INCLUSIVE CITIES

= healthy cities

for all.....

Editor: Nora Libertun de Duren

IDB

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Abstract

This publication reports on some of the health challenges facing cities. It aims to serve as a guide for public managers and decision makers optimize the great potential of cities to improve the well-being of those who reside in the cities of Latin America and the Caribbean. It is organized in two parts. The first part, Health Inequalities in Latin American Cities, focuses on identifying the ways in which social inequality has led to negative health outcomes, in order to make visible the relevance of the challenge of inequality and the urgency to grapple with it. The second part, Urban Policies for Healthy Cities, focuses on how cities can contribute to improving the health standards in their population.

The publication addresses critical issues for urban health, such as the interdependence between physical-social factors and health, the relationship between urban characteristics and the incidence of COVID-19, the connections between social inequality and exposure to pollution environment, the relationship between urban planning and gender violence, the power of urban interventions -such as public transport and social housing- to improve health indicators, and the relevance of having good data to improve the accessibility of health systems. All the contributions in this book are based on data and rigorous research, and present real cases of the cities of the region.

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3. List of acronyms

API	Application Programming Interface
CEB	Basic effective coverage
CHW	Community health worker
COVID-19	Coronavirus disease 2019
DANE	Data from the National Statistics Office
ECLAC	Economic Commission for Latin America and the Caribbean
ECR	Electronic clinical record
ELN	Ejército de Liberación Nacional
EPM	Empresas Públicas de Medellín
FARC-EP	Fuerzas Armadas Revolucionarias de Colombia
FLACSO	Latin American Faculty of Social Sciences
GHG	Global greenhouse gas
HiAP	Health in All Policies
IECS	Institute for Clinical Effectiveness and Health Policy
IMCV	Multidimensional Index of Living Conditions
JALs	Juntas Administradoras Locales
LAC	Latin America and the Caribbean
MINVU	Chilean Ministry of Housing and Urban Planning
MPI	Master Patient Index
OECD	Organization for Economic Cooperation and Development
OSS	Systematic Social Observation
OSUBH	Belo Horizonte Observatory for Urban Health
PAHO	Pan American Health Organization
PB	Participatory Budgeting
PHC	Primary health care
POT	Plan de Ordenamiento Territorial
PRIMED	Programa Integral de Mejoramiento de Barrios Subnormales en Medellín
PUI	Proyecto Urbano Integral
SDGs	Sustainable Development Goals
SDOH	Social Determinants of Health
SISF	Secretaría de Inclusión Social y Familia de la Alcaldía de Medellín
UHC	Universal health coverage
UN-HABITAT	United Nations Human Settlements Programme
URBEL	Belo Horizonte Urban Development Company
UVAs	Unidades de Vida Articulada
WB	World Bank
WHO	World Health Organization

4. List of contributors

Why are cities so important for health?

Nora Libertun de Duren is a leading expert on urban sustainability, social inclusion, and affordable housing. She leads the Inter-American Development Bank research and knowledge agenda on cities, and mainstreams gender and diversity issues in urban projects. Nora is also a lecturer in Urban Planning and Design at Harvard University. Previously, she was the Director of Planning and Natural Resources for New York City and has taught at various universities, including Columbia University. She has managed a portfolio of $2,000 million in sovereign loans for Latin America and the Caribbean, $1,000 million in federal and municipal funds for New York City's open space, and $2.8 million in research grants for climate change, gender, and diversity. She has published 20 peer-reviewed papers and more than 30 chapters and monographs. Nora holds a Ph.D. in Urban and Regional Planning from MIT, a Master's in Urban Design from Harvard University, and a Master's in Architecture from the University of Buenos Aires.

Foreword

Benigno López Benítez is Attorney at Law with a degree from the Catholic University of Asuncion Paraguay and an LLM from Georgetown University Washington, DC. He has ample experience in the public and private sectors in areas involving public and administrative law, banking law, and international law. He is General Counsel and Member of the Board of Directors of Central Bank. He served as Senior Adviser to the Executive Director at the International Monetary Fund. From August 2013 to September 2014, he served as Executive Legal Director of Itaipu, a binational entity in charge of providing energy to its owners: Paraguay and Brazil. From September 2014 until August 14, 2018, he was President of Instituto of Prevision Social. He was appointed Minister of Finance of Paraguay on August 15, 2018. On November 16, 2020, he was appointed as Vice President for Sectors and Knowledge at the Inter-American Development Bank. He moved to Washington DC, to serve at the IDB.

Juan Pablo Bonilla is the Manager of the IDB's Climate Change and Sustainable Development Sector (CSD). Previously, he was Chief of Staff to the Executive Vice President of the Inter-American Development Bank. Before joining the IDB, Dr. Bonilla was a member of the United Nation's CDM Executive Board. In Colombia, Dr. Bonilla served as the principal advisor to the country's Vice President, as Deputy Minister of Environment, and acting Minister of Environment, Housing and Territorial Development. Dr. Bonilla obtained a B.A. in Civil Engineering from the Universidad Javeriana in Bogotá, Colombia, and then received a M.Sc. in Engineering Management and Systems Engineering and a Ph.D. in Environmental and Energy Management from George Washington University.

Ferdinando Regalía, an Italian citizen, has been the Manager of the Social Sector (SCL) since October 16th, 2021. Before his appointment, Ferdinando served as the IDB Social Protection and Health (SPH) Division Chief. In this capacity, Ferdinando oversaw IDB support to its borrowing member countries' response to the COVID-19 pandemic in social protection and health. From 2008 to 2009, Ferdinando served as an advisor to the Vice President for Sectors and Knowledge of the IDB, providing quality oversight of operations and the economic and sector research agenda of the Vice Presidency. In 2007, he served as Chief of Social Policy and Economics at the United Nations Children's Fund (UNICEF) in South Africa, providing technical assistance in designing, financing, and implementing social protection programs to governments and non-governmental organizations in Southern Africa. Ferdinando holds a Ph.D. in Economics from Universitat Pompeu Fabra in Barcelona, Spain.

Part 1: Health Inequalities in Latin American Cities:

Health Inequities in Latin American Cities

Usama Bilal is an Assistant Professor in the Urban Health Collaborative and the Department of Epidemiology and Biostatistics at Drexel University's Dornsife School of Public Health. His primary research interest is the macrosocial determinants of health, with an interest in describing health inequities in urban environments, specifically urban health in Latin American cities (the Urban Health Collaborative's SALURBAL project); the health consequences of urban and neighborhood dynamics; and the effect of mass-influences on health and policy modifiers that mitigate/exacerbate these effects. Dr. Bilal received the prestigious NIH Director's Early Independence Award in 2018 for his The Health Consequences of Urban Scaling project. His work has also been funded by the Robert Wood Johnson Foundation. He earned a PhD in cardiovascular epidemiology from the Johns Hopkins Bloomberg School of Public Health, an MPH from the Universidad de Alcala in Spain, and MD from the Universidad de Oviedo in Spain.

Excess Deaths from the COVID-19 Pandemic and High Contagion in Cities

Ana María Ibáñez is a Principal Economics Advisor at the Inter-American Development Bank. She is the former Dean of the School of Economics at Universidad de los Andes and the Director of the research center (CEDE). Her research concentrates on the microeconomic analysis of internal conflict and migration. She studies the economic consequences of internal conflict, in particular the costs of war and conflict upon the civil population. The other strand of her research explores the causes and consequences of forced and economic migration.

Norbert Schady is the Chief Economist for Human Development at the World Bank. Dr. Schady has a BA from Yale University and a PhD from Princeton University. He has held various positions at the World Bank and the Inter-American Development Bank, and has taught at Georgetown and Princeton universities. Dr. Schady has a distinguished research background on a variety of topics, including early childhood development, teacher quality, and cash transfer programs. He has published three books and more than 30 articles in academic journals, including *The Quarterly Journal of Economics*, *The Review of Economics and Statistics*, and *The American Economic Journal: Applied*.

Spatial Health Inequality in Latin American Cities: Magnitude, Drivers, and Policy Alternatives

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Juliana Pinillos is a doctoral student in economics at the University of Southern California. Her research interests focus on inequality in developing countries and the way it relates to health and environmental issues. Through her research, Juliana seeks to combine empirical evidence with economic theory with the aim of helping to design more effective policies. She has worked on different topics, including informal urban settlements, rural development, and the impact of natural disasters in Latin American countries. She holds a master's degree from the Paris School of Economics and Paris 1 Panthéon-Sorbonne University. Before joining the Inter-American Development Bank as a Research Assistant, she worked at the International Center for Tropical Agriculture. She also has experience in the academic sector as Instructor in economics at Sciences Po.

Inequality and Ambient Air and Noise Pollution in Latin America and the Caribbean

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Air Pollution from Small-Scale Brick Kilns in Ciudad Juárez, Mexico, Has Severe Adverse Health Effects, Particularly among Households with Low Incomes

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Part 2: Urban Policies for Healthy Cities:

Local Public Choices and Public Health

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Health in All Urban Policies: Evidence from Latin American Cities

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Dèsirée Vidaña-Pérez, PhD in epidemiology, graduated from the National Institute of Public Health of Mexico. She received her undergraduate degree in social psychology and has a master's degree in sexual and reproductive health. She worked at the National Institute of Public Health in Mexico for eight years, where she was involved in research projects focused on topics such as adolescent pregnancy prevention, women's health, gender violence, and tobacco. Currently, Dèsirée is a post-doctoral fellow at the University of South Carolina, Arnold School of Public Health, where she is involved in tobacco research.

Reshaping Information Systems and Delivery of Primary Health Care to Improve Access to Health Services in a Low-Income Urban Setting in Argentina: The Case of Guaymallén, Mendoza

Adolfo Rubinstein, MD, MSC, PhD, is a Physician who graduated cum laude at the School of Medicine of the University of Buenos Aires (UBA). He has a master's degree in clinical epidemiology at the Harvard T Chan School of Public Health; a health economy diploma from the University of York, United Kingdom; and a doctorate in public health from UBA. He is also Full Professor of Public Health of the UBA. Dr. Rubinstein was national Minister of Health of Argentina from 2017 to 2019. He is also the founder and former Director General of IECS (2002–2017) and was Chairman of the Family and Community Medicine Division at Hospital Italiano de Buenos Aires from 1990 to 2010. Dr. Rubinstein is an Investigator of the National Council of Scientific Research of Argentina and has published more than 120 papers in international and national peer-reviewed journals. He is currently the Director of the Center for Implementation and Innovation in Health Policies, Institute for Clinical Effectiveness and Health Policy, Buenos Aires.

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Understanding the Transformation of Medellín, Colombia, into a Healthy, Safe, and More Equitable City

Jason Corburn, PhD is Professor in the School of Public Health and Department of City and Regional Planning at the University of California, Berkeley. He is the Director of the Center for Global Healthy Cities at UC Berkeley. Professor Corburn has over 20 years of experience working with urban communities and municipal local governments on designing, implementing, and evaluating urban health projects and programs. Professor Corburn is the author of six award-winning books on urban health and governance, and over 50 peer reviewed journal articles. His work has been funded by the US National Institute of Environmental Health Sciences, the California Endowment, Robert Wood Johnson Foundation, USAID, UN-Habitat, the World Health Organization (WHO), the Rockefeller Foundation, and others. Among his awards, he received the United Nations Association Global Citizenship Award, and was named one of the world's Top 40 Thinkers on Cities by Routledge in 2017.

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Jorge Pérez-Jaramillo is a Colombian architect and urbanist. He was Dean of the School of Architecture and Associate Professor, Universidad Pontificia Bolivariana de Medellín, from 1993 to 2001. He was most recently Dean of the School of Architecture at Universidad Santo Tomás, in Medellín. He was Director Departamento Administrativo de Planeación, Medellín (2012–15) and Deputy Director of Planning Área Metropolitana del Valle de Aburrá (2004–08). He recently coordinated the formulation of the Strategic Metropolitan Land Use Plan PEMOT for the Metropolitan Area of Medellin and the Aburrá Valley as a member of the Institute of Urban Studies IEU National University of Colombia. He has been a Senior Consultant to the World Bank, an elected Resident Fellow at the Bellagio Center, and a Visiting Fellow at King's College, Cambridge, United Kingdom. He coordinated the winning team of Medellín for the Lee Kuan Yew World City Prize in 2016.

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6. Foreword

6.1 Benigno López Benítez, Vice President for Sectors and Knowledge, IADB

This timely publication shows that urban policies can make an enormous contribution to improving public health. The built environment influences many aspects of health and well-being, including access to clean air and water, safe shelters, and public spaces that provide opportunities to socialize and exercise.

However, we are still behind in making this connection explicit in our urban policies and public health programs. Nor do we acknowledge enough that cities' characteristics are one of the main determinants of a population's health. Increasingly, unplanned and poorly serviced cities are associated with a high percentage of the population experiencing diseases related to exposure to air pollutants, lack of basic services, and more sedentary lifestyles (WHO, 2011). This is particularly true for the Latin America and the Caribbean (LAC) region, where—if current demographic trends continue—more than 86 percent of the region's population will be living in cities by 2050 (UN, 2020).

LAC's high rate of urbanization means that we can no longer delay making the connection between cities and public health. LAC cities exhibit persistent and deep levels of inequality, with the main cities in many countries experiencing greater levels of income inequality than exist in the country as a whole (UN-Habitat, 2020. This notorious social dynamic directly impacts people's health and longevity. Even after controlling for key variables, the life expectancy of women living in the neighborhoods in the lowest decile of income of Santiago de Chile is 18 years less than for those living in neighborhoods in the top income decile. Significantly lower life expectancy has also been documented for poorer areas of Panama City, Mexico City, Belo Horizonte, and Buenos Aires (Bilal et al., 2019). In addition, LAC cities are undersupplied with safe public green spaces, and the distribution and quality of public services, such as safe water, electricity, and sanitation, are uneven. As a consequence, there are serious gaps in people's access to these services, particularly affecting women, children, older adults, and people with disabilities (Libertun et al., 2021).

Because cities are home to most of LAC's households, they have become the foci of coronavirus disease 2019 (COVID-19) cases. It is still too early to understand the full impact of this pandemic on our societies. Yet it is already clear that its health and economic impacts are worse among already vulnerable groups and communities (Corburn et al., 2020). The health crisis has shown that deficits in the urban environment are powerful drivers of social inequalities. For example, those who reside in housing that lacks basic water services and who rely on overcrowded transportation systems have a harder time implementing hygienic and social distance measures that help prevent the transmission of the virus. It is important to underscore that the pandemic is superimposed on other health crises already affecting LAC cities, including dengue, noncommunicable diseases such as obesity and heart disease, and high levels of violence (Diez Roux et al., 2020). Violence in the Americas is concentrated in urban areas and is often clustered in the poorest, most marginalized areas of cities. Rates of violence against women are also higher in major cities. According to a WHO study on women's health and domestic violence against women that included Brazil and Peru, 28 percent of women in São Paulo and 51 percent of women in Lima reported having experienced physical or sexual violence by an intimate partner (WHO, 2021).

At the Inter-American Development Bank, we recognize that although cities are often the epicenters of crises, cities are also where many of the tools to solve these crises and learn from them are developed.

Cities are essential for realizing IADB's Vision 2025 of social inclusion and equality, productivity and innovation, and regional economic integration, and doing so while addressing the crosscutting issues of gender equality and diversity, and climate change and environmental sustainability. Reconciling the growing proportion of LAC's population that lives in urban centers with the goal of creating healthy cities for all is one of the major public health challenges of our time. How cities are planned, built, and governed determines whether they will worsen or improve public health and quality of life for all. In this publication, you will find information not just on some of the health challenges cities face but also on how to use cities' tremendous potential to improve the well-being of people in the region today and for generations to come.

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6.2 Juan Pablo Bonilla, Climate Change and Sustainable Sector Manager, IADB

The growing intensity and frequency of floods, droughts, violent storms, and extreme heat and cold waves call for us to increase the attention we pay to the impact of climate change on the health of urban residents.

This is especially true for the Latin America and Caribbean (LAC) region, where already the great majority of the population lives in cities. Acting now is even more important: one in four urban residents lives in a neighborhood that lacks some basic service, such as access to safe water or sanitation, or that is on polluted or floodable lands. In this context, the negative effects of climate change are likely to cause more damage among those already living in vulnerable conditions. For example, residents living in informal settlements are exposed to high levels of air pollutants, which increases their susceptibility to heat waves. At the same time, they often live in overcrowded housing units and lack access to green spaces that could help them mitigate the impact of heat on their health.

The protection of the environment and the protection of public health go hand in hand. The health of the planet depends on developing healthy cities, that is, cities that neither pollute their environments nor impair the health of those who reside in them. This deep interaction between the natural and the built environments also provides an opportunity for powerful interventions that create benefits for both people and the planet. Reducing air and water pollution would also lead to reducing social inequalities in cities. Likewise, supporting access to adequate in-house sanitation services for all urban residents would reduce the contamination of bodies of water near cities.

With the urgency of acting now to improve the health of people and the planet, this publication presents a series of papers that highlight both the challenges and the opportunities that thinking about urban health provides.

It includes in-depth studies covering cities all over the LAC region, including Buenos Aires, Belo Horizonte, Bogota, Ciudad Juarez, Guaymallén, Lima, Medellin, Mexico City, San Jose, Panama City, and Santiago in Chile. The publication also covers issues that are central to the health of our cities, such as the interdependency of physical and social factors on health outcomes; the relation between urban features and the incidence of COVID-19; the connections between social inequality and exposure to air and noise pollution; the way urban planning can impact gender violence; the power of urban interventions, such as public transportation and social housing, to improve health indicators; the role of innovation in social policies in triggering a positive urban transformation; and the relevance of using accurate data to increase the accessibility of health systems.

I enthusiastically invite you to read this publication and to make it yours by taking ideas from each of the cases and bringing them to your projects. Our shared purpose is designing, implementing, and sustaining cities that are more inclusive, more sustainable, and healthier for all people and our planet.

6.3 Ferdinando Regalía, Social Sector Manager, IADB

Promoting better health for all with equity, financial protection, and sustainability is critical when large health disparities are still present between and within countries in LAC region.

Unequal access to quality health care, higher exposure to risk factors, such as hypertension, unhealthy living habits, and tobacco use; a higher incidence of chronic non-communicable diseases (CNCDs) are growing and usually overlooked issues for people living in urban areas. Furthermore, health inequities are often pinned on socioeconomic status, membership in ethnic and racial groups, or living conditions. Significant differences in average life expectancy at birth between the rich and the poor continue in Latin American cities (Bilal et al., 2019).

Cities and their populations are changing rapidly. The epidemiological and demographic trends in urban settings reveal that social determinants and service demand are constantly transforming. For instance, young people are affected by growing mortality and morbidity rates from external causes, particularly violence. In contrast, a higher proportion of adults ages 65 and older means a rising demand for health services, especially at the primary level, including telemedicine, to manage chronic diseases. Yet health systems in the region suffer from fragmentation, with limited and often inefficient use of resources. This complex situation requires a concerted effort to develop and implement models of care that prioritize health promotion and preventive care. Investing in primary health care and moving to integrated health care networks have become tools for efficient health care spending, as illustrated by the case study in Mendoza, Argentina. The Guaymallén project, described in this publication, underscores how strengthening the health information system and technological capabilities paves the way toward universal health coverage (UHC).

This publication brings to light the intricacy of social and other determinants for health within urban settings. It discusses cities' power to improve health outcomes and reduce inequalities with intersectoral action. In the first section, drawn from case studies of several towns in the region, the authors uncover health inequalities using novel disaggregated data, revealing significant socioeconomic differences in life expectancies and excess mortality from COVID-19. In the second part of this book, the authors propose different urban policies and approaches, such as water and sanitation services, safe transportation, and housing, to better address public health issues such as exposure to air pollution or gender-based violence.

This monograph offers us a timely opportunity to gain experience by examining the interplay between urban policies and public health.

It provides a guide on how to work toward the objective of building better, more inclusive, and healthier cities. I invite you to read it and join the efforts to reconcile the urgent needs still required by the pandemic with a long-term sustainable agenda that seeks to foster better health conditions for all.

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7. WHY ARE CITIES SO IMPORTANT FOR HEALTH?

Santiago, Chile

7. Why are cities so important for health?

Nora Libertun de Duren, HUD/CSD, IADB

Providing clean water, collecting garbage, regulating the location of polluting activities, and preventing crime are just some of the many ways in which the performance of urban services has a direct impact on public health.

In addition, in times of health emergencies, city governments are essential to effectively channel resources to residents and to identify the most vulnerable populations and facilities. As COVID-19 demonstrated, cities are the first place affected by global crises that impact the health of the population and where often the actions to solve these crises originate.

The living conditions in Latin America and Caribbean (LAC) cities impact more than 520 million residents, about 80 percent of the region's population. But the provision of services in LAC cities is still incomplete and often of uneven quality. While sewage collection covers 87 percent of households, 72 percent of collected sewage is discharged untreated into water bodies near cities (UNICEF/WHO, 2019). Likewise, LAC's municipal solid waste average collection rate is high at 89 percent, but a minimum amount of it is adequately disposed of (IADB, 2019). People residing in poor neighborhoods are especially affected by irregular, low quality, or absent urban services. Those who dwell in informal settlements—about 25 percent of LAC urban residents—are more likely to lack access to safe drinking water or to sewerage services. Also, they are more frequently exposed to contamination and hazmats,[1] as these neighborhoods are often on or next to polluted sites and solid waste dumps (Auyero, 2009).

In addition to the challenges of delivering qualitative services to protect the health of all urban residents, climate change and demographic transformation are demanding new responses from urban governments. Many LAC cities are subject to increasing extreme weather and high levels of environmental pollution. Their vulnerability derives partly from increased exposure and partly from a process of unplanned territorial expansion (Hardoy et al., 2011). Residents are increasingly exposed to heat waves and other climatic hazards, including droughts, floods, and landslides (IADB, 2020). Ground pollution is also a serious concern for urban health as most toxic wastes are still disposed untreated into nearby rivers or water bodies or placed on land sites, while cities in coastal areas are suffering from global waste streams, such as plastic marine pollution (IADB, 2019). In addition, air pollution levels are problematic in numerous LAC cities. This problem derives partly from increasing motorization rates and lack of public transport alternatives, and partly from the absence of effective standards for fuel efficiency and vehicle emissions (IADB, 2020). This is a compounding problem because high levels of environmental pollution worsen the negative health impacts of climate change and climatic events. For example, respiratory disorders, including those exacerbated by fine particulate pollutants, such as asthma and allergic diseases, are associated with increasing median temperatures (Patz et al., 2014).

The changing demographic profile of LAC cities brings new demands for health services.

Urban households are smaller and older because of delayed maternity and increased longevity. In 1980, there was an average of four children per household; since 2010, the average is less than two (Libertun and Gallego-Lizon, 2019).[2] According to recent estimates, 18 LAC countries have total fertility rates below the replacement level,[3] following a pattern like the one already experienced in early industrialized countries (Vollset et al., 2020). However, and unlike these countries, LAC presents a pattern of polarization of the reproductive calendar; maternity is delayed among women with mid- and high income, while early maternity among women with low income persists (Cabella and Nathan, 2018).

1. Hazmat refers to a site that contains material (such as flammable or poisonous material) that would be a danger to life or to the environment if released without precautions.
2. For example, in Lima, Peru, the mean household size in 2017 was 3.4, shrinking from the 3.9 of 2010. In Mexico DF, mean household size in 2015 was 3.2, with a large share of households closer to 2.5 members (Libertun and Gallego-Lizon, 2019).
3. Replacement fertility is the level of fertility that, if maintained over time, will produce zero population growth under the assumption of constant mortality and absence of migration. It corresponds to a total fertility rate of 2.1 children per woman, the rate that ensures the replacement of the number of women of reproductive age.

By 2014, for the first time, the segment of people older than 60 years was more numerous than the percentage of those under the age of 15 years, thus reversing the demographic growth pattern in the region. Average life expectancy in LAC has increased 14.6 years since 1965, reaching 73.5 years by 2010, but with important differences by gender and region. Women live longer than men, with the gender difference in 2005–10 being 4.5 years. Life expectancy shows high variation by region, being 71.8 years in the Caribbean, 58.9 in Central America, and 61.4 in South America (Andean and Southern cone countries combined) (Hambleton et al., 2015). LAC mortality rates present a polarized pattern too. Homicides and transport accidents are the first- and the second-leading causes of death for people between 10 and 24 years of age, while heart diseases and diabetes are the leading ones for those older than 25 years (Pan American Health Organization, 2020). Low-income young men are the most likely to suffer violent death (IADB, 2020).

LAC still exhibits an extremely high level of income inequality; 8 out of the 20 most unequal countries of the world are in LAC.

Moreover, often, inequalities within LAC cities is even higher than that registered for the countries in which they are located. That is, the median Gini coefficient for LAC is 0.41, while LAC cities' Gini coefficient shows deeper inequalities. For example, in 2012, the urban Gini of Chile and Brazil hovered around 0.60 (UN Habitat, 2016). LAC cities' inequality is also patent in a pattern of socio-spatial exclusion. High-income households cluster in areas with a high level of services and infrastructure, while low-income households locate in vulnerable areas with substandard housing, faulty services, and inadequate infrastructure. Likewise, this is also part of what we know as *neighborhood effects* on health, a concept that underscores that there are factors that influence health at the community level, which are independent of individual household level factors (Galster, 2012).Of special interest to understanding neighborhood effects in cities is the intersection of social exclusion and identity. That is, households led by women, of rural origins, with people with disabilities, or whose members identify as afro descendants, Indigenous people, or ethnic minorities are more likely to be living in substandard housing or underserved neighborhoods (Kaltmeier and Breuer, 2020). These inequalities worsen the health outcomes among directly affected households at the same time as they exacerbate the vulnerability of cities to climatic and health disasters. This occurs because even small increases in the risk for climate-sensitive conditions, such as diarrhea and malnutrition, could result in very large increases in the total disease burden. Likewise, rising temperatures will affect the spread and transmission rates of vector-borne and rodent-borne diseases, which are more prevalent in neighborhoods lacking access to municipal and sanitation services (Costello et al., 2009).

