓ Overview of the research work on air pollution and health in Colombia
- ✓ Key findings and policy applications
- ✓ From local to international collaborations
- ✓ Challenges, opportunities and lessons learnt
- ✓ Expectations and future work

Building evidence on air pollution and health in Colombia

Challenges

- Data availability (limited air quality network) and open data access
- Long-term effects exposure assessment
- Limited national funding for long-term cohort studies
- Learning curve for accessing international funding
- Advancing in environmental justice and intervention studies
- Linking air pollution and climate change research

Opportunities

- Local authorities working with academic groups for building local evidence translated into policy
- Building national research capacity through training
- Collaborations with international research groups
- Potential international funding for health research studies in LMIC

Contents

- ✓ Overview of the research work on air pollution and health in Colombia
- ✓ Key findings and policy applications
- ✓ From local to international collaborations
- ✓ Challenges, opportunities and lessons learnt
- ✓ Expectations and future work

Next steps

✓Integrating national social, health and environmental data systems:

Creating a national census-based cohort for environmental and occupational health analysis (CIHR proposal 2023)

✓Research training in advanced methods: national training programs with international collaborations

✓Evaluation of feasibility scenarios for decreasing air pollution levels

✓Promoting environmental education and participation

✓Align research and decision-making agenda

✓Climate change + air pollution research

Increase international research collaborations aiming to close the gap

Questions

¡Thank you!

laurovi@uis.edu.co

@laurarovi1

Universidad Industrial de Santander