In sum, cities can make enormous contributions to improving the health standards of the LAC region by increasing the access to qualitative municipal services and implementing concrete actions to reduce environmental pollution levels and adapt to and mitigate climate change.

Despite their shortcomings, cities are still our best tool to effectively improve life quality and well-being for the majority of LAC residents. It is with this vision in mind that this monograph is organized into two parts. Part 1, Health Inequalities in Latin American Cities, focuses on identifying the ways in which social inequality has led to negative health outcomes, in order to make visible the relevance of the inequality challenge and the urgency to grapple with it. Part 2, Urban Policies for Healthy Cities, focuses on how cities can contribute to improving health standards in their population. All contributions are firmly rooted in data and grounded research, and present actual cases from the region.

Part 1 begins with a paper that summarizes the many ways in which inequality undermines the health of low-income residents. In "Health Inequities in Latin American Cities: A Framework and Two Case Studies to Understand the Impact of Inequality in Urban Areas of Latin America," Usama Bilal studies urban health as the outcome of a complex system of multiple factors, which are strongly interdependent. He illustrates this concept by analyzing the wide inequities in life expectancy at birth in the cities of Buenos Aires in Argentina, Belo Horizonte in Brazil, Mexico City in Mexico, San Jose in Costa Rica, Panama City in Panama, and Santiago in Chile. He found wide variability in age-adjusted and age-specific mortality, which was especially notable for deaths in men ages 15–39. He then explores in depth the cases of Santiago in Chile and Lima in Peru to find out whether these pre-existing inequities are continuing during the COVID-19 pandemic, and whether their magnitude is stable or is being amplified by the pandemic. His findings indicate an overall widening of inequality because of COVID-19, with significant heterogeneity in its impact by area and correlation with income levels.

In the next paper, "Spatial Health Inequality in Latin American Cities: Magnitude, Drivers, and Policy Alternatives" by Juan Pablo Chauvin and Juliana Pinillos, the authors show that the spatial clustering of people with similar socioeconomic characteristics within LAC cities does not suffice to explain the geographical disparities in life expectancy, the burden of noncommunicable diseases, and the impact of COVID-19. Multiple local characteristics, including climate, environmental vulnerability, and access to health care, water, and sanitation services, shape the ultimate health outcomes of each locality.

Their estimates for Brazilian cities show that, contrary to what has been observed in the United States, cities with higher average income per capita in Brazil were relatively more affected by COVID-19, in terms of both cases and deaths, after controlling for all other covariates. Likewise, COVID-19 took root in more affluent neighborhoods of Bogota, Colombia, first. However, significantly, in all cities, low-income neighborhoods—where residential overcrowding is high—bore most of the burden of the pandemic through the end of the first wave.

The third article, "Inequality and Ambient Air and Noise Pollution in Latin America and the Caribbean," by Bridget Hoffman and María Paula Medina Pulido, brings new empirical data on air and noise pollution, one of the most pressing public health issues in LAC cities. These types of pollution are linked to factors that impact human capital and economic outcomes, such as lower productivity and difficulty concentrating, and a wide range of mental and physical health outcomes. The authors analyze in-depth the metropolitan area of Santiago de Chile, where they analyze the data from 13 air quality monitoring stations that collect hourly data points on different pollutants at the *comuna* level. They find an unequal exposure to environmental pollution by socioeconomic status at the neighborhood level. For instance, the richest comunas, measured by per-capita household income, are less exposed to higher air pollution levels. Likewise, comunas with a higher percentage of the population working in formal employment, another proxy for higher socioeconomic status, are less exposed to air and noise pollution. Furthermore, they found that these same groups are more likely to have lower access to health care. In this way, their paper underscores the relevance of reducing air and noise pollution to improve health and quality of life and alleviate inequalities in LAC cities.

The section also includes three boxes that provide a snapshot of some other key dimensions of health inequality at the urban scale, and how that correlates with other urban dimensions. Box I, "Excess Deaths from the COVID-19 Pandemic and High Contagion in Cities," is authored by Ana María Ibáñez and Norbert Schady. It shows a strong correlation between urban density and the incidence of COVID-19, which calls for strengthening the provision of water and sanitation services, the systems for early detection of epidemics, and the provision of public health services, particularly in low and informal urban neighborhoods.

In Box II, "Gender Violence in Cities: An Urban Perspective on Violence against Women," Nora Libertun highlights the issue of violence against women as central to public health and social progress. She characterizes the specific ways in which cities make women more vulnerable to gender violence. She identifies that low access to housing tenure, lack of adequate public transportation services, and poorly maintained public spaces increase the exposure of women to gender violence. Finally, **in the Box III, "Air Pollution from Small-Scale Brick Kilns in Ciudad Juárez, Mexico, Has Severe Adverse Health Effects, Particularly among Households with Low Incomes," Allen Blackman** illustrates how certain types of microenterprises create severe environmental problems, mostly because of their large numbers and lack of adequate pollution control equipment. All in all, these three boxes provide different vantage points to the notion that exposure and vulnerability are determinants of health outcomes at the community and at the individual level, a concept that the next section explores in further depth.

Part 2: Urban Policies for Healthy Cities, begins with Box IV, authored by William Savedoff, "Local Public Choices and Public Health." It provides a framework that connects individual health outcomes with the specific characteristics of urban environments. It underscores the importance of municipal governments in improving public health. It specifically highlights the important role water and sanitation services, city zoning, and city transportation play in the health conditions of urban residents. Box V, "Housing and Health," by Nora Libertun, shows some specific ways in which housing conditions determine a household's health. She underscores that the evidence demonstrates that housing can be both a cause for better and for worse health in those who inhabit it, making it even more relevant to include housing policies as one of the main tools for improving health at the household level.

The paper "Health in All Urban Policies: Evidence from Latin American Cities" was written by Claire Slesinski, Andrea Cortínez-O'Ryan, Katherine Indvik, Mónica Mazariegos, Lídia Maria de Oliveira Morais, and Dèsirée Vidaña-Pérez, all researchers with the Salud Urbana en América Latina (SALURBAL). They are working together to study how urban environments and urban policies impact the health of city residents throughout LAC. Their paper offers a summary of the available scientific evidence of the health and health equity impacts of a variety of place-based urban policies. Importantly, it also presents a comprehensive review of the interventions implemented in Latin American and Caribbean cities that contributed to better public health outcomes. Accordingly, the paper presents interventions in many urban realms, such as transportation and mobility systems, housing and neighborhood programs, climate change mitigation and climate resilience, violence and injury prevention, and urban governance. Through this summary, the authors show that the region is a hub of urban policy innovation that has produced unexpected benefits across health, social welfare, and environmental sustainability.

The next paper included in this section, "Reshaping Information Systems and Delivery of Primary Health Care to Improve Access to Health Services in a Low-Income Urban Setting in Argentina: The Case of Guaymallén, Mendoza," authored by Adolfo Rubinstein and Cintia Cejas, brings insights connecting innovation with improved public health measures.

It portrays the strategy used to effectively increase the access to health care of the low-income households of a city in the province of Mendoza. It emphasizes the importance of having a coordinated strategy connecting national and local health systems, as well as moving from reactive health care to proactive care that focuses on improving population health. An important part of this strategy is to assign people to specific health clinics and primary care providers, who are responsible for providing care to these vulnerable households. The combination of a geographical and a social vulnerability approach resulted in significant improvements in health access and health indicators among those serviced by the public health system.

The last paper of Part 2, "Understanding the Transformation of Medellín, Colombia, into a Health, Safe, and More Equitable City," written by Jason Corburn, Jorge Pérez-Jaramillo, and Eliana Martinez-Herrera, delves deeper into the notion of innovation in urban policy as a powerful driver for improvements in public health. The authors trace the history of Medellin, which transformed itself from being one of the most violent cities in the world to a model of social inclusion. They focus on the combination of civil society participation, integrated development plans, and inclusions of previously marginalized populations and communities. The authors describe the many public works the city did, particularly in the most vulnerable neighborhoods. Yet they make clear that the transformation of Medellín is not complete and that it has more to do with its ongoing commitment to social justice and inclusive planning than just built environment and technological innovations. They also acknowledge that the COVID-19 pandemic is threatening some of the city's achievements in health, inclusion, and safety. In this way, the authors also emphasize the continual vigilance and work that assuring healthy cities for all requires

In sum, the papers in the Part 1 show that public health challenges are yet another aspect of the structural social inequality affecting the cities of the region, which are rooted in specific territories within the city. Therefore, actions to tackle them need to be both socially and spatially targeted. Examples of how to tackle this daunting task are the focus of Part 2. It shows that LAC cities have been a fertile ground for innovation, and while much is still to be done, there is an increasing understanding that the development of the region depends on having socially included and healthy cities and that these two qualities are interdependent.

It is our aim that this publication inspires more innovations toward a more prosperous, healthy, and just Latin American and Caribbean region.

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PART 1

8. HEALTH INEQUALITIES IN LATIN AMERICAN CITIES

Rio de Janeiro, Brazil

PART 1

8.1 HEALTH INEQUITIES IN LATIN AMERICAN CITIES

A Framework and Two Case Studies to Understand the Impact of Inequality in Urban Areas of Latin America and the Caribbean

Bogotá, Colombia

8.1 Health inequities in Latin American cities: A Framework and Two Case Studies to Understand the Impact of Inequality in Urban Areas of Latin America and the Caribbean

Usama Bilal, Drexel University

8.1.1 Abstract

This article summarizes the importance of studying health and health inequities in cities of Latin America. First, we summarize historical studies examining urban health inequities and provide a framework based on understanding cities as contexts for health, causes of health, modifiers of the effects of other factors, and complex systems formed by heterogeneous agents at multiple levels with strong interdependencies. We then provide two case studies to highlight the importance of studying health inequities in cities, one focused on all-cause mortality and one focused on excess mortality from COVID-19. We close with an outline of potential interventions that may help in mitigating these health inequities. Considering the importance that the Sustainable Development Goals have placed on improving health, building sustainable cities, and reducing inequality, there is urgency in intervening to mitigate these inequities. Local and national governments and international multilateral organizations in the region should prioritize health equity as one of their primary goals in the development of policies that affect the residents of urban areas.

8.1.2 Introduction

We live in an urban world. More than half of the world's population lives in cities, and this number continues to increase (UNDP Population Division, 2018). In fact, according to UNDP, around 70 percent of the population of the world will be living in cities by 2050 (UNDP Population Division, 2018). Some recent research has even highlighted that these numbers may be severely underestimated and that more than 80 percent of the population is currently living in cities (OECD/European Commission, 2020). However, this situation is heterogeneous over time and space. The Americas, in general, and Latin America and the Caribbean (LAC) in particular, is one of the most urbanized regions in the world, with levels of urbanization above 80 percent in 2018 (UNDP Population Division, 2018). The LAC region has urbanized rapidly over the last few decades (**Figure 1**): from 1950 to 2018, there was a doubling in the proportion of people living in urban areas in the LAC region, from 41 percent in 1950 to 81 percent by 2018 (UNDP Population Division, 2018).

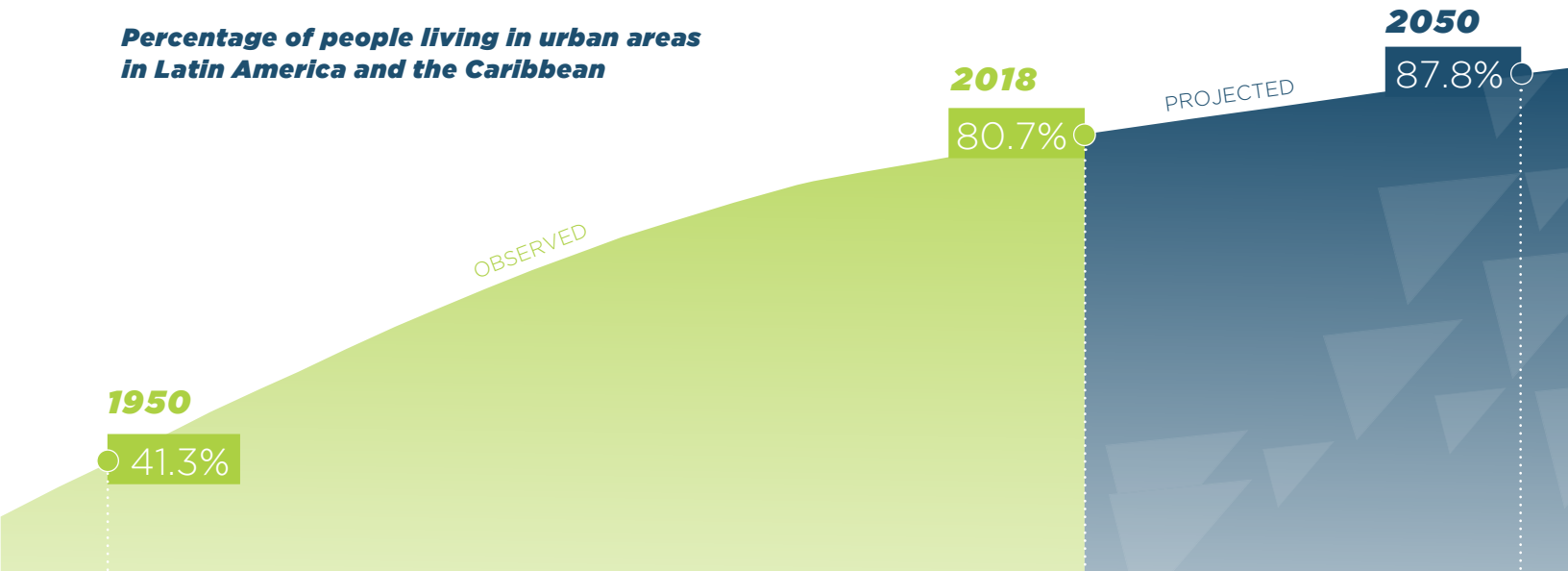
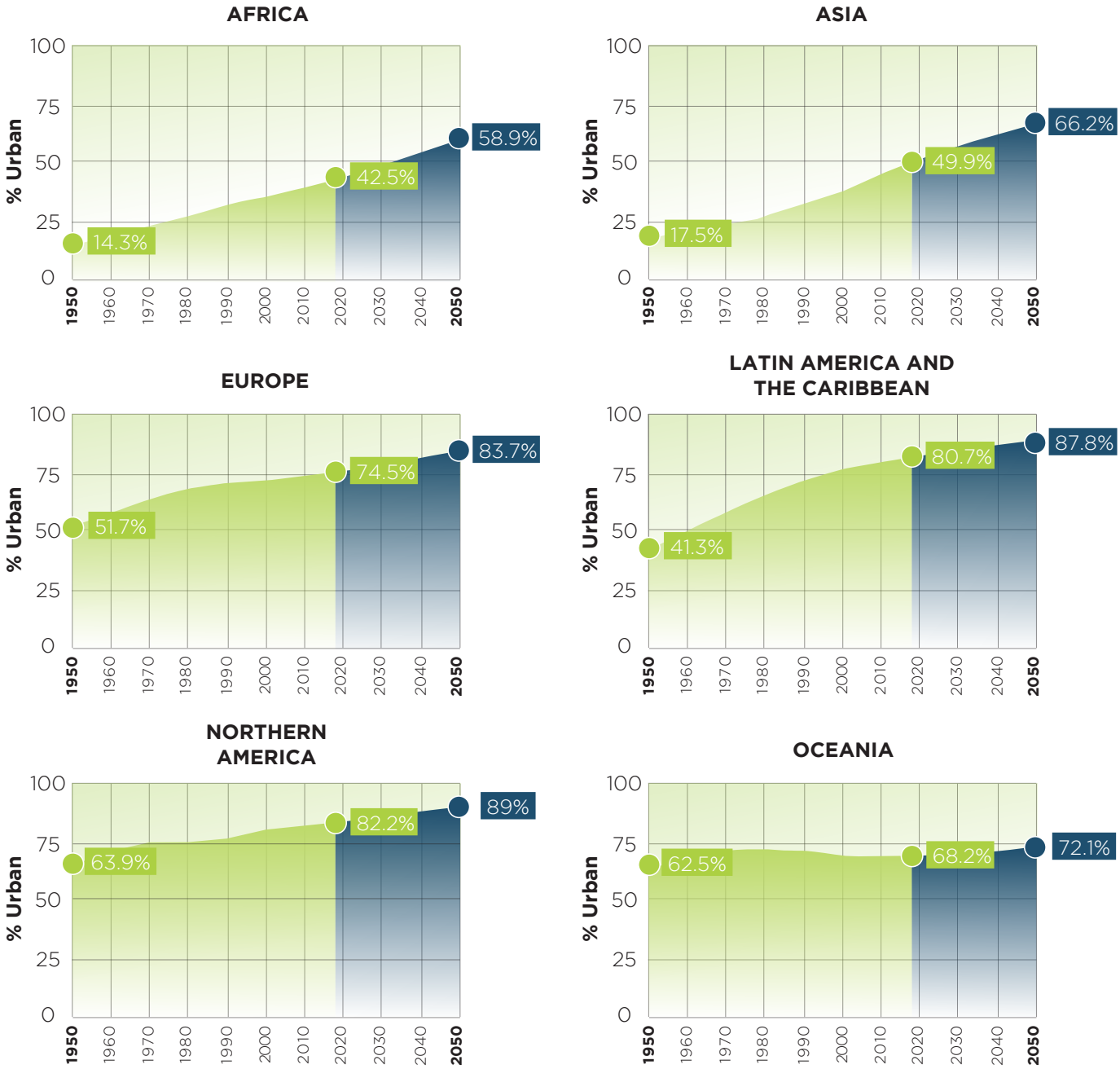


Figure 1 **Proportion of urban population by world region**

Note: The orange areas are observed data; the purple areas are projected data.
Source: Authors' elaboration with data from the World Urbanization Prospects, 2018.



Living in cities has consequences for public health, both positive and negative, as increases in population density and social and economic interactions can be concurrently health-promoting and harmful (Dye, 2008).

Some aspects of city living are positive, such as increased diversity and increased access to jobs or services, while others are negative, such as increased air pollution, overcrowding, and exposure to advertisement of hazardous products (tobacco, fast food). Minimizing the negative aspects while leveraging the positive ones should be a key objective of public health practitioners in cities (Sarkar and Webster, 2017). These public health goals are especially important in the LAC region, considering its high levels of urbanization (Diez Roux et al., 2018; Quistberg et al., 2019).

These consequences of city living are not equally distributed (Diez-Roux, 2020b; Williams and Collins, 2016). Cities are also highly unequal areas in which people are segregated in terms of socioeconomic status (SES) and their race or ethnicity (Diez-Roux, 2020b). In an analysis of more than 1 billion tax records in the United States, Chetty et al. (2016) reported very wide disparities between the life expectancy of individuals by income, and that these disparities were highly heterogeneous by city. In other words, while SES is a universal driver of health, the magnitude of these disparities varies by city and can therefore be intervened upon. These consequences may be especially acute in the LAC region, as it is among the most unequal regions in the world (Diez Roux et al., 2018), with 8 of the 20 most unequal countries in the world being in the LAC region (World Bank Group, 2018). During 2020, the importance of cities for health was highlighted by the increased death tolls from COVID-19 in many urban areas. Hyperconnected cities around the world, including Madrid and New York City, experienced very large crises of mortality not seen since the 1918 influenza pandemic (Faust et al., 2020). Cities in the LAC region have also suffered the consequences of the COVID-19 pandemic (Diez Roux et al., 2020), in terms of both its health and its economic impacts.

Achieving an understanding and seeking the mitigation of health inequalities in urban areas is a cross-cutting theme of the Sustainable Development Goals (SDGs).

Specifically, SDG-3 focuses on the need to "ensure healthy lives and promote well-being for all at all ages"; SDG-10 aims to "reduce inequality within and among countries"; and SDG-11 strives to "make cities inclusive, safe, resilient and sustainable." This chapter is therefore situated at the intersection of SDGs 3, 10, and 11, and is divided into four sections. First, we describe a framework to understand health inequities in cities, with a special focus on LAC cities, and an applied example with COVID-19 inequities. This is followed by two case studies: (1) an in-depth look at inequities in mortality within six large LAC cities (Buenos Aires, Belo Horizonte, Santiago de Chile, San Jose, Ciudad de Panama, and Ciudad de Mexico); and (2) an overview of emerging inequities in the context of COVID-19 in two large LAC cities (Santiago, Chile; and Lima, Peru). These cities were chosen for their size, regional importance, and wider data availability, and because they represent some paradigmatic cases of health inequalities in the region. Last, we close with a summary of interventions that may help in mitigating these inequities.

8.1.3 Framework

8.1.3.1 Historical studies examining social factors and health

There is a long history of research in urban health inequities. A number of historical studies were conducted in European cities during the sanitary reforms of the 19th century. With the advent of capitalist modes of production in the Netherlands and England, large masses of workers moved to cities, leading to challenges in housing, water access, sanitation, nutrition, and working conditions (Szreter, 2003). The need to have a productive workforce led to the urban sanitary movement (Bernabeu Mestre, 2009), which included classical reformers such as John Snow, Edwin Chadwick, and Rudolf Virchow. Virchow himself claimed that epidemics were symptoms of a society that was out of joint, and that when large masses of people live in unfavorable conditions, disease will become epidemic and affect large parts of the population (Virchow, 1849).

Research during the 19th and early parts of the 20th century also included studies on mortality by neighborhood and social class. For example, Villermé found higher mortality in neighborhoods of Paris that had a higher proportion of tax-exempt (poor) households (Krieger, 2001), while Engels described higher mortality in poorer neighborhoods of Manchester but also of poorer people within each neighborhood (Krieger, 2001). In the United States, W.E.B. Du Bois found a strong relationship between living conditions and mortality in the Black population of Philadelphia (Sharon and Lorraine, 2018), while Arenal described pauperism in Spain and its effects on health (Bernabeu-Mestre and Gascón Pérez, 1999). In the case of LAC, Salvador Allende himself published a landmark study, Realidad Medico-Social Chilena, in which he summarized inequalities in height and weight (both indicators of appropriate nutrition) by the socioeconomic status of neighborhoods and households of Chile in 1934 (Allende, 2005; Waitzkin, 2005). However, this focus on contextual factors started declining during the 20th century, as ideologies started shifting toward individualism (Tesh, 1988). We have essentially shifted from trying to understand how health habits are influenced by social factors to taking these habits as health determinants themselves, ignoring the social context (Armstrong, 2009).

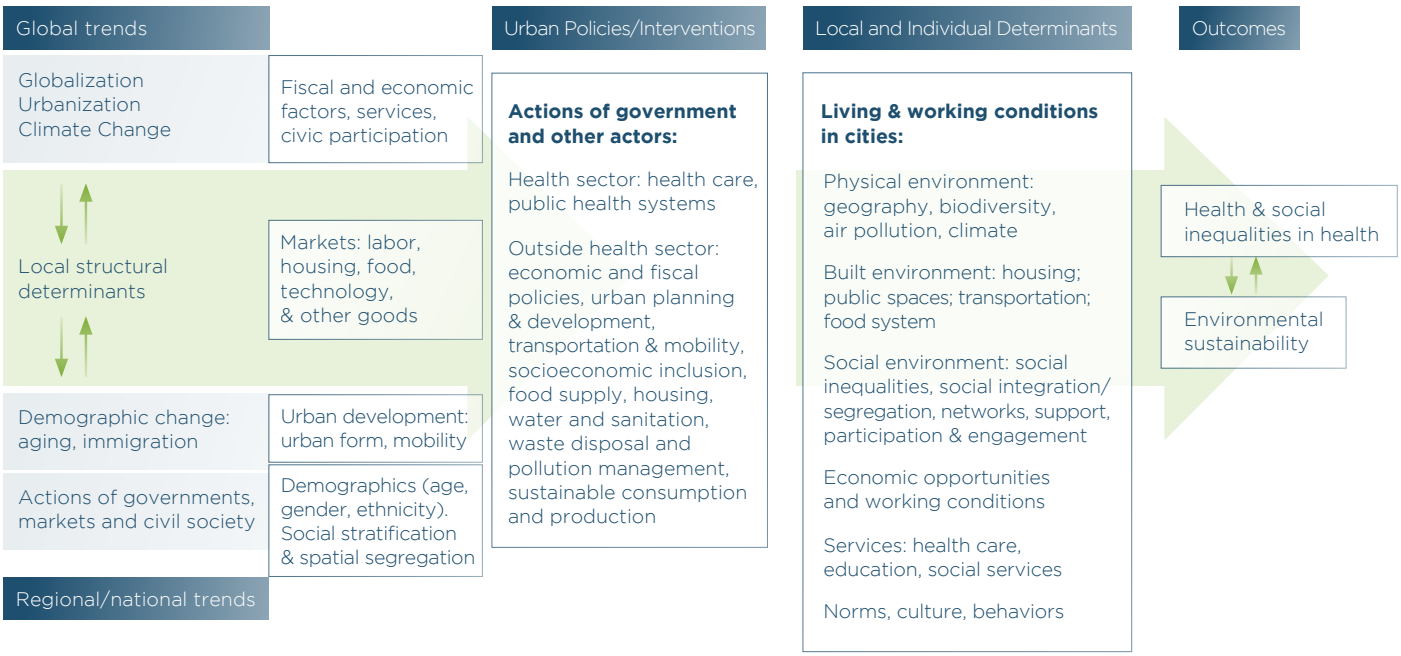
This trend toward individualism in public health reverted in the last few decades of the 20th century. In 1985, Geoffrey Rose published his landmark commentary entitled Sick Individuals and Sick Populations (Rose, 1985), in which he postulates that there is a key difference between the causes of individual cases and the drivers of population-level incidence. In his example, the causes of two individuals having hypertension or not is different than the drivers of the systolic blood pressure distribution in London civil servants or Kenyan nomads. The reasons behind this difference lie not in the characteristics of individuals, but in the characteristics of populations, in what he terms "mass influences acting on the population as a whole" (Rose, 1985). In this article, we look at two of these key influences: the urbanization process and area-level socioeconomic features.

8.1.3.2 How does urbanization and social inequity affect health?

To understand how these processes drive the differential distribution of health outcomes by city or neighborhood, we turn to the framework outlined by Diez-Roux (2020a, 2020b). Under this framework, we can illustrate the links between cities or neighborhoods and health through four different conceptualizations: (1) places as contexts for health, (2) places as causes of health, (3) places as modifiers, and (4) places as systems. The framework shown in **Figure 2**, developed by the Salud Urbana en America Latina (SALURBAL) study, outlines some of these links and pathways, and provides a comprehensive look at the different ways in which places, both cities and neighborhoods, can affect health and health inequities (Diez Roux et al., 2018).

Figure 2 ***Conceptual model of key drivers of urban health, equity, and sustainability, from the SALURBAL study***

Source: From Diez-Roux et al, 2018 (CC-BY 4.0 License).



The first of these, places as contexts in which health occurs, results from the description of health outcomes in terms of place, in terms of the environment where the population is (Diez-Roux, 2020a, 2020b). Most of the examples shown in the historical section above and a number of the results in the case studies we will describe later in this article, try to conceptualize the effects of place on health by describing how health outcomes vary according to context (city or neighborhood). For example, the simple description that the life expectancy of areas of London (Cheshire, 2012) or Baltimore (Baltimore City Health Department, 2017) vary by over 20 years is a powerful description in itself, but it also justifies looking at factors that may be driving these differences.

The second conceptualization, of places as causes of health, tries to shift the paradigm from individual-level causes of disease (e.g., genetics, lifestyle behaviors) toward contextual factors (physical and social environments) (Diez-Roux, 2020a, 2020b). Under this conceptualization, there are two key aspects to consider: composition and context. On the one side, given the strong segregation patterns that occur in cities (both socioeconomic and racial/ethnic), if certain populations, such as people that live in poverty, are segregated into specific areas, we may observe worse health outcomes in those areas just because of their composition. On the other side, if these areas also get lower investments, lower access to resources, and increased exposure to toxic aspects such as air pollution, then the features of the area itself will drive worse health outcomes.

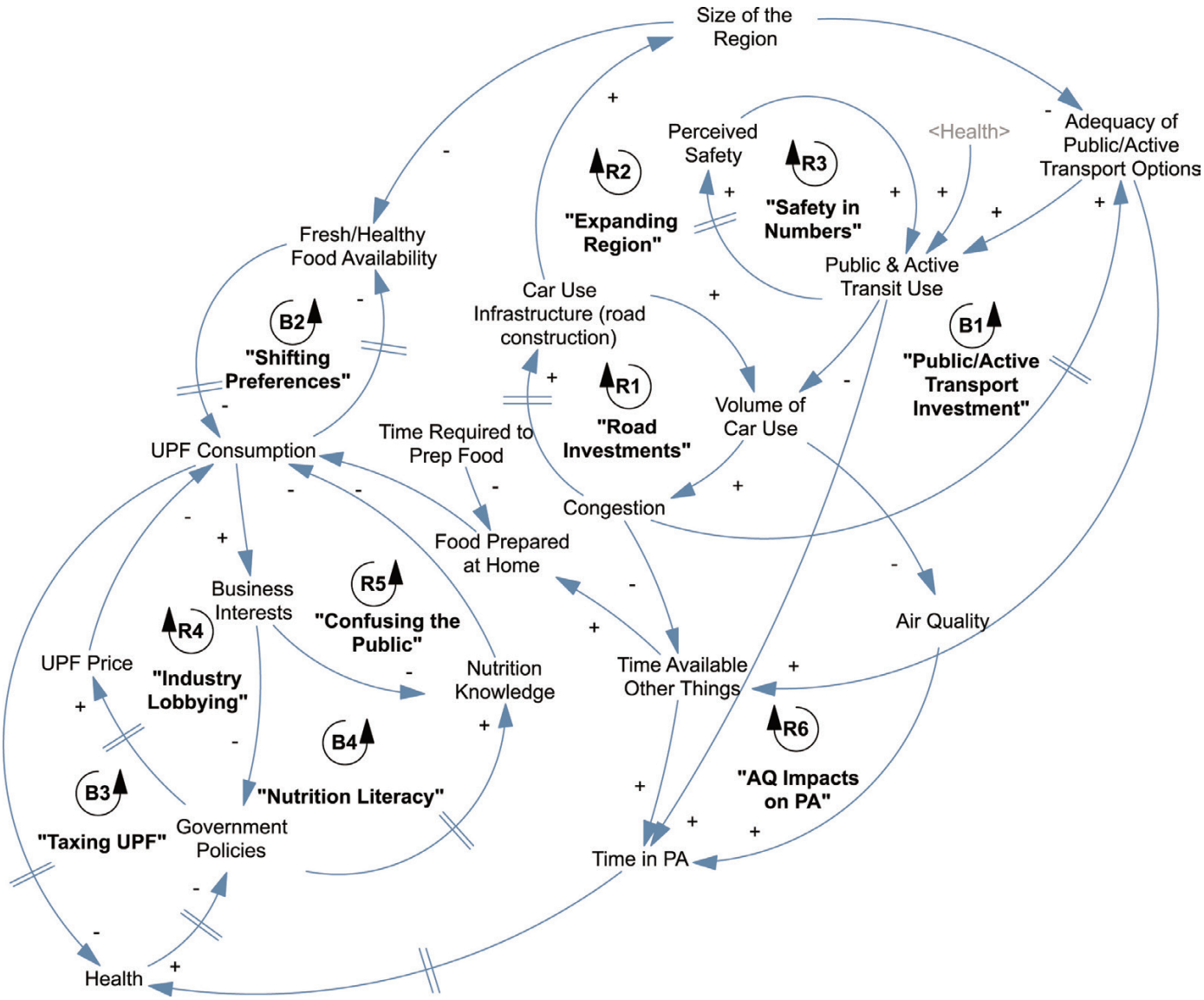
These two aspects are challenging to differentiate as they feed on each other. For example, disinvestments in an area may lead to the wealthier population of the area moving out, and the poorer population (with no other option) having to stay in, in a phenomenon known as differential neighborhood selection (Glass and Bilal, 2016; van Ham et al., 2012), leading to extreme neighborhood segregation. This is an example of places as effect modifiers of individual characteristics, the third conceptualization (Diez-Roux, 2020a, 2020b).

Last, we can also understand cities as complex systems that feature heterogeneous agents, acting at multiple levels, with strong interdependencies in social networks and a causal structure with feedback loops, where the actions of agents affect and are affected by other factors (Diez-Roux, 2020a, 2020b; Langellier et al., 2019).

For example, the causal loop diagram in **Figure 3**, produced in a workshop from the SALURBAL study, highlights how nutrition and physical activity in a city are affected by multiple factors and is part of a causal structure with numerous feedback loops (Langellier et al., 2019). For example, the feedback loop R3 (“safety in numbers”), may generate health inequities if there is a social gradient in public and active transit use that creates a social gradient in safety perceptions and that feedback again into public and active transit use.

Figure 3 ***Synthesis causal loop diagram of the system that influences food behaviors and transport, based on community-based workshops organized by the SALURBAL study***

Source: From Langellier et al. 2019 (CC-BY 4.0 License).



While these conceptualizations are useful to understanding the effects of cities and urbanization on health, and help in understanding some aspects of health inequities in cities, we also want to introduce two extra concepts that provide additional clarity in terms of urban health inequities: differential exposures and differential vulnerabilities (Diderichsen et al., 2018). Under this framework, health inequities are generated through increased exposure to noxious factors (or decreased exposure to health-promoting factors) by disadvantaged groups and through an increased vulnerability to the effects of these factors in the same groups (Diderichsen et al., 2018). For example, someone of low socioeconomic status (SES) may be exposed to increased advertisement for smoking (Brown-Johnson et al., 2014) but may also be more vulnerable to the effects of this marketing, as they have increased occupational stress levels, which may increase the likelihood of smoking (Kouvonen et al., 2005). At the contextual level, someone living in an area with higher deprivation may be exposed to higher availability of unhealthy foods (Franco et al., 2009; Franco et al., 2008), while their lower income complicates access to healthier foods (Drewnowski and Eichelsdoerfer, 2010). These aspects may act independently or concurrently, generating health inequities in the process (Diderichsen et al., 2018).

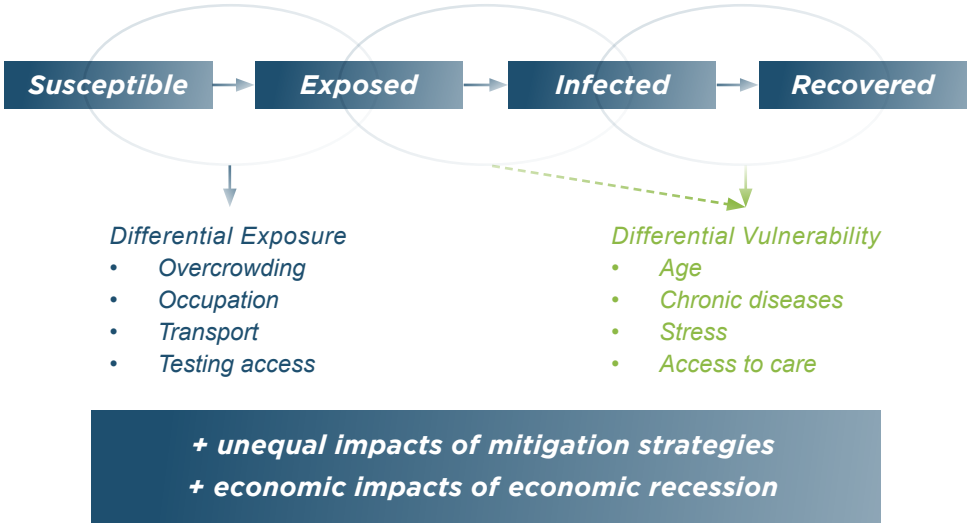
The collection of social factors that drive these differences in exposure and vulnerability are collectively known as the social determinants of health (SDOH). These are the conditions in which people are born, grow, live, and work (World Health Organization, 2012). The World Health Organization (WHO) and many more multilateral organizations have made repeated calls for action in tackling SDOH, urging countries to monitor these determinants and address the root causes of health inequities.

8.1.3.3 Framework to understand COVID-19 inequities

The framework of differential exposure and differential vulnerability can be very helpful to understanding inequities in COVID-19. In a subsequent section of this article, we show a case study of COVID-19 inequities in two large LAC cities (Santiago and Lima). To better understand and contextualize those results, here we introduce a framework to understand how inequities in COVID-19 emerge. This framework poses that observed inequities in COVID-19 outcomes (incidence, hospitalizations, and mortality, for example) are the result of two co-occurring phenomena: increased exposure to SARS-CoV-2 and increased vulnerability to the severe effect of COVID-19 (see **Figure 4**).

Figure 4 ***Framework outlining inequality generation points in COVID-19 outcomes***

Source: Prepared by the author



Differential exposure to SARS-CoV-2 occurs primarily in work, leisure, and household settings. On the one side, occupational exposure is clearly higher in health care (Eyre et al., 2020a). However, increased occupational exposure also occurs for other occupations that either serve the public directly (e.g., grocery stores, bars, and restaurants) or have overcrowded conditions (e.g., meatpacking, kitchens) (Dyal, 2020; Furuse et al., 2020). Even within similar work settings, there may still be differences in exposure. For example, janitorial personnel in hospitals have a much higher exposure rate to COVID-19 as compared to medical personnel (Eyre et al., 2020b). Within households, overcrowding and water access may also be important factors. For example, the neighborhoods with the highest overcrowding rates in Chicago, New York City, and Philadelphia in the United States, have the highest incidence rates (Bilal et al., 2021c). Lack of water may also hinder prevention efforts by making hand hygiene difficult. For example, the Iztapalapa delegation of Mexico City had some of the highest COVID-19 rates and a much lower rate of connection to the water network (Franco et al., 2020). Another aspect that may drive differential exposure to SARS-CoV-2 are difficulties in accessing testing. Considering the social patterning of testing in cities of the United States (Rader et al., 2020), and the limited access to testing in many LAC countries, we expect that testing will follow the same social gradients as other factors in LAC cities.

Differential vulnerability to severe COVID-19 is higher in older ages and in people with prevalent chronic diseases (Williamson et al., 2020). For example, cardiometabolic conditions such as diabetes, hypertension, and prevalent cardiovascular disease, along with respiratory and liver disease, are associated with higher mortality after infection (Williamson et al., 2020). Given the strong social patterning of most chronic conditions, we then expect higher vulnerability to severe COVID-19 in these same groups. Differential vulnerability to COVID-19 may also emerge if access to care is socially patterned too. Given the fragmentation of health care systems in some countries of the region, with existing social gradients in access both to any care and to good quality care (Barraza-Lloréns et al., 2013; Garcia-Subirats et al., 2014; Neelsen and O'Donnell, 2017; Wagstaff et al., 2015), increased loads during the pandemic may have led to a worsening of care for the most vulnerable populations.

In the following two sections, we present two case studies as applications of these frameworks. First, we expand on a previously published case study of spatial inequities in life expectancy in six large LAC cities. Second, we specifically explore excess mortality from COVID-19 in Santiago and Lima and describe associations with area-level socioeconomic factors.

8.1.4 Case Study: Inequities in mortality within six large cities

8.1.4.1 Introduction

As we have mentioned repeatedly in this article, the LAC region is characterized by very wide social inequalities, with some of the most unequal countries worldwide being in Latin America (World Bank Group, 2018). These social inequalities generate inequalities in health through some of the processes we mentioned in the Framework section, including the segregation of more disadvantaged individuals into specific areas of the city, which in turn may have worse living conditions, and which in turn may also drive worse health outcomes (Diez-Roux, 2020a, 2020b). While this spatial segregation of individuals has been better characterized in high-income countries (Williams and Collins, 2016), there's scant evidence on their existence and magnitude for LAC cities.

In 2019, we compiled data from the SALURBAL study to describe differences in life expectancy at birth within six large LAC cities: Buenos Aires (Argentina), Belo Horizonte (Brazil), Santiago (Chile), San Jose (Costa Rica), Mexico City (Mexico), and Panama City (Panama) (Bilal et al., 2019). Here, we present a more in-depth characterization of these results.

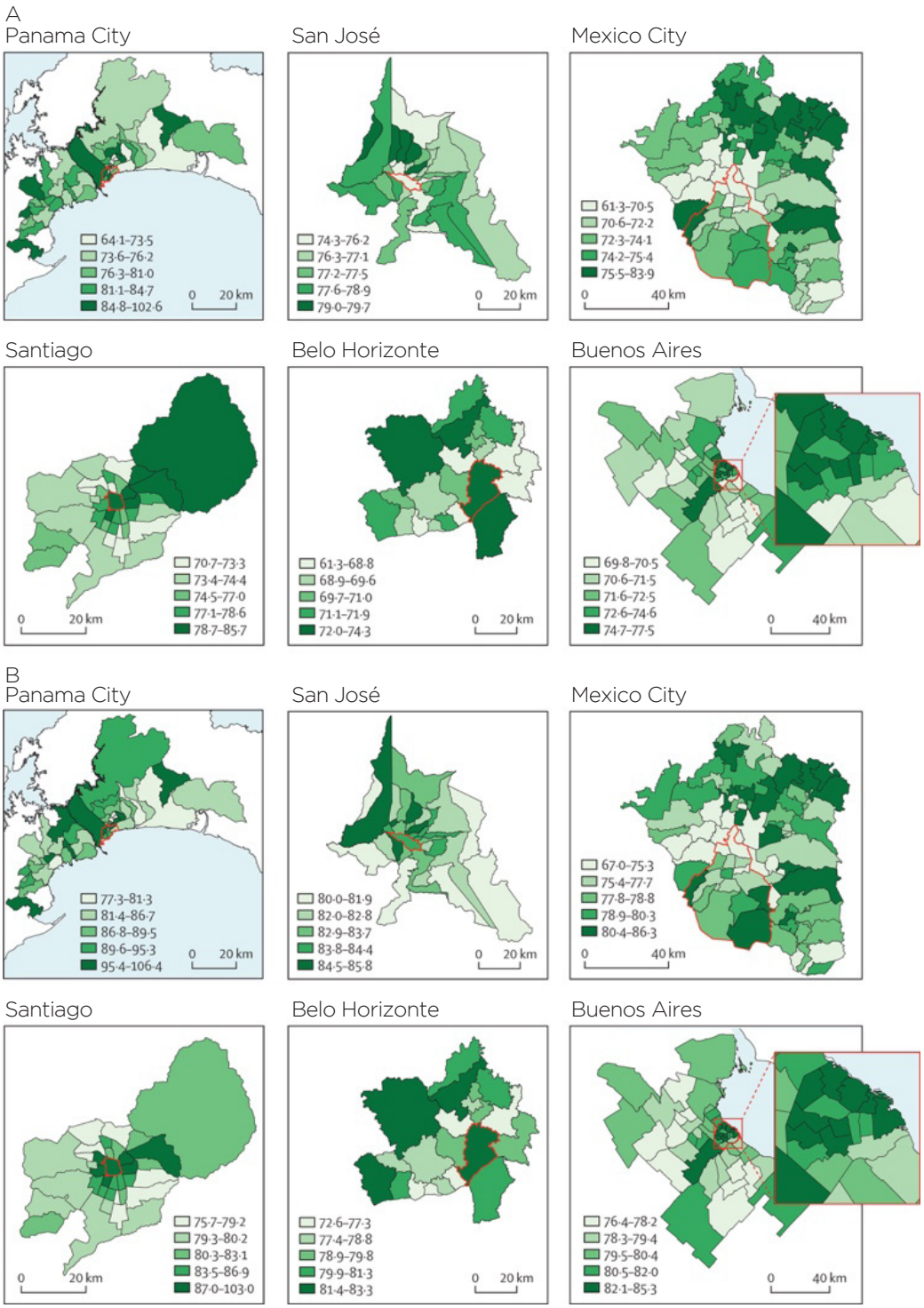
Specifically, we look at spatial inequities in age-adjusted and age-specific mortality and look for associations between these levels and an expanded number of social environment factors. For a methodological account of the data and methods used in this study, we refer readers to the original manuscript (Bilal et al., 2019).

8.1.4.2 Results

In the original results, we described very wide inequities in the life expectancy of small areas of these six cities, especially in Santiago de Chile and Panama City. We also showed the spatial patterning of life expectancy, which mirrored other social stratification patterns, such as a core-periphery pattern in Buenos Aires, or a higher life expectancy in a Northeastern cone of Santiago de Chile (see **Figure 5**).

Figure 5 ***Spatial distribution of life expectancy at birth among men (top panels) and women (bottom panels) in six large cities of Latin America***

Source: From Bilal et al., 2019 (CC-BY 4.0 License).



In **Figure 6**, we show the variability in age-adjusted rates within each city. We find that mortality is higher among men, as compared to women, and that there is wide variability within each city, especially in Panama and Santiago, while this variability was narrower in San Jose. In **Table 1**, we show the relative disparity in age-adjusted mortality rates in areas with high (defined as the 90th percentile) vs low (defined as the 10th percentile) mortality. We found that Panama City, Santiago, and Buenos Aires had the widest inequities in mortality, with the areas with the highest mortality in these cities having around 50 to 60 percent higher mortality than the ones with the lowest mortality, in the case of men, and 30 to 50 percent in the case of women. For the other three cities, these inequities were narrower.

Figure 6

Age-adjusted mortality rates in areas of six large cities of Latin America

Note: Mortality standardized to the WHO 2000–2025 population. Data and methods available in Bilal et al. (2019).

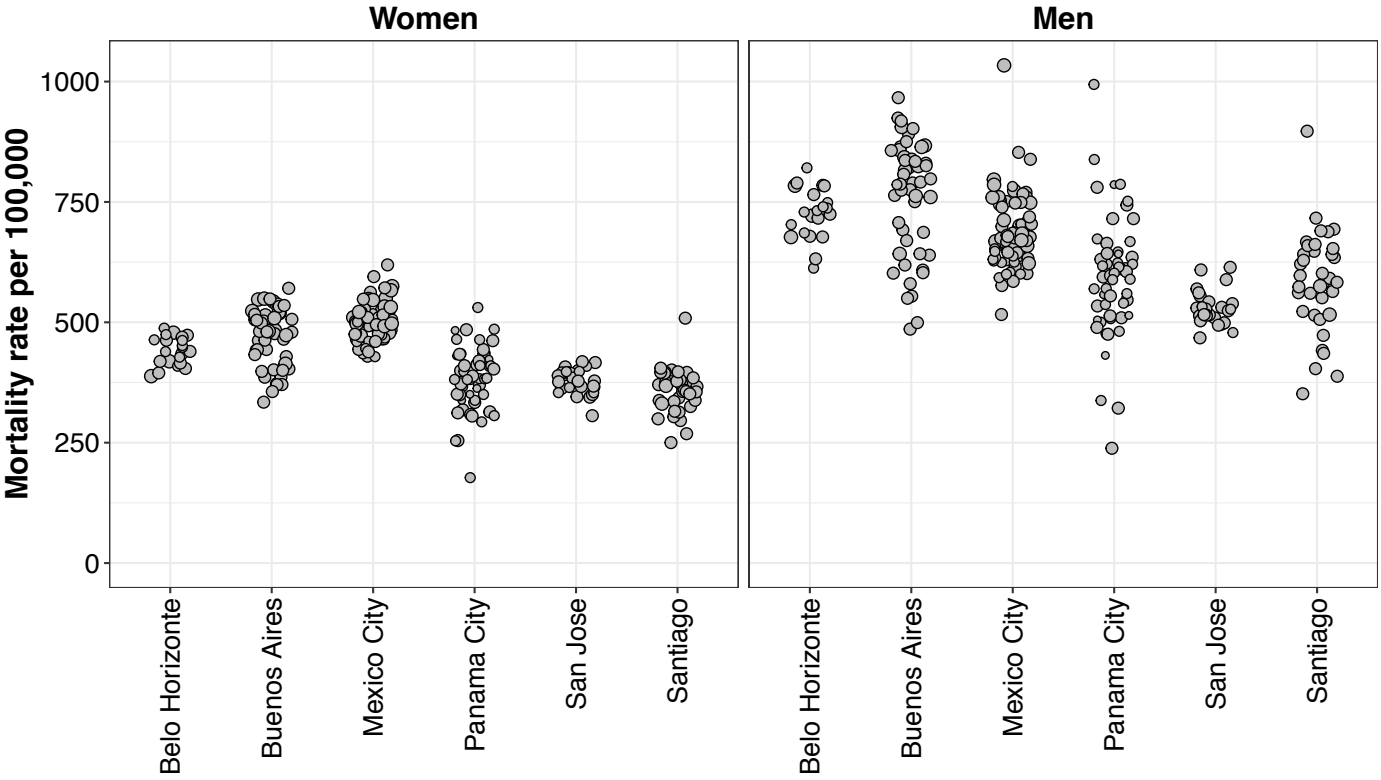


Table 1

Within-city relative differences in age-adjusted mortality per 100,000 population in six large LAC cities comparing areas with high vs low mortality

Source: Prepared by the author based on Bilal, U., et al., 2019

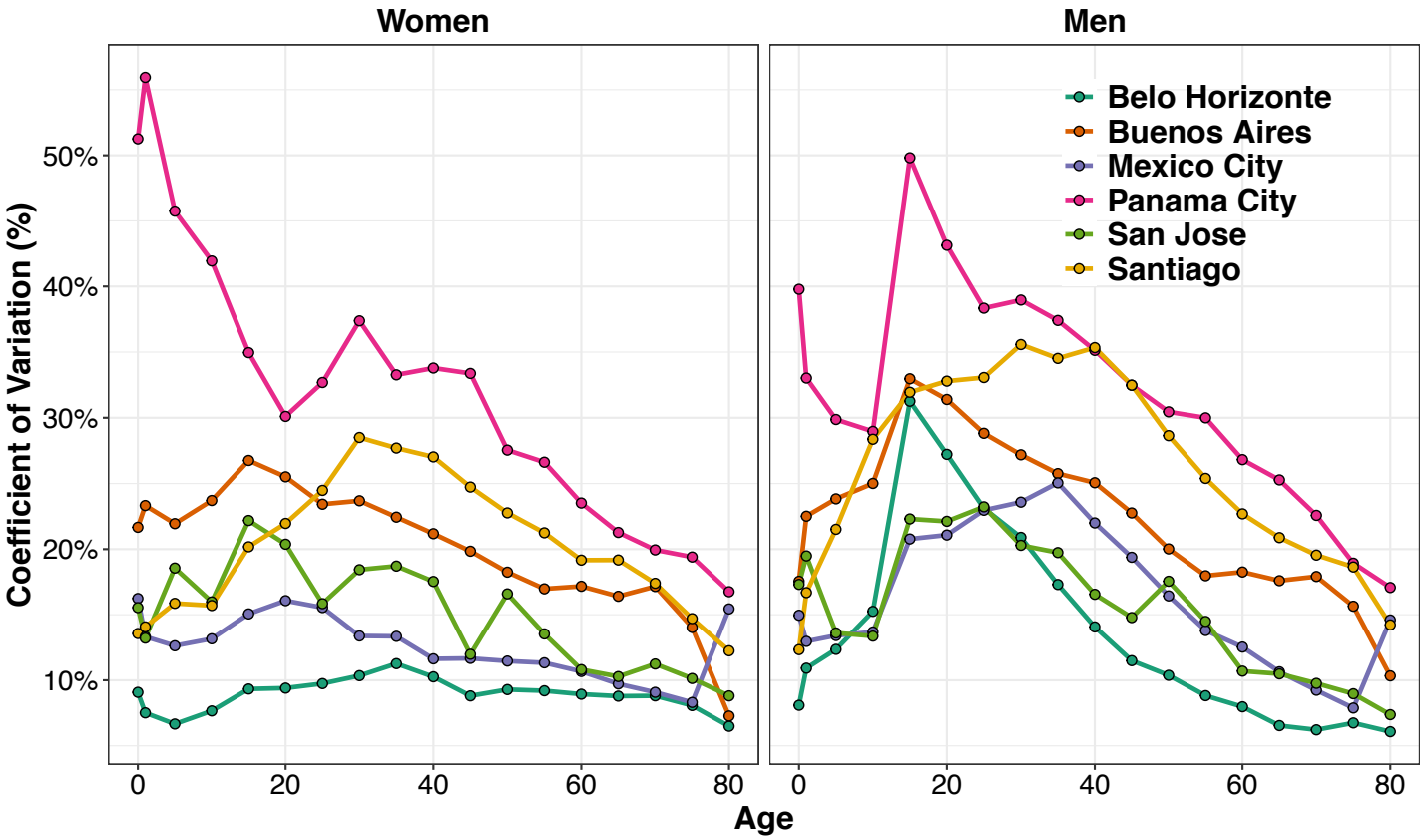
Note: Mortality adjusted using the WHO 2000–2025 standard population. Ratio is computed as the mortality rate in the 90th percentile (P90) over the mortality rate in the 10th percentile (P10). Cities are sorted by the average ratio between both sexes. Data and methods available elsewhere (Bilal et al., 2019).

City	*Men*	*Women*
Panama City	57%	51%
Santiago	57%	31%
Buenos Aires	48%	39%
Mexico City	28%	19%
San Jose	16%	17%
Belo Horizonte	16%	17%

In **Figure 7**, we show the variability in age-specific rates by city and sex. First, we find that in Panama City, there is a much higher variability at younger ages in both men and women. For example, the coefficient of variation comparing areas of Panama City to each other is above 30 percent for mortality rates in ages 20 or below in both genders, but this decreases over time, with coefficients of variation below 30 percent for all ages above 50. Given the importance of mortality at younger ages in determining longevity, gaining a better understanding of what is driving these differences may help reduce inequities in mortality for Panama. For all the other cities, we observe a much wider variability in mortality rates for young adults, especially men ages 15 through 39. These age groups also happen to be the most affected age groups in terms of violence.

Figure 7 ***Variation in age-adjusted mortality rates in six large LAC cities, by age***

Note: Mortality standardized to the WHO 2000–2025 population. Data and methods available in Bilal et al. (2019). Coefficient of variation calculated as sd(mortality rate)/mean(mortality rate).



In **Figures 8 and 9**, we graphically display the correlations between the proportion of people with a high school diploma (secondary education) or above and the proportion of households living in overcrowded situations (more than three people per room) versus the age-adjusted mortality rate per 100,000. First, we found an overall pattern in most cities of higher mortality in areas with lower levels of educational attainment or higher levels of housing overcrowding. However, this correlation was weaker in Mexico City and San Jose.

Figure 8

Association of age-adjusted mortality per 100,000 population for women and men with educational attainment in six large Latin American cities

Note: Mortality standardized to the WHO 2000–2025 population. Data and methods available in Bilal et al. (2019).

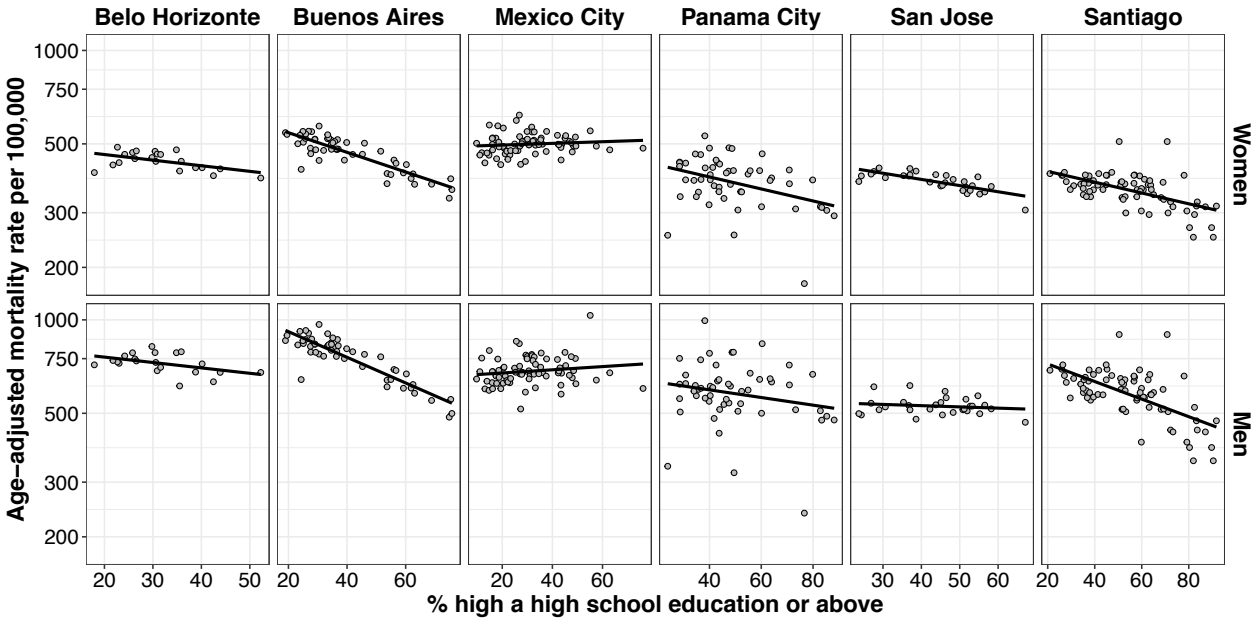
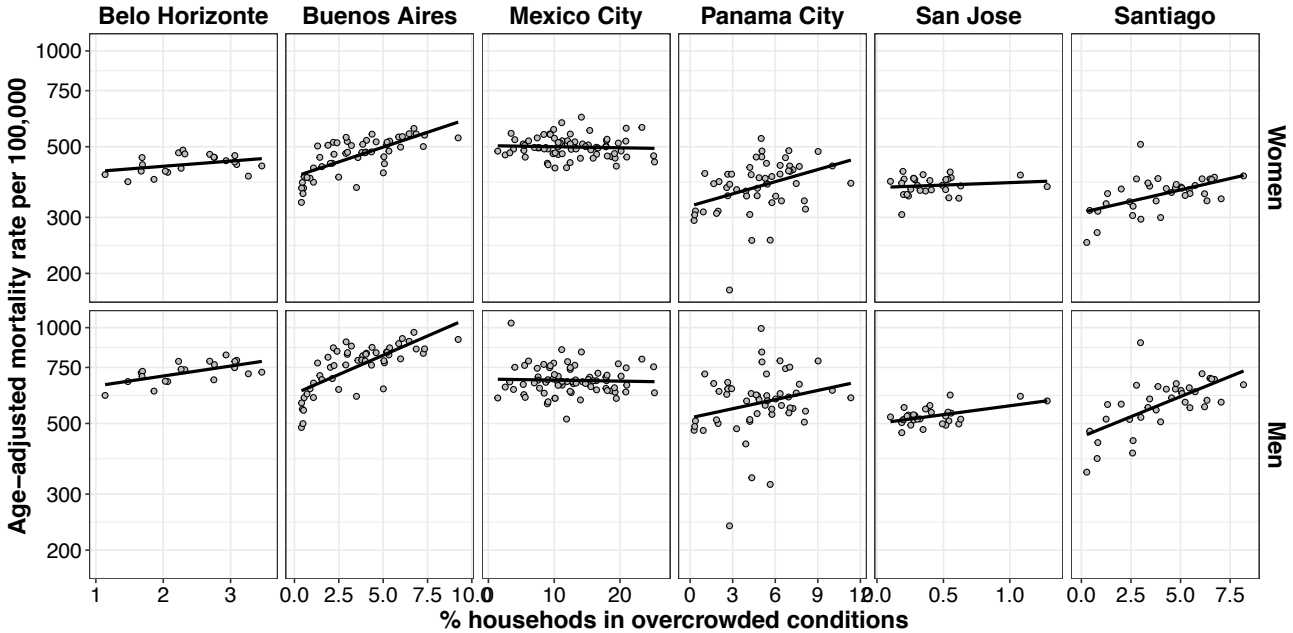


Figure 9

Association of age-adjusted mortality per 100,000 population for women and men with housing overcrowding in six large Latin American cities

Note: Mortality standardized to the WHO 2000–2025 population. Data and methods available in Bilal et al. (2019).



8.1.4.3 Conclusion

In this case study, we have expanded on our previous research describing the wide inequities in life expectancy at birth in Buenos Aires, Belo Horizonte, Mexico City, San Jose, Panama City, and Santiago. We found a wide variability in age-adjusted and age-specific mortality, which was, in most cases, especially notable for deaths in men ages 15–39. We also found strong associations with social environment factors, including educational attainment and housing overcrowding.

While other studies have reported this for cities in high-income countries (Cheshire, 2012; Dwyer-Lindgren et al., 2017; Hunt et al., 2015; Jonker et al., 2013), to our knowledge this was the first time that spatial variations in life expectancy were described in LAC cities. Our results were similar to a previous study in Buenos Aires that showed similar gradients in age-adjusted and cause-specific mortality (Diez Roux et al., 2007). However, results across settings are challenging to compare given the different spatial units, outcomes, and temporal scopes of all studies.

The heterogeneity in our results, with some cities having narrower or wider socioeconomic gradients, may be due to four potential factors. First, overall levels of segregation are vary widely by city (Sabatini, 2006), making this a plausible explanation for narrower disparities in cities with lower segregation. Second, there may also be weaker socioeconomic gradients in some countries for other structural reasons, as has been shown in Costa Rica and Mexico (Rosero-Bixby, 2018; Rosero-Bixby and Dow, 2016). For example, in Costa Rica, there's a much weaker social gradient in mortality compared to other Latin American countries (Rosero-Bixby and Dow, 2016). In fact, this lack of a strong social gradient has been proposed as a reason why Costa Rican levels of mortality are better than the United States, with much higher health expenditures and GDP (Rosero-Bixby and Dow, 2016).

Third, there are differences in the measurement of socioeconomic status. However, measures in this study were harmonized using the IPUMS international recode (Jeffers et al., 2017), and we found consistent associations across indicators as shown in Figures 8 and 9. Fourth, there are differences in the quality of mortality registration, as shown elsewhere (Adair and Lopez, 2018; Palloni and Pinto-Aguirre, 2011; Peralta et al., 2019). Understanding these heterogeneities at the city level is a future area of research, as having a good ascertainment of the quality of vital registration systems is key.

In summary, we have expanded over our previously examined case study of life expectancy inequities in six large cities of Latin America, resulting in three key findings.

First, while mortality and life expectancy are highly variable within cities, this variability is heterogeneous. For example, the ratio of mortality between areas with high vs low mortality was 57 percent/51 percent in Panama City and 16 percent/17 percent in San Jose, in men and women, respectively. Second, mortality among young adults contributes meaningfully to this variability, indicating a potential role for violence in these inequities. And third, socioeconomic gradients in mortality are consistent across two example indicators but are weaker in some cities (San Jose and Mexico City).

However, the COVID-19 pandemic has caused enormous changes to population health worldwide. While some people have called COVID-19 the "great equalizer," as previous sections have shown we expect wide inequalities to emerge given differential exposure to SARS-CoV-2 and differential vulnerability to severe COVID-19. In the following section, we examine how these inequities have been amplified during the COVID-19 pandemic.

Mexico City, Mexico

8.1.5 Emerging inequities during the COVID-19 pandemic in Santiago and Lima

8.1.5.1 Introduction and methods

As of March 2022, COVID-19 had killed more than 6 million people worldwide (Dong et al., 2020), and the LAC region has arguably been the most affected region worldwide, with some of the countries with the highest mortality rates per 100,000 (Dong et al., 2020). As we have mentioned before, Latin America (LA) is highly urbanized and has wide health inequities (Bilal et al., 2019; Bilal et al., 2021b).

Here, we explore whether these pre-existing inequities are continuing during the COVID-19 pandemic, and whether their magnitude is stable or is being amplified by the pandemic. Policymakers in the region have expressed skepticism regarding the existence of COVID-19 inequities (Basoalto and Silva, 2020). Since wide inequities in COVID-19 have been reported in cities in high income countries, including Spain and the United States (Agencia de Salut Publica de Barcelona, 2020; American Public Media Research Lab Staff, 2020; Berkowitz et al., 2020; Bilal et al., 2021c; Rentsch et al., 2020), we find it plausible that these inequities will also exist in LA cities.

To explore this, we used daily mortality data for the *comunas* and *distritos* of Santiago de Chile and Lima (Peru) and show patterns in excess mortality compared to previous years, along with associations with socioeconomic factors as obtained from the 2017 census in each country. Excess mortality is defined as the difference between observed mortality in 2020 versus what would have been expected in 2020 had previous years patterns held constant during 2020. In other words, we compute a baseline mortality rate based on previous years, and compared that to what actually was observed in 2020. Had the pandemic not occurred, we would have expected our observed rate in 2020 to be similar to previous years.

For Santiago, we use data from the 36 comunas that make up the Gran Santiago region, while for Lima we use data from the 50 distritos that make up the Lima Metropolitana region. For each comuna or distrito, we compare the total number of deaths from January through December 31, 2020, to the average number of deaths in the same period in 2017–19 and compute a measure of relative excess mortality (mortality in 2020/mortality in 2017–2019). Data for Santiago come from the Department of Statistics and Health Information (DEIS) of the Ministry of Health of Chile, and data for Lima come from the Sistema Informático Nacional de Defunciones (SINADEF) by the Ministry of Health in Peru. Then, we used data from the 2017 census in each country to derive indicators of the percentage of the population ages 25 or above with university education and the percentage of the households living in overcrowded situations (more than three people per room or 2.5 people per bedroom).

8.1.5.2 Results

Figures 10 and 11 show the association between excess mortality and the socioeconomic indicators for Santiago and Lima, respectively. There is a clear association, with higher levels of education and lower levels of overcrowding strongly associated with excess mortality. Specifically for Lima, the areas with the highest levels of educational attainment (proxied by the percentage of the population ages 25 or above who completed university education) had 70 percent lower excess mortality as compared to the areas with the lowest levels of educational attainment. In Santiago, this association was similar but narrower in magnitude, with the difference in excess mortality between areas with the highest versus lowest levels of educational attainment being around 17 percent. Part of this difference may be due to excess mortality having been much higher in Lima (or Peru in general) as compared to Santiago (or Chile in general), which magnifies differences between areas.

We also explored correlations with percentage of overcrowded households. We found that areas with the highest levels of overcrowding, as compared to areas with the lowest levels of overcrowding, had 94 percent higher excess mortality in Lima and 16 percent higher excess mortality in Santiago.

Figure 10 Association of excess mortality in 2020 (as compared to 2017–19) with educational attainment and overcrowding in distritos of Santiago (Chile)

Source: Prepared by the author based on 2017 Census.
Note: Education and overcrowding data come from the 2017 census.

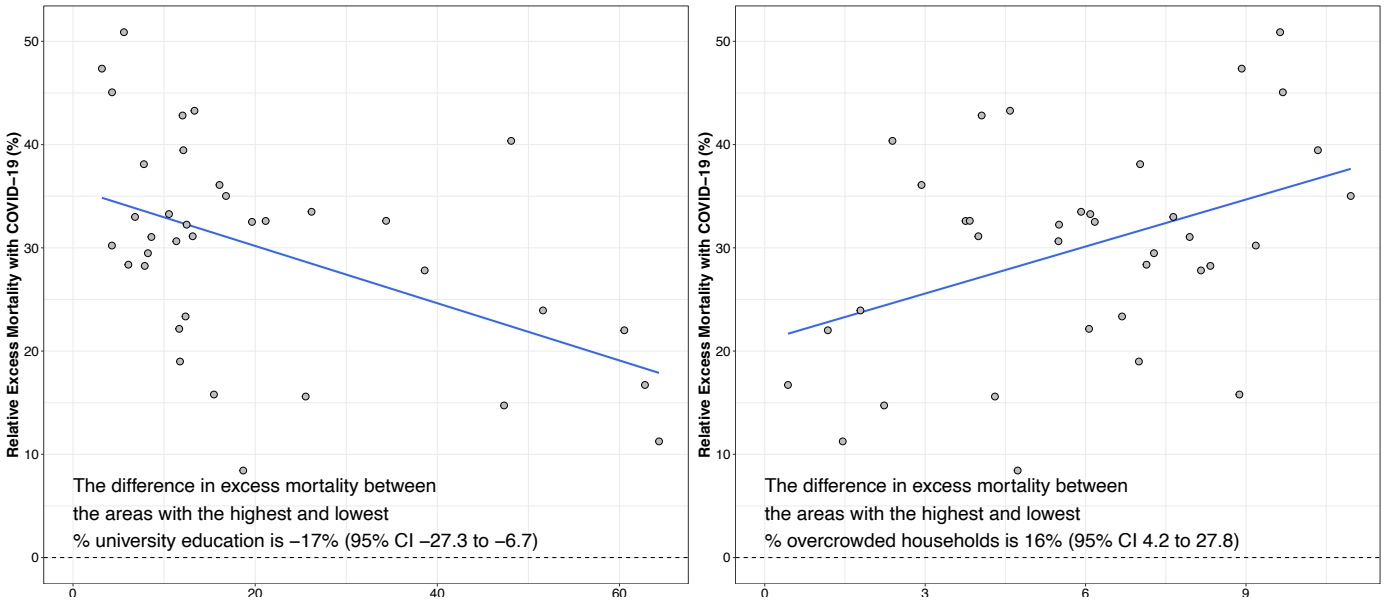
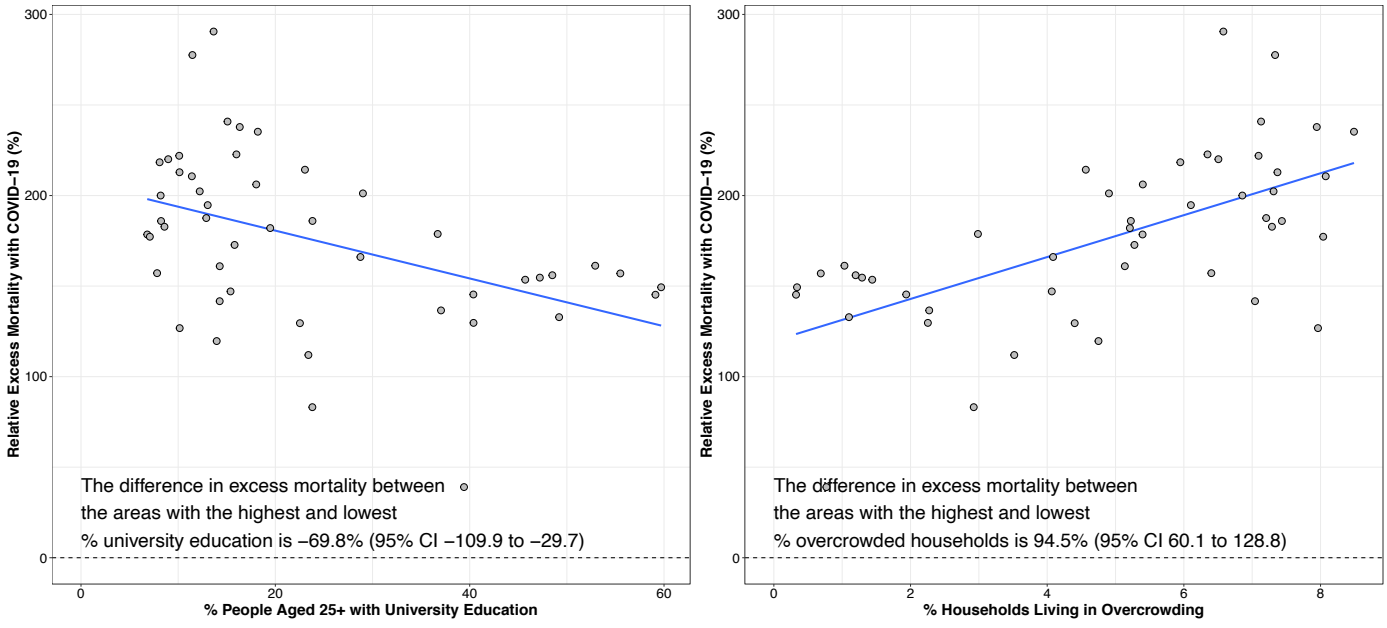


Figure 11 Association of excess mortality in 2020 (as compared to 2017–19) with educational attainment and overcrowding in distritos of Lima (Peru)

Source: Prepared by the author based on 2017 Census.
Note: Education and overcrowding data come from the 2017 census.



8.1.5.3 Conclusion

In this case study of excess mortality in Santiago (Chile) and Lima (Peru), we found a wide heterogeneity in the impact of the COVID-19 pandemic by area in each city. While the heterogeneity was wider in Lima, we also found significant social gradients in Santiago. We previously reported a widening of inequalities in Santiago with the COVID-19 pandemic (Bilal et al., 2021a), which is confirmed by these current results, meaning that the inequities we described in the first case study (Bilal et al., 2019) will most likely be wider for 2020.

Potential causes of this excess mortality during the COVID-19 pandemic in areas with lower educational attainment or higher overcrowding may be due to differences in exposure to SARS-CoV-2 (Berkowitz et al., 2020), differences in the underlying vulnerability to COVID-19 because of increased prevalence of chronic diseases (Raifman and Raifman, 2020), or differences in the treatment of the disease. For example, there is a strong social patterning of cardiovascular disease, hypertension, and diabetes in Chile (Ortiz et al., 2020), while this transition into higher prevalence of chronic diseases for people of lower SES is still underway in Peru (Quispe et al., 2016).

In summary, we have shown that during the COVID-19 pandemic, mortality has increased more in areas of lower SES in Santiago and Lima. In the following section, we highlight some strategies to reduce health inequities in cities.

8.1.6 Interventions to mitigate health inequities

The two case studies have highlighted the complex network of factors that give rise to health inequities in urban settings. To mitigate these inequities, we propose the following three-pronged approach, first described by Diez Roux (2020b). First is increasing awareness of the existence of these inequities. Initial research on the case study highlighting COVID-19 inequalities in Lima and Santiago was driven by a statement by the Minister of Health of Chile that there were no inequalities in COVID-19 mortality in Chile (Bilal et al., 2021a). Second is targeting interventions toward specific areas and groups. In our exploration of inequalities in mortality across six large LAC cities, we found wide inequities within these cities, with the areas with the highest mortality having up to 57 percent higher mortality as compared to those with low mortality. These inequities were concentrated among young adults (especially for men), pointing to the importance of targeting these populations with preventive interventions. Third and last is addressing fundamental causes of health inequities. As both case studies showed, there is a very strong and universal link between the SDOH (educational attainment, sanitation, housing, employment) and mortality, both before and during the COVID-19 pandemic.

8.1.6.1 Raising awareness and changing the narrative

One of the first steps toward the mitigation of health inequities is having a precise description of their existence and magnitude. For example, research conducted among health commissioners and mayors of US cities has shown that lack of data on health inequities, which leads to lack of awareness on their existence, is a barrier to enacting and implementing policies that mitigate these inequities (Purtle et al., 2018). Other descriptions of health inequities have been used as advocacy tools, including a description of life expectancy inequities in London (Cheshire, 2012). Similarly, during the 2015 municipal elections in Madrid, several of the candidates for the mayoralty commented on the existence and reasons behind inequities in life expectancy between neighborhoods of the city, receiving extensive media coverage (Grasso et al., 2015). As outlined above, our work reporting the widening of health inequities in Santiago (Chile) during the COVID-19 pandemic was motivated by statements from health officials that negated the existence of COVID-19-related health inequities in Chile (Bilal et al., 2021a). Placing health inequalities at the center of the political discourse can influence advocacy efforts and support multisectoral policies needed to address them (see the next two sections).

A second important aspect of raising awareness relates to the quality and granularity of the data. In the case of LAC cities, two specific aspects are of importance. First, some countries in the region, such as Peru, have vital registration systems with deficient coverage of all deaths. This phenomenon of undercounting, which may be differential by SES, may obscure the description of health inequities or make difficult the exploration of associations with socioeconomic factors (Peralta et al., 2019; Peralta et al., 2020). While we applied demographic methods to correct this issue in the first case study involving six large LAC cities (and assumed consistent coverage from 2017 to 2020 in the second case study), we cannot rule out that these corrections have been potentially incomplete. Second, there is limited availability of data at granular levels of geography. Both of our case studies described above use data at the municipality level (*comunas, distritos, cantones, partidos*, etc.), which may be adequate for large cities with large numbers of these units but may hide heterogeneity within these areas. The SALURBAL study (Diez Roux et al., 2019; Quistberg et al., 2019) is currently exploring smaller area (census tract or similar) estimates of life expectancy using geocoded mortality, allowing for a better characterization of spatial inequities within cities of several sizes.

8.1.6.2 Targeting of interventions

One way of intervening to reduce health inequities includes improving living conditions in underserved areas. Slum upgrading programs, including comprehensive neighborhood interventions and specific focused interventions, can improve living conditions and reduce health inequities (Diez-Roux, 2020b; Henson et al., 2020; Lein et al., 2019). In a review of slum upgrading programs, researchers from the SALURBAL study found evaluations for 13 programs, most in Latin America (Henson et al., 2020). The authors found some positive effects of the interventions, although these depended on the context and specific health outcome. Here, we highlight two types of interventions: comprehensive neighborhood interventions and transportation improvements.

The Vila viva program in Belo Horizonte (Brazil), was a set of interventions designed to recover and upgrade precarious settlements in the city (Friche et al., 2015; Lein et al., 2019). It included a set of physical recovery interventions, including improving the roadway system, public lighting, green areas, and other urban equipment, a set of interventions designed to improve sanitation, housing interventions, legalization of the settlements by providing land tenure, and social development interventions (Friche et al., 2015; Lein et al., 2019). A preliminary evaluation of the effects of this intervention found a decline in mortality rates during the study period compared to a control area and the rest of the city (Friche et al., 2015). In a more recent example, the SALURBAL study is evaluating the effects of the regeneration of public housing in Santiago and in Viña del Mar (Chile), through a project called RUCAS (*Regeneracion Urbana, Calidad de Vida, y Salud*, or Urban Regeneration, Quality of Life, and Health) (Lein et al., 2019; SALURBAL, 2020). This project is using mixed methods to assess changes in quality of life and health outcomes after the interventions are completed.

Interventions regarding transportation have also been tested in Latin America. In 2004, the city of Medellin (Colombia) implemented a cable car (Metrocable) that connected an impoverished neighborhood with the downtown areas, where most people had to commute for work, drastically reducing commute times. In an analysis published in 2012 (Cerda et al., 2012), the authors compared this neighborhood to control neighborhoods that were similar on every respect except for the intervention. After the intervention, homicide rates and perceived violence were lower for the entire city but were significantly reduced in the intervention neighborhoods especially. For example, the homicide rate in the neighborhoods served by the Metrocable was reduced by 66 percent more than in comparable neighborhoods (Cerda et al., 2012). The SALURBAL study is evaluating a similar intervention in Bogota (Colombia), where a cable car (TransMiCable) is connecting impoverished neighborhoods with downtown areas. This evaluation is part of a project known as TrUST (*Transformaciones Urbanas y Salud: el caso de TransMiCable en Bogota*, or Urban Transformations and Health: The case of TransMiCable in Bogota) (Sarmiento et al., 2020). This evaluation goes beyond the usual health outcomes (e.g., physical activity), and includes individual measures of exposure to air pollution, commute times, and a mixed methods assessment of the perceptions of neighbors regarding the changes in their neighborhood (Sarmiento et al., 2020).

8.1.6.3 Addressing fundamental causes

A final set of interventions include addressing fundamental causes of health inequities. Fundamental causes are social resources (wealth, education, race privilege, etc.) that shape health inequities, regardless of the health outcome under study (Link and Phelan, 1995; Riley, 2020). The distribution of these resources is shaped by societal arrangements that act as mass influences (Rose, 1985), driving population health outcomes for different social groups (Riley, 2020). Addressing these fundamental causes may prove the most challenging of all these interventions but may also have the largest consequences. In fact, the Centers for Disease Control and Prevention (CDC) in the United States considers addressing socioeconomic factors as the most impactful (and challenging) strategy to improve public health (Frieden, 2010). In a comprehensive review by Thornton et al. (2016), the authors classify these potential interventions on the SDOH into five different categories: (1) education and early childhood, (2) urban planning and community development, (3) housing, (4) income enhancements and supplements, and (5) employment (Thornton et al., 2016).

One of these aspects, beyond the urban planning and housing interventions we mentioned before, where research has been abundant in Latin America is on the effect of conditional cash transfers on social and health inequities. For example, the Bolsa Familia program of Brazil (Neves et al., 2020; Soares et al., 2010), a conditional cash transfer program, has the potential to reduce health inequities (Bernal et al., 2019; Neves et al., 2020), including in outcomes that affect youth (Guanais, 2015; Machado et al., 2019), and has been shown to reduce poverty levels (Alves and Escorel, 2013) but not intergenerational poverty (Neves et al., 2020). Other challenges remain (Soares et al., 2010), including oral health (Calvasina et al., 2018) and nutrition inequities (Neves et al., 2020), along with the potential discretionality in its eligibility (Eiró, 2019). In a comparative study of several conditional cash transfer programs in Latin America, researchers found a wide heterogeneity in the implementation and features of these programs in Brazil, Mexico, Colombia, and Ecuador, and subsequently on both their reach (Robles et al., 2019) and their effects on poverty and health (Millán et al., 2019; Soares et al., 2010).

There are also other interventions that may reduce inequalities beyond the ones outlined above. For example, interventions in specific areas of health care and health care systems have been shown to improve health equity in the United States (Purnell et al., 2016), while the expansion of primary health care access in Brazil has been found to be associated with reduced inequities in the use of screening programs (Mullachery et al., 2020). There are also interventions that go further upstream. For example, in an analysis of data from Brazilian municipalities, having more women in politics was associated with declines in under-five mortality, partially through improvements in primary health care and income redistribution programs (Hessel et al., 2020).

8.1.7 Conclusion

There seems to be a clear consensus that health equity is within the fundamental purview of public health.

The Pan American Health Organization (PAHO) strategic plan for 2020–2025 has placed health equity at the "heart of health," highlighting that progress has been slow in closing health equity gaps (PAHO, 2019). The Centers for Disease Control and Prevention in the United States have also recently updated the 10 essential public health services, placing equity at the center of public health (Centers for Disease Control and Prevention, 2020).

In this article, we have reviewed the importance of measuring health inequities within cities in Latin America. We have outlined a framework to understand these inequities, with a specific application to COVID-19. We also describe two case studies, one looking at inequities in life expectancy and mortality within six large cities, and another looking at excess mortality with the COVID-19 pandemic in two cities. Last, and derived from these case studies, we closed with some interventions that may help mitigate these inequities. The health care system, both through private and public provision, can act both to widen or narrow these inequities (Mullachery et al., 2020). Third-sector and other nongovernmental organizations may also play key roles in the mitigation of inequities (Kolker and Carroll-Scott, 2020), including through direct service provision, but also through advocacy. Partnerships between these organizations and academic institutions can help provide the necessary evidence to advocate for specific actions that may help in achieving health equity. We live in an urban world that is highly unequal, and this is especially true for Latin America. Achieving health equity should therefore be a primary goal of national and local governments in the region.

KEY FINDINGS

The Sustainable Development Goals have placed a strong emphasis on improving health and reducing inequities.

This chapter summarizes the importance of studying health and health inequities in cities of Latin America.

We provide a summary of historical studies and frameworks to understand health inequities in urban areas.

We then outline two case studies focused on examining several inequities in mortality across several large Latin American cities. Finally, we highlight potential interventions that may help mitigate these inequities.

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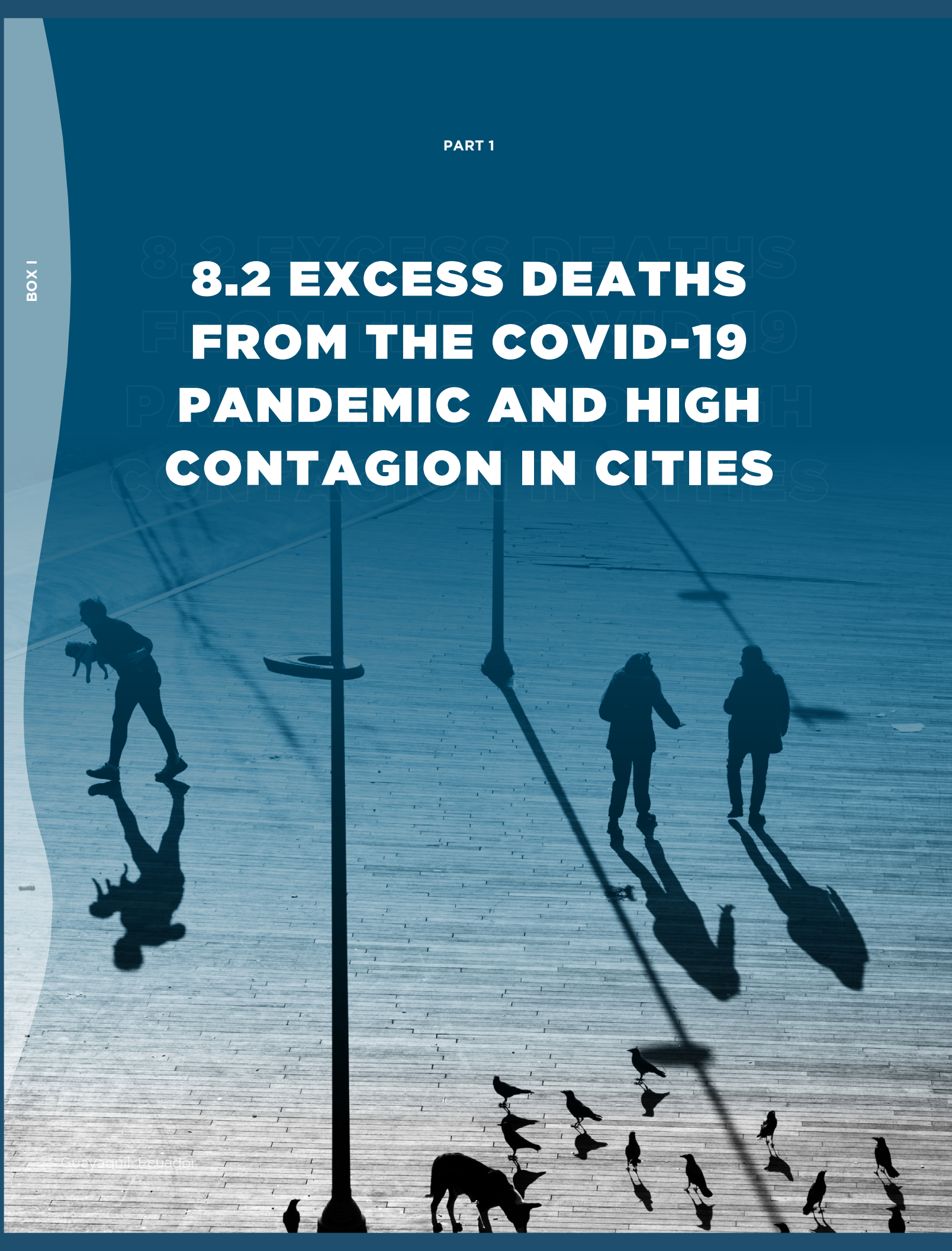
BOX I

8.2 EXCESS DEATHS FROM THE COVID-19 PANDEMIC AND HIGH CONTAGION IN CITIES



Guayaquil, Ecuador

8.2 Box 1: Excess Deaths from the COVID-19 Pandemic and High Contagion in Cities

Ana María Ibáñez, IDB (VPS/VPS) ***Norbert Schady, WB***

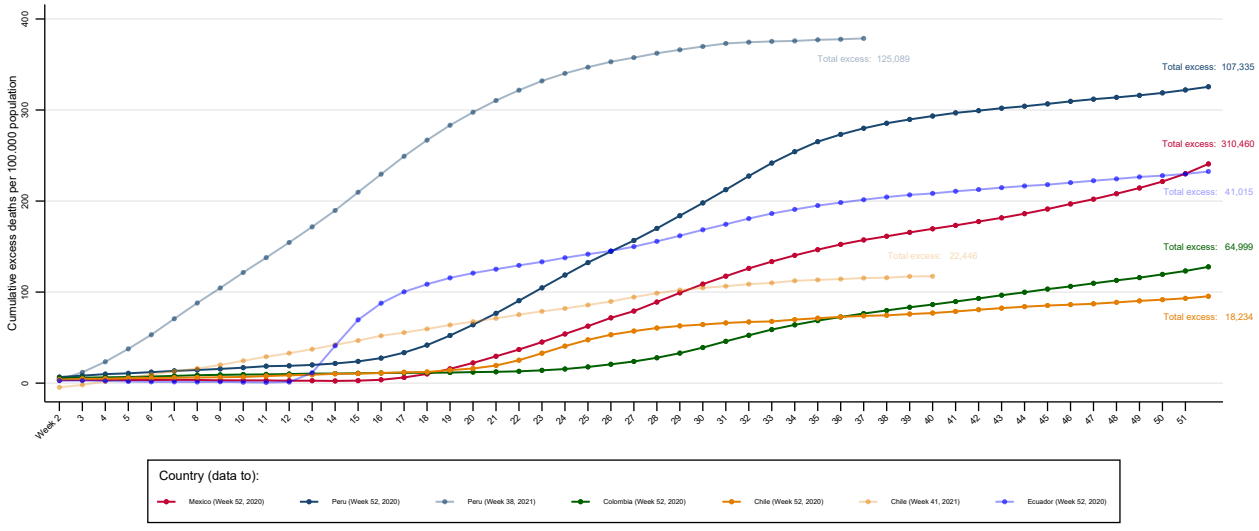
The COVID-19 pandemic affected Latin America and the Caribbean (LAC) more strongly than other regions.

As of early March 2022, more than 1.6 million people had died in the region, which is equivalent to about a third of the total deaths from COVID-19 in the world despite only hosting 8.4 percent of the world population. This figure is also a lower bound on the true number of deaths. The difficulties in registering deaths from COVID-19, especially at the beginning of the pandemic, and the drop in health care visits for other diseases because of the saturation of the system mean that the impact could be even greater.

Estimating how many deaths the pandemic caused and in which population groups it was concentrated makes it possible to measure its real impact, focus mitigation policies on the most affected groups, and implement policies to prevent the impacts of a future pandemic. Ibáñez, Schady, and Ortega (2022) address these two questions for five countries in the region: Chile, Colombia, Ecuador, Mexico, and Peru.

The total number of deaths from COVID-19 was significantly higher than those reported in official statistics. The actual number of deaths is estimated by comparing the weekly excess deaths during 2020 and 2021 against the weekly average deaths between 2017 and 2019. **Figure 12** illustrates the cumulative excess deaths in the five countries for 2020 and for Chile and Peru in 2021, as well as the rate per 100,000 inhabitants. For 2020, the accumulated excess deaths in the five countries was 542,043, that is, 1.7 times more than the figures reported in official statistics as deaths from COVID-19, with high heterogeneity among the five countries. In Colombia it was 1.03 times as high, while in Ecuador it was 2.9 times as high.

Figure 12 ***Accumulated excess deaths 2020 and 2021 (total and rate per 100,000 inhabitants)***



Source: SINADEF, Secretaría de Salud del Gobierno de México Estadísticas Vitales (DANE), Instituto Nacional de Estadística (INE), INEC, DGEC, World Bank Population estimates and projections (2020).
Epidemiological week 1 excluded as it represents a partial week. Last update: December 20th, 2021

How were the excess deaths distributed by population groups? Adults over 65 years of age are especially vulnerable to the effects of COVID-19 and were, therefore, its main victims. **Table 2** shows that, for the cumulative excess deaths in 2020, the death rate for those over 65 years of age was between 4.3 and 9.4 percent for Peru and Ecuador, respectively. Although the number of deaths was proportionally higher for adults older than 65 years, the risk of death increased much more in other age groups. For example, the probability of death for people between 25 and 39 years old increased between 11.2 and 57.4 percent for Chile and Peru, respectively. This causes a significant loss of human capital as these age groups participate more in labor markets and are in their most productive working years.

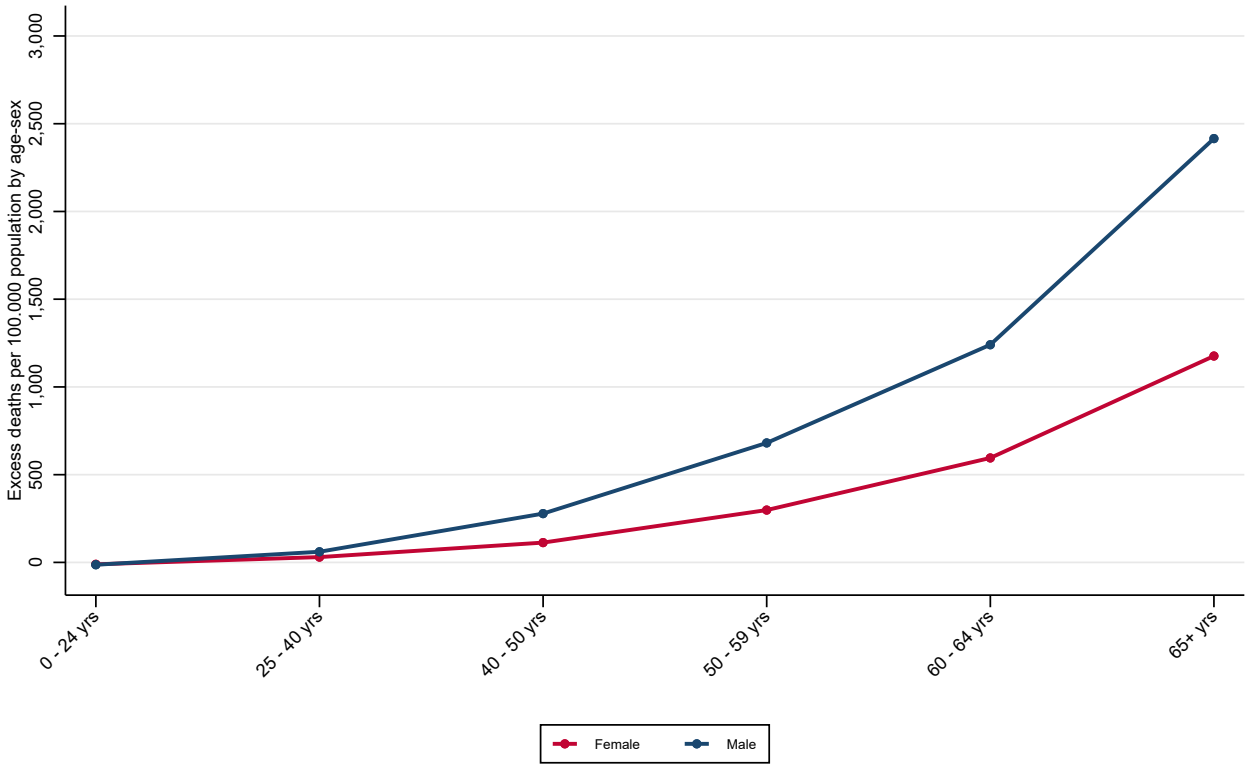
Table 2 **Death rate and change in risk of death by age group**

	Chile		Colombia		México		Perú		Ecuador	
	Deaths as share of age group population	Change in the probability of death	Deaths as share of age group population	Change in the probability of death	Deaths as share of age group population	Change in the probability of death	Deaths as share of age group population	Change in the probability of death	Deaths as share of age group population	Change in the probability of death
Age groups:										
0 - 24 years of age	0.05%	-13.35%	0.1%	-2.5%	0.09%	-11.53%	0.07%	-4.45%	0.13%	-13.3%
25 - 39 years of age	0.11%	11.21%	0.1%	36.0%	0.23%	24.79%	0.12%	57.34%	0.21%	39.2%
40 - 49 years of age	0.22%	13.22%	0.2%	41.7%	0.53%	56.10%	0.33%	117.01%	0.52%	79.8%
50 - 59 years of age	0.52%	16.57%	0.6%	41.3%	1.14%	72.47%	0.81%	159.19%	1.36%	102.6%
60 - 64 years of age	1.12%	26.28%	1.2%	46.1%	2.07%	76.87%	1.54%	184.33%	2.90%	122.0%
65+ years of age	4.61%	17.58%	4.7%	30.5%	5.77%	42.97%	4.30%	99.72%	9.38%	69.6%

All data for 2020. Epidemiological week 1 excluded as it represents partial weeks. Source: SINADEF, Secretaría de Salud del Gobierno de México, Estadísticas Vitales (DANE), Instituto Nacional de Estadistica (INE), Instituto Nacional de Estadística y Censos de Ecuador (INE), National Censuses of Colombia, Chile, Peru, Ecuador, El Salvador and Mexico. Last update: Dic 20th, 2021.

Men died in greater proportions. This happened in all five study countries and was particularly pronounced for Ecuador, Mexico, and Peru. **Figure 13** illustrates the case of Mexico in 2020. Up to the age range of 25 to 39 years, the rate of excess deaths per 100,000 inhabitants is similar between men and women. From the age range of 40 to 49 years, the gap in the risk of death between men and women widens in such a way that the risk of death for men over 65 years is more than double that for women.

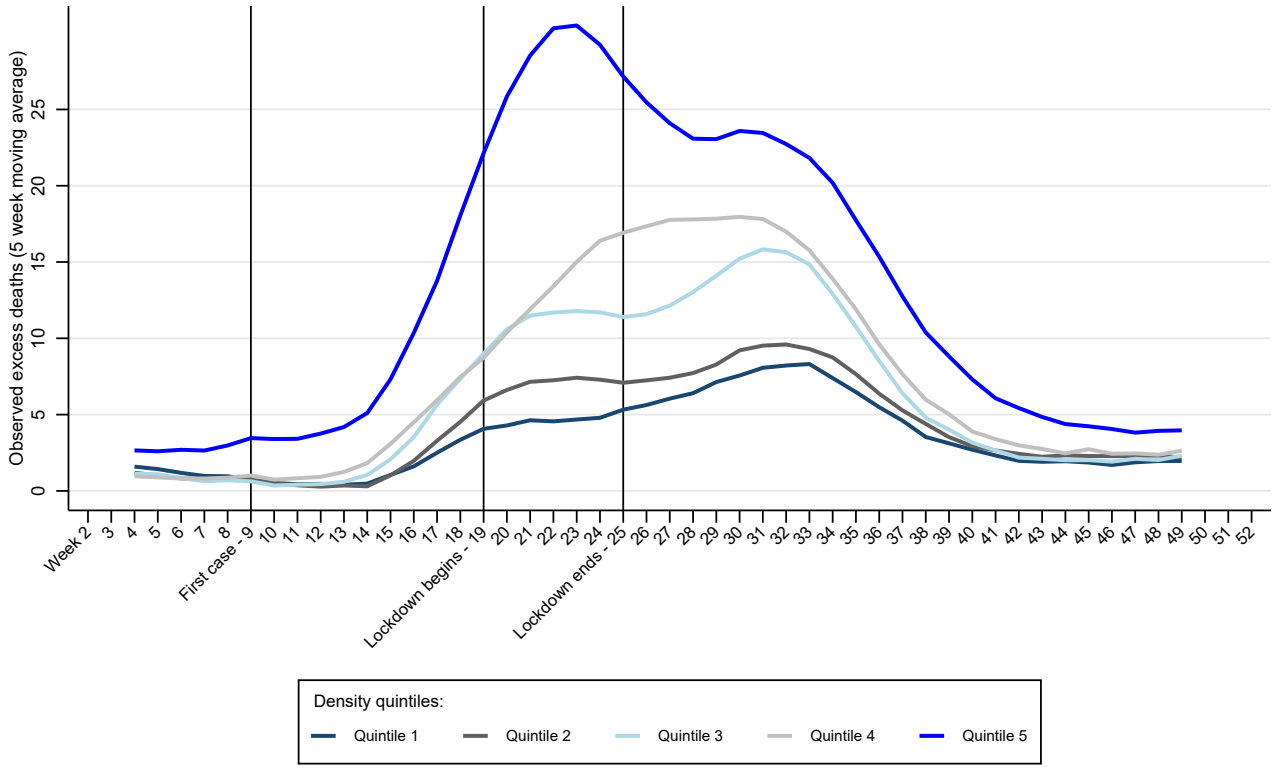
Figure 13 **Mexico, 2020: Rate of excess deaths per 100,000 inhabitants by sex**



Source: Secretaría de Salud, Gobierno de México. Last update: February 2nd, 2021. Epidemiological week 1 excluded as it represents a partial week. Week 51: December 13th to 19th 2020.

A high percentage of deaths were concentrated in cities. The presence of international airports facilitated contagion in the initial weeks of the pandemic. Once the pandemic had reached the countries, the high density of large cities, overcrowding in informal neighborhoods, and high labor informality that made it difficult to comply with social distancing rules contributed to the rapid spread of the virus. Guayaquil and Lima were two dramatic examples of the rapid spread of the virus and the high number of deaths it caused. The excess death rates were much higher in the most densely populated cities of the five countries, as can be seen in **Figure 14**, which shows the evolution of the weekly excess death rate for 2020 in Peru divided by quintile of population density. This dynamic was particularly pronounced for Peru, Ecuador, and Mexico.

Figure 14 ***Peru, 2020: Weekly excess death rate by population density quintile***



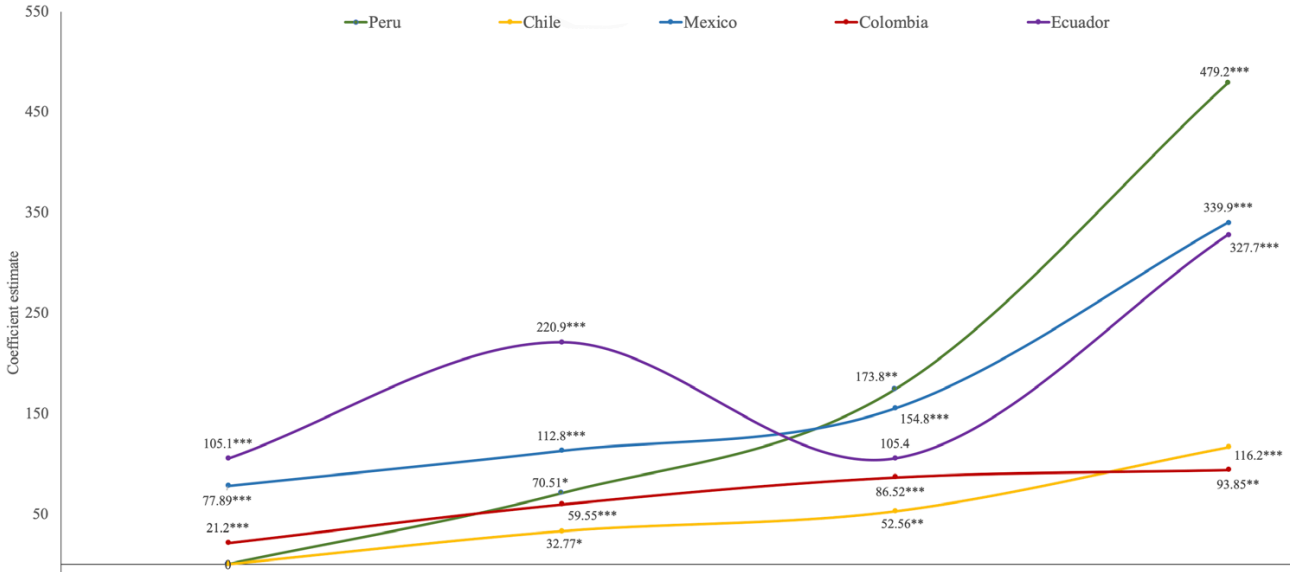
Source: SINADEF and Census. Last update: January 8th, 2021. Epidemiological week 1 excluded as it represents a partial week.
Week 52: December 27th 2020 to January 2nd 2021. Non-violent deaths only.
Density quintiles by population. Quintile 5 groups the districts with the highest ratio of population to square kilometers

Endnotes

The correlation between population density and excess deaths is also evident in **Figure 15**. This graph shows the correlation between the population density quintile and the rate of excess deaths per 100,000 inhabitants. Low population density, that is, municipalities located in quintiles one and two of population density, is associated to a lesser extent with excess deaths from COVID-19. Once population density increases, the association with excess deaths deepens, especially for those located in quintiles four and five. The graph illustrates a clear break in the slope for Peru, Mexico, and Ecuador for the municipalities in quintiles four and five of population density. In these countries, the correlation coefficient for excess deaths in quintile five of population density is 1.5, 3, and 6.8 times as large as for quintile three.

Figure 15 **Coefficient estimate for quintile by population density on rates of excess deaths**

Source: Prepared by the author based on SINADEF, Secretaría de Salud del Gobierno de México, Estadisticas Vitales (DANE), Instituto Nacional de Estadistica (INE), Instituto Nacional de Estadística y Censos de Ecuador (INE), National Censuses of Colombia, Chile, Peru, Ecuador, El Salvador and Mexico. Last update: Dec 20th, 2021.



PART 1

8.3 SPATIAL HEALTH INEQUALITY IN LATIN AMERICAN CITIES: MAGNITUDE, DRIVERS, AND POLICY ALTERNATIVES

Cusco, Perú

8.3 Spatial Health Inequality in Latin American Cities: Magnitude, Drivers, and Policy Alternatives

Juan Pablo Chauvin, IADB (RES\|RES)

Juliana Pinillos, University of Southern California

8.3.1 Abstract

Spatial health inequities are pervasive across and within Latin American cities. This article explores the magnitude of spatial inequalities in health outcomes, their drivers, and policies that can be deployed to address them. Life expectancy, the burden of noncommunicable diseases, and, more recently, the impact of COVID-19, all exhibit large geographic disparities. These variations are correlated with individual-level socioeconomic factors, such as low schooling levels and high poverty rates. Nevertheless, spatial health inequalities are not only a reflection of the residential clustering of vulnerable individuals. Local environments themselves can improve or further deteriorate their communities' public health outcomes. These include weather conditions, public utilities, recreational infrastructure, and externalities—notably air and noise pollution. The current evidence suggests that existing policy tools available to local and national governments can be effective in creating healthier built environments, reducing and preventing negative externalities, and promoting healthier lifestyles in cities and neighborhoods.

8.3.2 Introduction

There are large disparities in health outcomes across individuals in Latin America and the Caribbean. These are closely related to socioeconomic conditions. Individuals' education and income, for example, are tied to their ability to access health care services and make healthier lifestyle decisions.

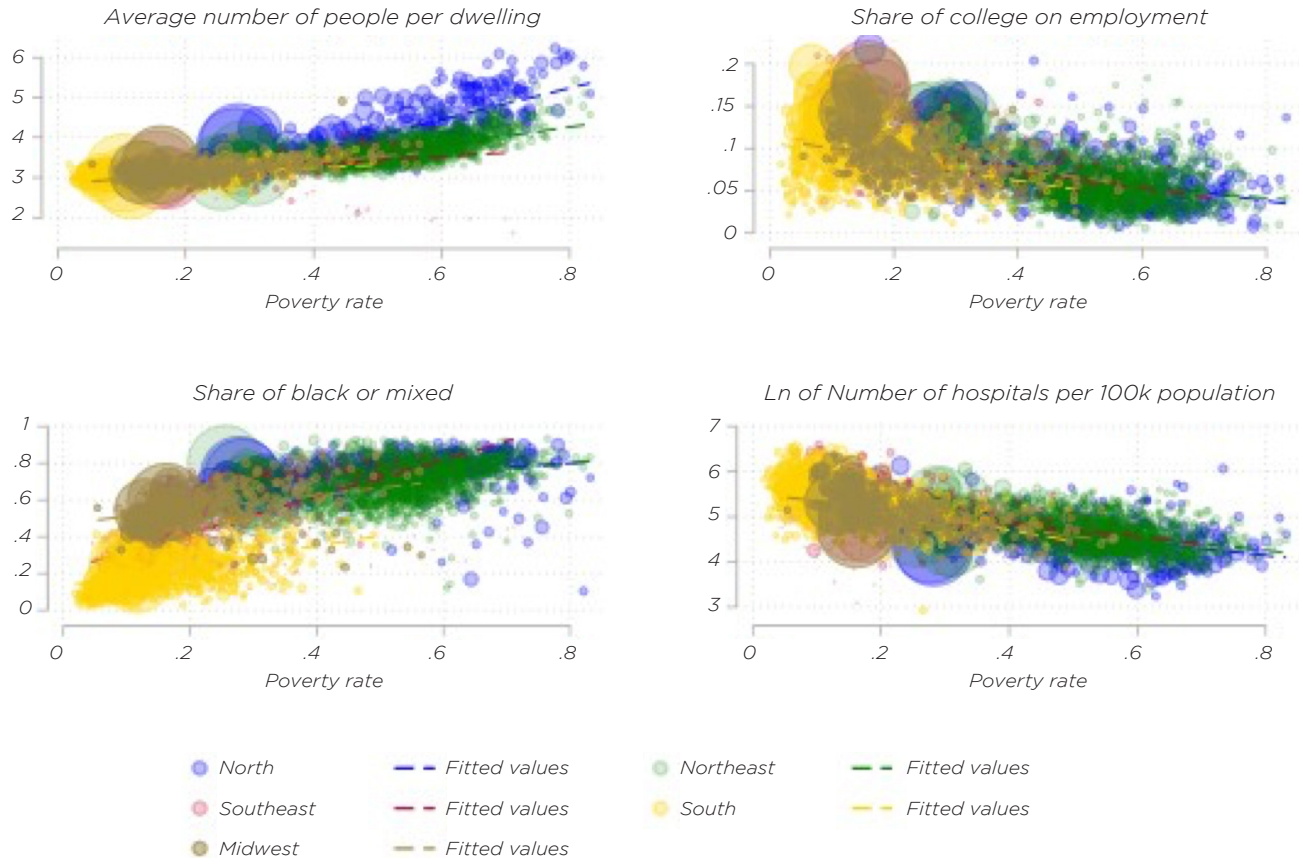
This, in turn, translates into diverging health care outcomes. For example, there is a higher probability of a person having at least two health risk factors (i.e., high cholesterol, hypertension) when that individual's education level is below secondary, relative to those with at least secondary education (Berlinski et al., 2020).

An important feature of these inequalities is that they have a clear spatial dimension. Health outcomes vary, often significantly, across cities and across neighborhoods of the same city. Part of this geographic variation is explained by the fact that people with similar socioeconomic characteristics tend to spatially cluster. This is illustrated in Figure 16, which shows some of the correlates of local poverty rates across Brazilian cities. Higher poverty rates tend to be associated with higher residential overcrowding (number of people per dwelling), lower shares of college in employment, and larger shares of ethnic minorities in the population, which Giuffrida (2007) has shown to be a good predictor of spatial disparities in health outcomes.

Please address related correspondence to juancha@iadb.org. *Nicolás Herrera L., Haydée Svab, and Julio Trecenti provided outstanding research assistance. The opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the Inter-American Development Bank, its Board of Directors, or the countries they represent.*

Figure 16 Correlates of poverty rate across cities in Brazil

Note: Authors' calculations using data of 3,762 Brazilian cities with population greater or equal to 5,000. 240 cities from North, 1,454 from Northeast, 1,042 from Southeast, 616 from South and, 295 from Midwest. Cities are weighted by population. Data from Chauvin (2021a).



Although the composition of the population of urban areas explains part of the observed heterogeneity in health outcomes across space, it does not fully account for all the observed variation. Spatial segregation itself can create and perpetuate health disparities. Low-income areas of cities frequently have limited access to key infrastructure such as drinking water, sewerage, and public transit. They also have reduced access to health services, as illustrated in Figure 16 (bottom right), which shows that poorer Brazilian cities tend to also have fewer hospitals per 100 thousand people. This exposes their population to unhealthy environments, leading to worse health outcomes relative to economically better-off areas. Spatial differences in the access to health care services is not the only problem that low-income areas face; the quality of it is also different. Within cities, spatial health inequality goes hand in hand with spatial socioeconomic inequality. Figure 17 provides an illustration showing some of the correlates of bad health quality, defined as the percentage of individuals that considered their health service as "bad" or "very bad" across sub-metropolitan geographic units in Bogotá, Colombia. A poor health service is a feature of areas of the city where there are also high levels of labor informality and high illiteracy rates—both variables associated with low income levels—as well as high residential overcrowding. On the other hand, even after controlling for individual characteristics such as education and income, and the way they affect self-selection into neighborhoods, there is still a significant relationship between health variables and the characteristics of the local environment. For example, using data from Italy, Bilger and Carrieri (2013) point out that people in neighborhoods with low environmental quality are more likely to suffer from chronic diseases. In Latin American cities, security perception and residing in a walkable neighborhood are related with high levels of physical and mental health, while street noise is negatively related with these outcomes (Gomez et al., 2020).

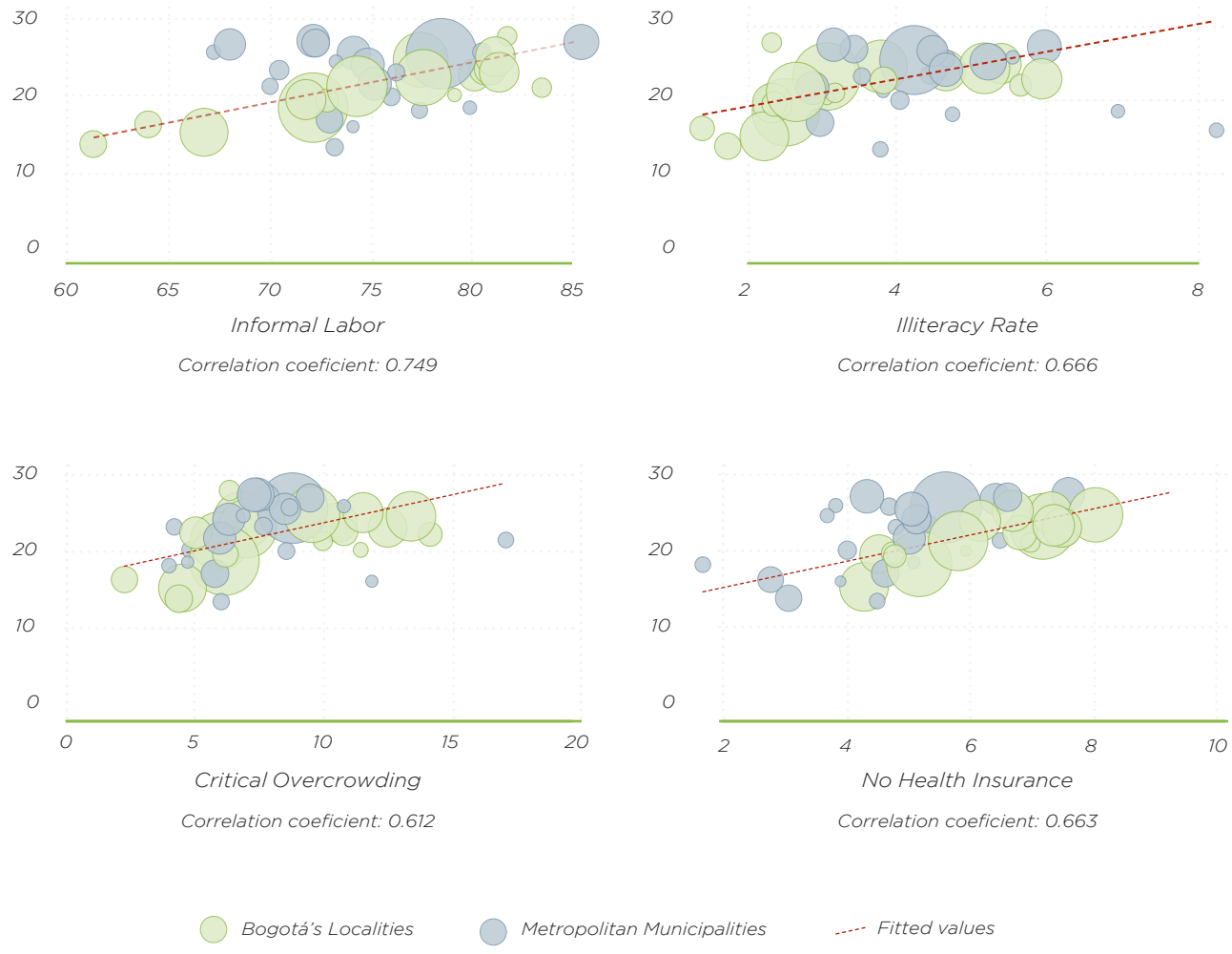
This article presents an overview of the existing evidence on three interrelated questions: How large are spatial inequalities in health outcomes? What are their key drivers? And what can public policy do about them?

Section 2 explores the magnitude of the variations in health outcomes across space (i.e., across cities and neighborhoods in multiple Latin American countries). Section 3 discusses the factors that could explain such urban differences. Section 4 reviews some of the most common implemented policies for addressing these disparities. Last, Section 5 concludes the discussion.

Figure 17

Bad health quality perception and socioeconomic characteristics across Bogotá's Metropolitan Area

Note: Bogotá's metropolitan area includes the 20 localities of Bogotá and 20 surrounding municipalities. Localities include 1922 neighborhoods. Localities and municipalities are weighted by population. Bad health quality is defined as the percentage of individuals that considered their health insurance service as "bad" or "very bad." Critical overcrowding is measured as those households with more than three people per room. People working in enterprises with up to five workers are considered part of the informal labor sector. For other details see DANE (2009, 1). Correlations are computed using data from the Multipropósito Survey (SDP, DANE, and Gobernación de Cundinamarca, 2017) and the 2018 National Census (DANE, 2018).



8.3.3 How large are spatial health disparities?

8.3.3.4 Health disparities across cities

Between 2000 and 2017, Latin America and the Caribbean experienced improvements across a broad range of health outcomes. Life expectancy increased by around four years, while under five-age mortality fell by 46 percent, and infant mortality by 35 percent (OECD/The World Bank, 2020).

Despite this progress, health inequalities persist across cities in the region. For instance, the burden of cardiovascular diseases such as hypertension (HTN) could be alarming for cities such as Buenos Aires (29 percent) but substantially lower in others, like Quito (9 percent) (Hernández-Hernández et al., 2010). Although this may reflect differences in culture and diets between these two countries, national-level data suggest that Argentina's hypertension—32.34 percent—(Díaz and Ferrante, 2015) is not drastically different from Ecuador's—37.2 percent—(Ministerio de Salud Pública, 2019). A closer look suggests that within the same country, there are also remarkable differences across cities. For example, in Argentina the HTN prevalence in La Plata is 32.7 percent but it could reach up to 39.8 percent in General Bengrano (Carbajal, 2013).

In a similar way, overweight in the population ages 0–19 (according to the definition of the International Obesity Task Force, IOTF) is roughly 3.5 times as high in Tijuana, Mexico that in Ouro Preto, Brazil (Rivera et al., 2014). While there are large disparities among cities of different countries, most of the observed spatial inequality in health outcomes appears to be driven by differences across cities of the same country. In a sample of 286 Latin American cities, for example, 57 percent of the variation in infant mortality rates is explained by within-country variation (Ortigoza et al., 2020).

8.3.3.4.1 Disparities in life expectancy

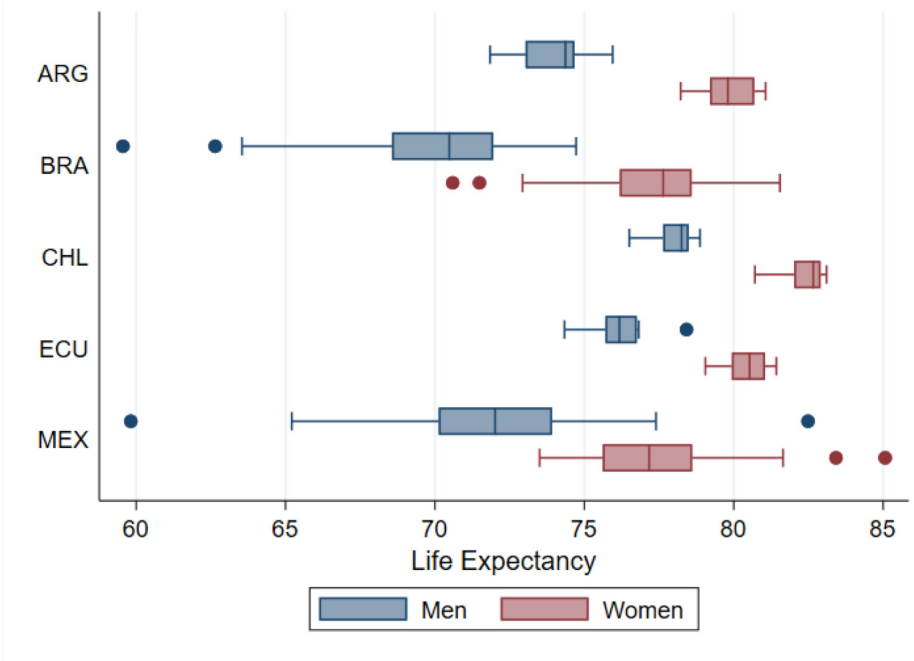
Spatial disparities in morbidity translate into spatial differences in life expectancy. Males have a six-year lower life expectancy in Mexico City than in Santiago, Chile. For females, the gap is of almost eight years (Bilal et al., 2019). In a recent study including urban areas from multiple countries in the region, Bilal et al. (2021a) found that the gap between the cities with the highest life expectancy (David City, in Panama) and the lowest life expectancy in their sample (Juliaca, in Peru), is around 8.3 years.

Figure 18 illustrates these differences by showing the cross-city distributions of gender- specific life expectancy in five countries in the region, using data from 188 cities with a population of at least 200,000. In all countries, females have a higher life expectancy than males, with an average gap of around seven years. The difference between the city with the highest and the lowest life expectancy within each country can be nearly three years for those countries with a more homogeneous life expectancy distribution (Argentina, Chile, and Ecuador), and even higher for other countries, where geographic inequalities tend to be more pronounced. For Mexican men, this difference is almost 23 years. Such disparity is 1.3 times the gap between Canada and Haiti, the top and bottom life-expectancy countries in the region (United Nations and Affairs, 2019). In Brazil, the same difference is around 13 years for both men and women.

Geographic differences in life expectancy are partly explained by the fact that local populations experience disparate health risks and morbidities across cities. For example, the percentage of deaths caused by communicable, maternal, neonatal, and nutritional (CMNN) diseases in Latin American cities can range from 6 to 55 percent. And even more pronounced differences can be found in the share of deaths associated with noncommunicable diseases, which can range between 28 and 71 percent (Bilal et al., 2021b).

Figure 18 ***Differences in life expectancy by gender in five Latin American countries***

Note: Life expectancy is computed for 117 Latin American cities with population greater than or equal to 200,000 (22 from Argentina, 81 from Brazil, 11 from Ecuador, and 63 from Mexico). Cities are weighted by population. The definition of city is comparable across countries. The estimation of life expectancy is done under standard life tables as defined by WHO (2014). Different to Bilal et al., 2021b, age-mortality rates are not discounted by mortality patterns or potential errors in the registration. Mortality and population data come from the ministries of health and national agencies of statistics: INDEC and MSAL (Argentina), IBGE (Brazil), INEC (Ecuador), and INEGI (Mexico).

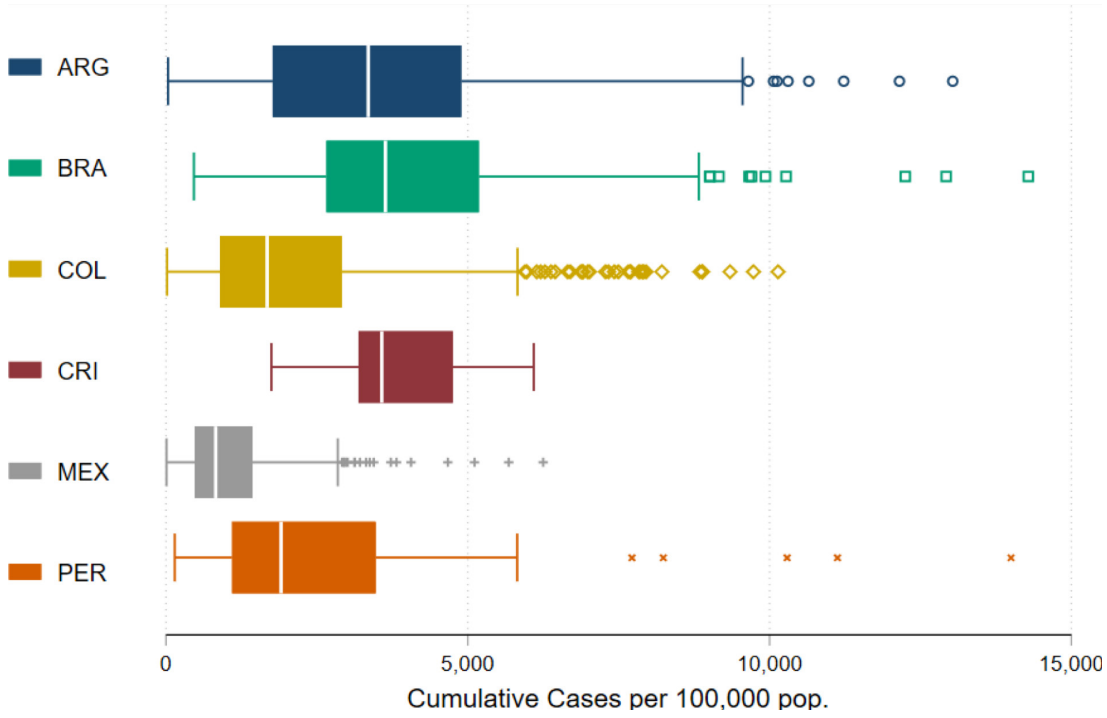


8.3.3.4.2 Disparities in the impact of COVID-19

Cross-city differences in exposure to health risks also became starkly apparent as the COVID-19 pandemic unfolded. The virus first arrived in the continent at the end of February 2020. Brazil was the first country to confirm an infection and would remain as one of the most affected countries in the world in the subsequent months. From the very beginning of the pandemic, the impact of the disease exhibited large variation across cities of the same country. **Figure 19** shows the cross-city distribution of the number of confirmed cases per 100 thousand people in six countries from the region as of January 2021. Part of this variation reflects differences in testing capabilities, but even after addressing these concerns, it is clear that during the first year of COVID-19, the city you lived in mattered for how exposed you were to the virus (Chauvin, 2021b). For Brazilian cities above the 75th percentile of confirmed cases per capita, the incidence was more than four times the number of confirmed cases of the cities at the bottom 25 percent. In Peru and Colombia, half of the cities experienced more than 1,700 cases per 100 thousand inhabitants, which was about two times the Mexican median incidence. In Argentina, the most affected city had 220 percent more cases per capita than the cities at the third quartile.

Figure 19 **COVID-19 confirmed cases per 100,000 people across six Latin American countries**

Note: Cumulative cases per capita are restricted to 1,904 Latin American cities with population greater or equal to 10,000. There are 240 observations from Argentina, 388 from Brazil, 615 from Colombia, 17 from Costa Rica, 463 from Mexico, and 182 from Perú. COVID-19 data are updated until the latest available date per city, as revised on February 10, 2021. The definition of city is not necessarily comparable across countries. For each country the respective unit of analysis is: municipalities for Brazil, Colombia, and Mexico; departments for Argentina; cantons in Costa Rica; and districts in Perú. Data comes from Chauvin (2021a).

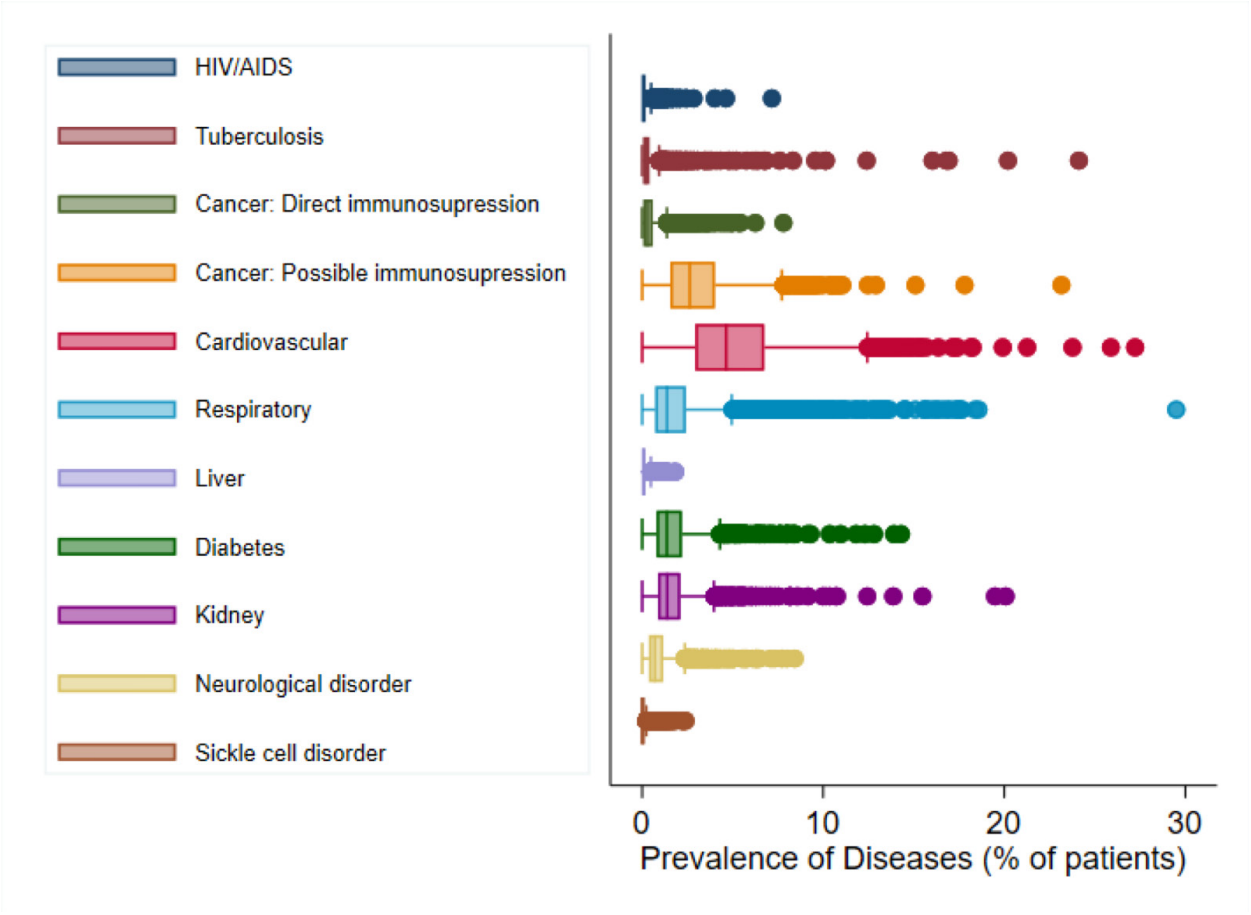


Spatial disparities in health outcomes that existed before the pandemic likely played a role in shaping the unequal geographic incidence of the disease. **Figure 20** depicts, for 3,761 Brazilian cities with population of at least five thousand, the prevalence of pre-existing conditions associated with severe COVID-19 complications among patients in public and private hospitals in 2019. In general, the most common diseases (cardiovascular, respiratory, kidney, tuberculosis, and diabetes) tend to exhibit large geographic variation. For cardiovascular preconditions, cities at the 75 percentile have an incidence that is about 3.5 times those at the 25 percentile. Some cities display a prevalence as high as 28 percent, that is, six times the median. These differences are even more striking for respiratory diseases, as the city with the highest incidence of preconditions (29 percent) has 21 times the median prevalence. Cancer with possible immunosuppression, diabetes, and kidney diseases have a prevalence at the 75 percentile that is around 2.5 times that of cities at the 25 percentile.

In contrast, low-prevalence diseases, such as liver-related or sickle cell disorders, tend to have a more homogeneous distribution across urban areas.

Figure 20 ***Pre-existing conditions across cities in Brazil***

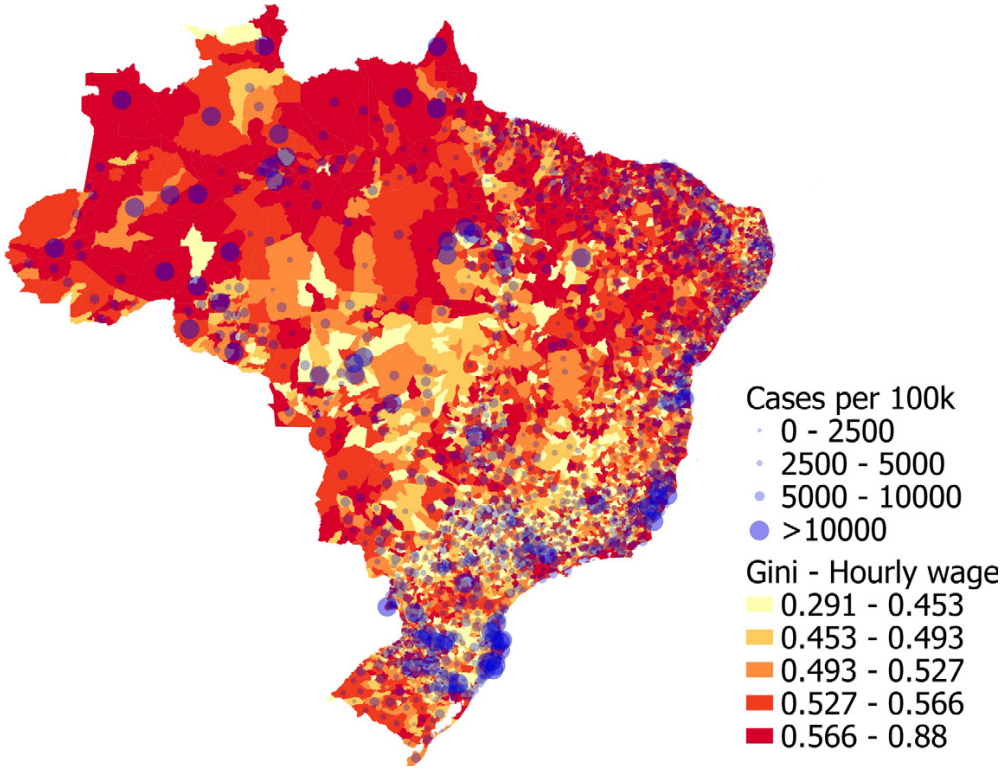
Note: Authors calculations with data of 3,761 Brazilian cities with population greater or equal to 5,000. Data comes from Chauvin (2021b). Prevalence of diseases per patient is computed using hospitals patients' data from 2019.



The spatially heterogeneous impact of COVID-19 could, in turn, worsen overall spatial inequality in the future. Preliminary studies suggest that the pandemic is likely to deepen economic inequality across individuals in Latin America and the Caribbean (Bottan et al., 2020; Busso et al., 2020). At the same time, some of the most affected regions include those that had high levels of inequality to begin with. This can be seen, for the case of Brazil, in the map in **Figure 21**. The map shows the spatial variation of COVID-19 cases and inequality—measured by the Gini coefficient of hourly wages. The spread of cases was particularly severe in the most populated cities, located in the South and Southeast regions. However, in other regions with relatively smaller urban areas in terms of population, there was a considerably large number of cases per capita. Northern cities with high inequality levels seem to have suffered a disproportionately higher incidence than comparable cities in other Brazilian regions. Although further research in this area is needed, these patterns suggest that COVID-19 could widen pre-pandemic spatial inequalities. Early evidence from the metropolitan area of Santiago, Chile, where pre-COVID-19 inequities have worsened since the beginning of the pandemic (Bilal et al., 2021a), also points in this direction.

Figure 21 ***Inequality and impact of COVID-19 across Brazilian cities***

Note: Authors' calculation based on data from Chauvin (2021b). Cumulative cases of COVID-19 are computed for 1,469 cities with a population of at least 20 thousand. COVID-19 data as of March 7, 2021.



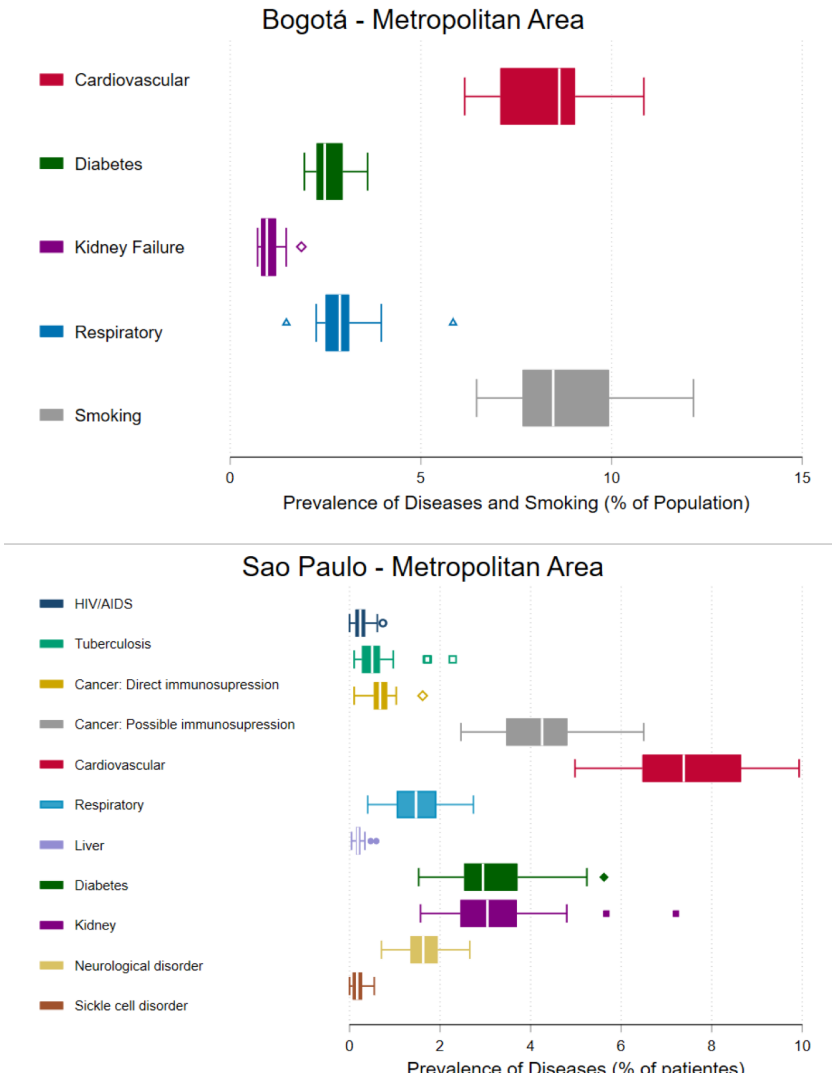
8.3.3.5 Spatial health disparities within cities

Variation in health outcomes across sub-city units

Health disparities within cities can also be remarkably large. **Figure 22** illustrates this with data of 39 metropolitan sub-city units from São Paulo and 40 sub-units from Bogotá. In Bogotá, although there are no large differences in the incidence of some noncommunicable diseases like diabetes and kidney failure, for others there are considerable disparities. For example, the incidence of cardiovascular diseases in the most affected sub-city unit is double the prevalence of the least affected one. And this is also observed for other health-related behaviors such as smoking. In the case of São Paulo, gaps in the incidence of disease among patients are especially large for cardiovascular, diabetes, kidney diseases, and cancer with possible immunosuppression. In particular, in the sub-city unit with the highest incidence of cardiovascular illnesses, the difference is 35 percent higher than in the sub-city unit at the 25th percentile. For kidney failure and diabetes the difference between sub-city units at the 95 percent percentile can be more than four times the prevalence in the least affected one.

Figure 22 ***Differences in health outcomes across sub-city units in Bogotá and São Paulo***

Note: Bogotá's metropolitan area includes the 20 localities of Bogotá and 20 surrounding municipalities. Localities include 1922 neighborhoods. Localities and municipalities are weighted by population. Data come from the Multipropósito Survey (SDP, DANE, and Gobernación de Cundinamarca, 2017). São Paulo's metropolitan area includes São Paulo and 38 neighboring municipalities. With data from Chauvin, 2021b, prevalence of diseases per patient is computed using hospitals patients data. This figure does not include controls since its purpose is merely descriptive.



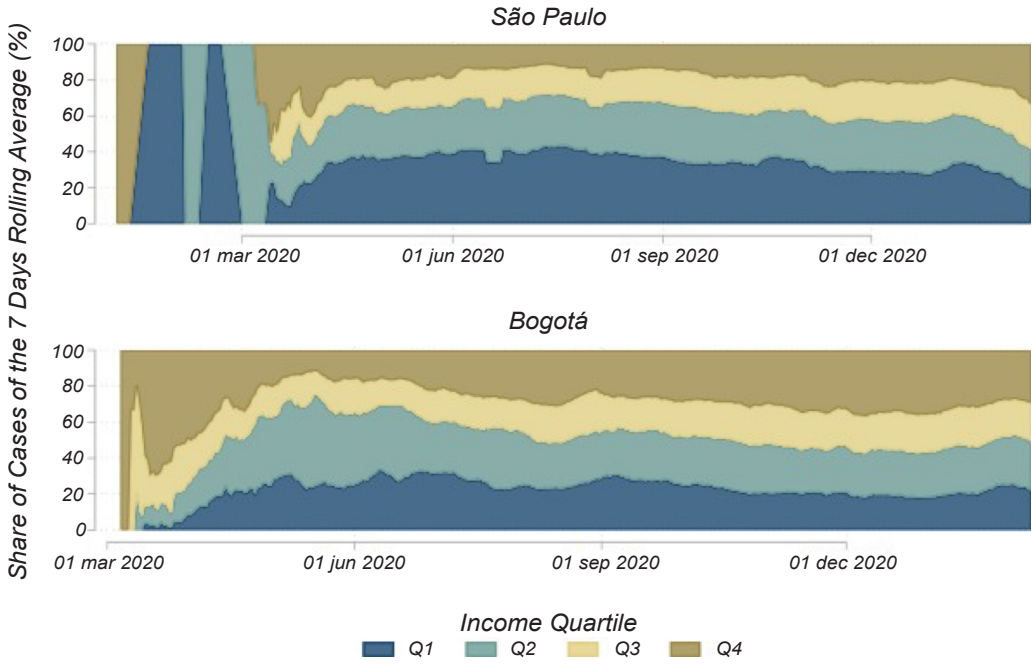
As in other regions of the world, in Latin America, within-city disparities in health outcomes are closely related with neighborhood characteristics. For example, across 50 neighborhoods of Bogotá, Parra et al. (2010) find that having safe parks and safety from traffic is positively associated with health-related quality of life (HRQOL) and self-rated health (SRH) among older adults. In turn, street noise had a negative effect on SRH. In São Paulo, Andrade et al. (2014) found a significant relationship between mental disorders and neighborhood social deprivation—an index that considers income, education, and family size. Exposure to crime was also correlated with anxiety and mood swings. Furthermore, these disorders more often affected vulnerable groups such as women and migrant men.

8.3.3.5.2 Neighborhoods and the spread of COVID-19

In Bogotá and São Paulo, the evolution of COVID-19 cases across income quartiles shows that the virus initially took root in relatively more affluent neighborhoods, where international travelers—who brought the disease to the country (Candido et al., 2020)—are more likely to reside. However, that changed rapidly over the following weeks. **Figure 23** illustrates this with data from metropolitan sub-city units. While the first infection occurred earlier in São Paulo than in Bogotá, in both cities the initial cases were concentrated in sub-city units belonging to the highest income quartile. Over time, however, the transmission of cases quickly affected other areas at different income levels, in particular, those from the lower-income quartiles. And in both cities, low-income neighborhoods (those in quartiles 1 and 2) bore most of the burden of the pandemic through the end of the first wave. Toward the end of 2020, new cases became more uniformly distributed among localities, particularly in Bogotá. Across sub-city units in São Paulo, the top 25 percent continued to have a relatively lower share of cases than the other quartiles for most of the observed period.

Figure 23 ***The spread of COVID-19 across neighborhoods in São Paulo and Bogotá***

Note: Authors' calculations using COVID-19 data of Secretaria Municipal da Saúde (2021) and SALUDATA (2021) for the 96 districts of São Paulo and the 20 Localities of Bogotá. Income data are taken, respectively, from the Secretaria Municipal da Saúde (2018) and the Multipropósito Survey (SDP, DANE, and Gobernación de Cundinamarca, 2017).



8.3.4 What explains spatial health inequalities in the region?

8.3.4.1 The role of the urban environment

8.3.4.1.1 Health and the local natural environment

A key determinant of health outcomes of the population of a geographic area—either urban or rural—is its natural environment. Temperatures, precipitation levels, and altitudes are closely tied to a city location, and they can affect the population's factors in multiple ways. Take for example a city's vulnerability to tropical diseases. Many cities in Latin America and the Caribbean are located in the tropics, where weather conditions expose their inhabitants to mosquito-borne infections, such as malaria, dengue, and zika. Among Colombian municipalities, areas with a higher rainfall variability had an average of four more cases of dengue per month—70 percent of the mean (De la Mata and Valencia-Amaya, 2014). Dengue has been associated with alterations in the immunological system (García et al., 2011), which could result in subsequent development of more severe diseases. Several studies find that in utero and postnatal exposure to such tropical diseases can indeed have long run effects. For example, adults who had malaria during childhood are more likely to interrupt their education earlier and to be illiterate (Barreca, 2010; Carrillo, 2020; Lucas, 2010). They also perform worse in cognitive tests (Venkataramani, 2012) and tend to have lower incomes (Bleakley, 2010).

Even relatively small atmospheric variations can have important health consequences. For example, evidence from the United States suggests that extreme temperatures can have negative effects on birth weight (Deschênes et al., 2009) and lead to higher mortality rates (Barreca, 2012; Deschenes and Moretti, 2009). And cities located at high altitudes, such as Mexico City, La Paz, or Quito, can be more vulnerable to particulates' pollution because motor engines are less efficient there than in cities at lower altitudes (Giraldo and Huertas, 2019).

Latin America and the Caribbean region is also vulnerable to major natural disasters such as earthquakes, hurricanes, and floods. Such events can impact local health outcomes in a variety of ways. Using data of disasters in Latin America over the last 100 years, Caruso (2017) finds that tropical cyclones increase the probability of being disabled. Earthquakes have had negative effects on child nutrition in Colombia (Bustelo et al., 2012), and similar results have been found in Nicaragua after Hurricane Mitch (Baez et al., 2010). The frequency and severity of these events are expected to increase over the next decades as a result of climate change (Pachauri and Meyer, 2014; UNDRR, 2019), and they will pose increasingly higher risks for cities in the region (Harlan and Ruddell, 2011; McMichael and Lindgren, 2011).

The ultimate impacts on health of risks related to the natural environment—such as tropical diseases, temperature fluctuations, or natural disasters—are not independent of human action. They are mediated by the preventive measures adopted by communities, including investments in adequate public infrastructure and preventive health services. But the financial burden that natural risks bring about can be dramatically higher in some localities than in others, and in many cases they can exceed the fiscal capacity of local and regional governments.

8.3.4.1.2 Health and urban built environment

In addition to their natural environment, health outcomes in urban areas are also affected by the built environment. Urban infrastructure, especially related to water, sanitation, and mobility, can have a substantive impact on individual and community health outcomes (WHO and UN-HABITAT, 2016).

Access to safe drinking water is tightly linked to the health outcomes of a city's population. There is ample evidence of this link in Latin America. During the 1990s, following a series of privatizations of water companies in Colombia, Granados and Sánchez (2014) document that, even though improvements in overall water access were limited, cities that received less of this service after the reform had smaller reductions in infant mortality. During the same period and following a similar privatization process in Argentina, child mortality decreased by about 8 percent, and in the poorest areas the impact was close to 26 percent (Galiani et al., 2005). Gamper-Rabindran et al. (2010) also show, this time using data from Brazil, that providing access to piped water reduces infant mortality, particularly in municipalities with the highest levels of under-one-year mortality rates.

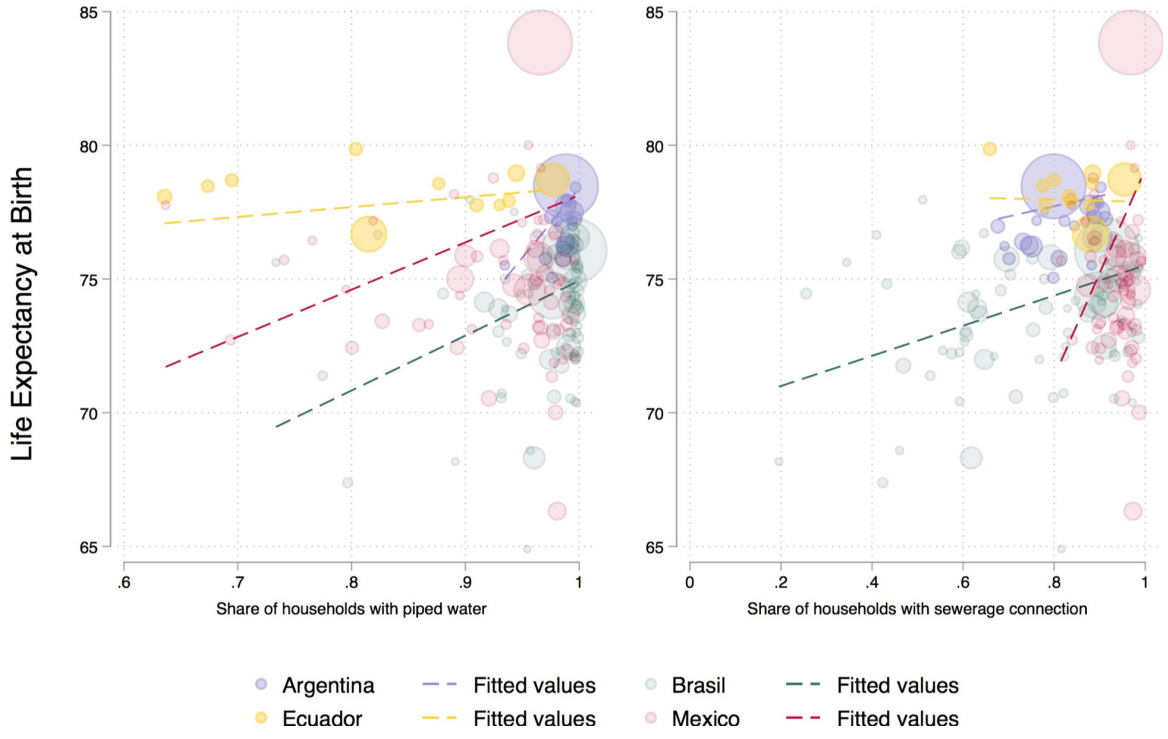
Across Latin American cities, access to safe drinking water is also linked to a higher life expectancy. This is illustrated in Figure 24 (left), which uses data from 177 cities with a population of at least 200,000, located in four different countries in the region. To different degrees, access to piped water is positively linked to life expectancy across cities of the same country. Studies from other regions of the world, especially in Africa and Asia, also find positive effects of water interventions on the prevalence of communicable diseases such as diarrhea and typhoid fever (Ashraf et al., 2017; Duflo et al., 2015; Kosec, 2014).

Access to infrastructure that allows for an adequate treatment and disposal of human excreta and sewage is another key component of a healthy urban environment. By 2025, it is estimated that municipal solid waste will increase by 70 percent globally to 2.2 billion tons/year, and despite the recent progress in sanitation coverage (Hoornweg and Bhada-Tata, 2012), many cities still lack proper management of such disposals. In Latin America, the cost-benefit ratio of water and sanitation improvements has been estimated to be around 5.0, suggesting large gains from a social perspective (Hutton, 2012). In cities without an adequate residuals management system, the population is more vulnerable to transmittable diseases, and they run the risk of developing long-term health conditions. For example, infant mortality has been associated with open defecation (Geruso and Spears, 2018), especially in cities with higher population density (Hathi et al., 2017).

Figure 24 (right) shows that, in most countries, cities where a larger share of the population has access to a sewerage connection tend to also have a higher life expectancy at birth. Other studies have also documented this relationship. For instance, Ortigoza et al. (2020) show that increased access to piped water and sewage significantly reduces infant mortality rates in a sample of 286 Latin American cities with populations above 100,000. Their estimations suggest that sanitation improvements can reduce infant mortality rates

Figure 24 ***Correlates of mortality rates across cities in four Latin American countries***

Note: Correlates are computed for 117 Latin America cities with populations greater than or equal to 200,000 (22 from Argentina, 81 from Brazil, 11 from Ecuador, and 63 from Mexico). Cities are weighted by population. The definition of city is comparable across countries. The estimation of life expectancy is done under standard life tables as defined by WHO (2014). Unlike in Bilal et al. (2021b), age-mortality rates are not discounted by mortality patterns or potential errors in the registration. Data from Chauvin (2021a).



between 15.5 and 6.2 percent. These patterns do not seem to be driven by sample composition: in the context of 363 cities of the continent, Bilal et al. (2021b) also find that a higher life expectancy is related to a higher access to water and sanitation, among other socioeconomic factors. Galdo and Briceño (2005) find that in Quito, Ecuador, improvements in sewage coverage reduced child mortality.

The urban built environment can also facilitate or constrain the adoption of healthier lifestyles among individuals (Smith et al., 2012). For example, access to public transit can influence the amount of physical activity that individuals perform. In the United Kingdom, switching from a passive transport mode such as cars to active commuting (i.e., walking or cycling) or to public transportation is associated with an average reduction of 0.3 kg/m^2 in the body mass index (BMI). In turn, switching to cars leads to an equivalent increase in BMI (Flint et al., 2016). In the United States, the decline in density and the emergence of suburban areas brought about a higher reliance on vehicles and subsequent increases in obesity (Zhao and Kaestner, 2010).

8.3.4.1.3 Transport infrastructure and the spread of transmissible diseases

Another type of infrastructure with strong links to local health is that related to transport, especially one that improves the connectivity between cities. This can have many and sizeable positive effects on the economy and on health (ITF, 2018; Leduc and Wilson, 2012), which are discussed in section 8.3.4. But it also makes cities more interdependent and facilitates the diffusion of transmissible diseases across space. Historically, cities that were more connected were the first to be affected by pandemics such as the Black Death in Europe (Jedwab et al., 2020). Outbreaks that took place in more recent periods, such as the Spanish Flu (1918), H1N1 (2009), Ebola (2014–16), spread more rapidly around the world, thanks in no small part to the modern global transport infrastructure (Abhishek et al., 2014; Basco et al., 2021).

Transport connectivity also played a key role in the diffusion of COVID-19. This was the case in Brazil, where the virus spread after the arrival of infected international travelers coming from western Europe. Southeast cities with large populations and strong international connections, such as São Paulo, Rio de Janeiro, and Belo Horizonte, were precisely the first to experience infections (Candido et al., 2020).

Table 3 presents regression estimates of the correlations between different types of connectivity and the initial arrival of COVID-19 across Brazilian cities. In this analysis, the dependent variable is the number of days that the city remained with zero cases since January 1, 2020. The first two columns show the correlations of this outcome with measures of international air connectivity, including the distance to the closest international airport and the number of flights that arrived at that airport in 2019, weighted by distance. Column (1) estimates the partial effect of these international connectivity indicators, without including other controls. It shows that urban areas that were more distant from international airports or had fewer international travelers remained COVID-free for a longer time. Column (2) adds population variables to the basic model. Once population controls are included, the size and statistical significance of international connectivity measures drop significantly, which highlights the fact that more populated cities tend to also be more internationally connected. Moreover, the negative and significant association with population variables indicates that more populated and denser cities were more likely to experience cases early in the pandemic.

Once COVID-19 entered Brazil, national connectivity also played a role in its diffusion. Columns (3) to (6) from Table 3 show the impact of various measures of domestic air and land connectivity on the time elapsed until a city reported its first COVID-19 case. Similar to the results of international connectivity, cities with a higher number of domestic flights—columns (3) and (4)—reported the first case of COVID earlier than others, and this correlation remains even after including population controls. The last two columns focus on measures of land connectivity computed by the Brazilian Institute of Geography and Statistics (IBGE, 2017). Connectivity degree is defined as the number of cities that have a direct connection to the focal city, while the proximity index is calculated as the inverse of the average distance to the rest of the cities in the national road network. These results are also consistent with the estimates of air connectivity.

Table 3 Delays in COVID-19 first confirmed case and city connectivity in Brazil

Logarithm of days between January 1, 2020, and the first confirmed case in the city

	(1)	(2)	(3)	(4)	(5)	(6)
International Air Connectivity						
Distance to international airport	0.055***	−0.000				
	(0.010)	(0.006)				
International flights	−0.004**	−0.002				
	(0.002)	(0.002)				
Domestic Air Connectivity						
Distance to domestic airport			0.063***	0.009		
			(0.006)	(0.006)		
Domestic flights			−0.006***	−0.002*		
			(0.002)	(0.001)		
Land Connectivity						
Connectivity degree					−0.062***	−0.007
					(0.009)	(0.005)
Proximity Index					−0.196**	−0.025
					(0.086)	(0.053)
Population Controls						
Log of population		−0.106***		−0.102***		−0.099***
		(0.008)		(0.009)		(0.008)
Log of population density		−0.036***		−0.034***		−0.037***
		(0.005)		(0.004)		(0.004)
Observations	3,759	3,759	3,730	3,730	3,732	3,729
R^2	0.177	0.490	0.246	0.493	0.300	0.491

Source: Prepared by the author based on SINADEF, Secretaría de Salud del Gobierno de México, Estadisticas Vitales (DANE), Instituto Nacional de Estadistica (INE), Instituto Nacional de Estadística y Censos de Ecuador (INE), National Censuses of Colombia, Chile, Peru, Ecuador, El Salvador and Mexico. Last update: Dec 20th, 2021.

Notes: Estimations are restricted to cities with populations greater than or equal to 5,000. Air connectivity is defined as the distance to the closest international or domestic airport (in km), and the number of international or domestic flights weighted by distance. These variables are included as the natural logarithm. All models are estimated by OLS and include state fixed effects. Robust standard errors are in parentheses and clustered at the state level. Data comes from Chauvin (2021b).

*** $p < .01$, ** $p < .05$, * $p < .1$

8.3.4.2 Spatial disparities in access to health care

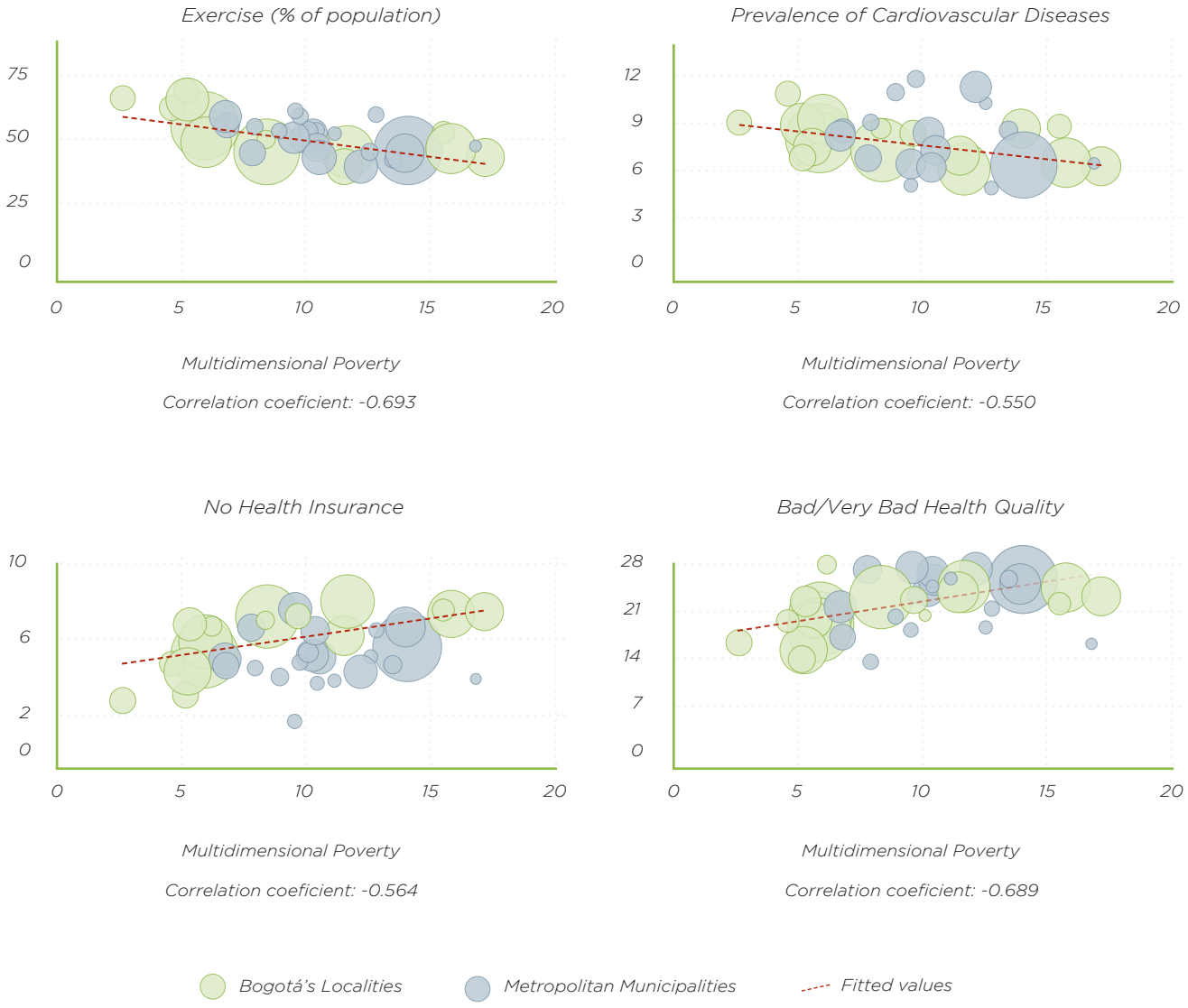
Compared to OECD countries, Latin America is still behind in terms of access to medical resources. For example, the region has on average two doctors per 1,000 population, in contrast with the 3.5 OECD mean. Additionally, out-of-pocket health expenditure is considerably higher (34 percent) than in rich countries (21 percent), reflecting insufficient health insurance coverage (OECD/The World Bank, 2020).

Within Latin American countries, access to health care differs significantly across cities. In a survey conducted by the Pan-American Health Organization, the percentage of respondents who reported getting an appointment within the same week was 59 percent in São Paulo, 82 percent in Montevideo, and around 67 percent in Santiago and Buenos Aires. There are also spatial variations in the lack of health insurance. In Buenos Aires, lack of health insurance coverage reaches 17 percent, in Santiago it is 11 percent, and in São Paulo and Montevideo it is about 2 percent (Balsa et al., 2011).

Sizable gaps in access to health care exist also across neighborhoods of the same city. Even in high-income countries like the United States, where connectivity infrastructure is better developed, mortality increases when there are fewer doctors within 25 miles of the patient (Li, 2014), or when the closest hospital is farther away (Buchmueller et al., 2006). The connection between physical access to health care centers and outcomes has also been documented in Latin American countries (Weis et al., 2020). For example, across Peruvian cities, increases in travel time to health care facilities have been associated with higher pneumonia fatality rates in under-five children (Carrasco-Escobar et al., 2020). Access to health insurance can also vary significantly within cities. This is illustrated in **Figure 25** using data of sub-metropolitan units (localities) from Bogotá, Colombia. The population of higher-poverty localities tend to have, at the same time, worse health outcomes and a higher likelihood of lacking health insurance.

Figure 25 ***Poverty and health across Bogotá's metropolitan area***

Note: Bogotá's metropolitan area includes the 20 localities of Bogotá and 20 surrounding municipalities. Localities gather include neighborhoods. Localities and municipalities are weighted by population. Bad health quality is defined as the percentage of individuals that considered their health insurance service as "bad" or "very bad." Exercise is measured as the proportion that reported doing physical activity at least once per week, during the last month. Data come from the Multipropósito Survey (SDP, DANE, and Gobernación de Cundinamarca, 2017) and the 2018 National Census (DANE, 2018).



8.3.4.3 Negative urban externalities

8.3.4.3.1 Congestion, pollution, and health

An important characteristic of urban areas that is also tied to health outcomes is population density. Density brings about many economic benefits, but at the same time creates conditions for individuals to negatively affect other people's welfare. Two such externalities are traffic congestion and air pollution. The decision of an individual to drive instead of taking public transit, for example, does not only contribute to traffic congestion and deficient road safety, but it also leads to the generation of polluting emissions and noise. Drivers typically do not consider these external effects when they decide to use their vehicles.

Urban air pollution is a growing concern in many Latin American cities. While the WHO target for average of particulate matter (PM_{10}) is 35 Qg/$m^{3,}$ multiple large cities in the region have recorded particulate levels well above that target, including Santiago in Chile (64), Mexico city (56), and Bogotá (52) (Riojas-Rodríguez et al., 2016). Several studies have shown a clear negative impact of air pollution on health outcomes. In Mexico City, using a 10-year panel of 48 municipalities, Arceo et al. (2016) found that increasing 1 Qg/m3 in 24-hour particulate matter increases weekly infant deaths per 100,000 births by 0.23. Further evidence from US counties also shows that air pollution is related with higher child mortality rates (Chay and Greenstone, 2003).

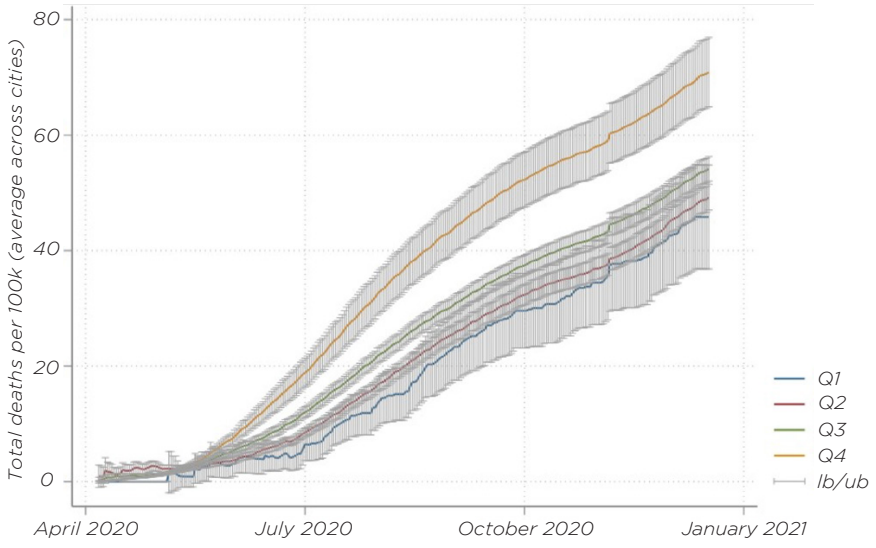
8.3.4.3.2 Urban characteristics and the spread of COVID-19

Another well-known externality associated with high-density environments is the spread of infectious diseases. The likelihood of contagion of such diseases typically grows with the number of human interactions, and interactions are, in turn, an exponential function of total population (Schläpfer et al., 2014).

Such patterns have been observed during past pandemics and recently confirmed by the spread of COVID-19. As with other infectious diseases, the size of a city's population was an important predictor of the local impact of the pandemic. **Figure 26** illustrates this, showing the evolution of weekly deaths per 100 thousand people in Brazilian cities between April 2020 and January 2021, separately for each city population quartile. As discussed above, the virus arrived earlier in more populated cities, which also tend to be more internationally connected. This meant that, from the very beginning, large cities were more affected by COVID-19, both in absolute and in per-capita terms. Throughout the first year of the pandemic, cities in higher population quartiles systematically reported more deaths per capita than cities in lower population quartiles. And the initial gap, rather than closing as smaller cities started to also report infections and deaths, grew over time.

Figure 26 **Impact of COVID-19 in Brazil over time by city size quartiles**

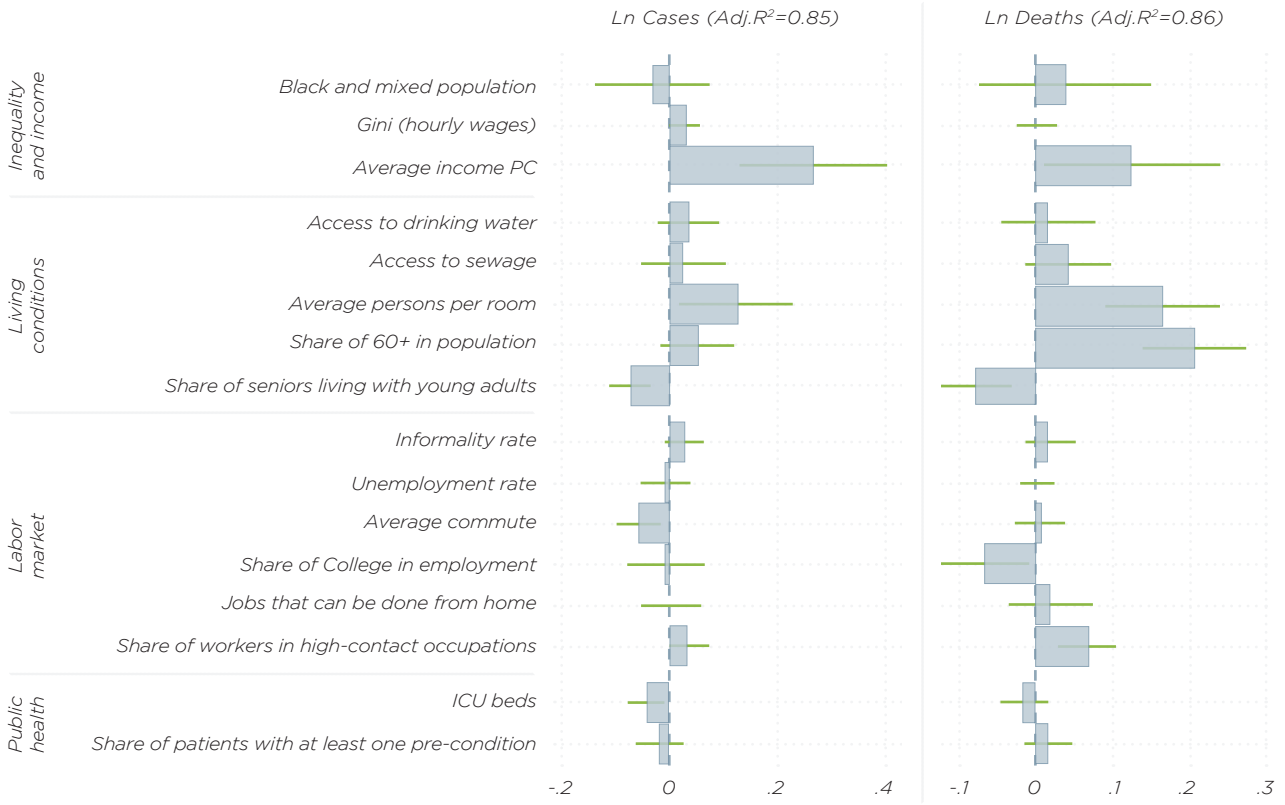
Note: Each line represents the average evolution of deaths per capita across cities at each population quartile. Vertical lines correspond to the 95 percent confidence intervals. The impact of COVID-19 is computed for 3,762 cities using data from Chauvin (2021b).



But population and density are not the only city characteristics that facilitated the spread of COVID-19. To shed light on what other factors explain why the pandemic affected some places more than others, **Figure 27** reports regression estimates of the effects of four sets of variables on city-level cumulative COVID-19 cases and deaths per capita by January 2021, using data of 2,439 Brazilian cities from Chauvin (2021b).[4] Four sets of socioeconomic characteristics are considered: (1) inequality and income, (2) living conditions, and (3) labor market, and (4) public health.

Figure 27 Correlates of the local impact of COVID-19 in Brazil

Note: Each bar represents the point estimates for each regressor. Respectively, the dependent variables are the natural logarithm of the total number of confirmed cases and confirmed deaths from COVID-19 in each city. Data are updated until January 20, 2021. Estimations also control for population (which allows for interpreting the results in per capita terms), population density, urbanization, the number of international passengers and the number of national passengers arriving at the closest airport in 2019 (as indicators of exposure to air travelers), average maximum yearly temperature, average yearly precipitation, broadband connections density, the share of domestic workers in local employment, the percentage of the population living in slums, and distance to São Paulo. It also includes other baseline public health variables, including the number of doctors and the number of ventilators. All variables are standardized. Regressions are estimated by OLS and include state fixed effects. Lines represent 95 percent confidence intervals. Robust standard errors are clustered at the state level. Estimations are restricted to 2,439 cities with population greater than or equal to 10,000. Data come from Chauvin (2021b).



4. Chauvin (2021b) shows that the effects of city characteristics on local cases and deaths can fluctuate over time. However, for most variables the direction of the effect is consistent throughout the first year of the pandemic.

These estimates show that, contrary to what has been observed in the United States (Desmet and Wacziarg, 2021), cities with higher average income per capita in Brazil were relatively ***more*** affected by COVID-19, in terms of both cases and deaths, after controlling for all other covariates. Chauvin (2021b) shows that higher-income cities also experienced higher mobility, as a smaller share of the population stayed at home for most of this period. In contrast with cities in high-income countries, in Brazilian cities a large part of the population is unable to perform their work from home and lacks the savings to support prolonged periods of economic inactivity. Cities with higher income are also characterized by a relatively higher demand for goods and services, which translates in a higher availability of jobs and creates the incentives for increased mobility.[5] This is also consistent with the fact that, as shown in Figure 27, cities with larger shares of workers in high-contact occupations also experienced more COVID-19 deaths per capita. Note that, as previously discussed, this is not necessarily the case when we consider the variation within metropolitan areas. Richer neighborhoods within São Paulo, for example, were relatively less affected by COVID-19 on a per-capita basis. This suggests that low-income populations living in more affluent cities were particularly vulnerable to the pandemic.

Another important result related to the urban environment that comes out of this analysis is that housing conditions also shaped the local impact of COVID-19. In particular, a factor that appears to have played an important role after accounting for all other covariates is residential overcrowding (as measured by the number of persons per room living in the average household). Cities with more residential overcrowding experienced more infections and deaths than other cities.

Additional results highlight that local vulnerability to the pandemic was also related to the composition of the local population, and in particular with the share that was at increased risk. For example, controlling for all other variables, cities with older populations—which, before vaccinations, were at significantly higher risk of developing severe complications from the disease (Davies et al., 2020; Levin et al., 2020)—experienced more deaths per capita. The presence of higher-vulnerability people may have also created incentives for precautionary behavior in the rest of the population, as suggested by the fact that fewer deaths per capita were observed in cities with large shares of households where older and younger generations cohabitate.

8.3.5 Health inequalities and local public policy

Even though addressing spatial health inequalities requires action at different geographic scales, there are multiple policy instruments that local governments can deploy and that can lead to meaningful improvements. Among the most effective, as discussed above, is the provision of basic public services such as water and sewerage. This is also a development outcome in itself, and one of the United Nations' Sustainable Development Goals. But there are other interventions that can also contribute to reducing spatial inequalities, directly or indirectly.

One example is public transit, which may have had an adverse effect in the propagation of infections during the COVID-19 pandemic, but has been shown to have positive health effects in normal times through decreased pollution externalities. A study covering 58 countries found that subway openings between 2001 and 2016 reduced particulates by 4 percent in highly polluted cities. The study also estimates that, for a typical city in this sample (population of 5.3 million and a 2 percent birth rate), a new subway system can avoid around 22–34 infant deaths each year (Gendron-Carrier et al., 2021). Ortigoza et al. (2020) also find, looking at Latin American cities, that an improvement of one standard deviation in mass transit availability can decrease infant mortality rates by 6.6 percent. Another benefit of public transit projects is that they can create incentives for increased physical activity even in contexts where large shares of the population walk or rely on informal transportation. In Bogotá, Lemoine et al. (2016) found that the implementation of the rapid bus system—TransMilenio—was related to an increase of physical activity of around 22 minutes/day across income groups.

Other, less costly local policies can also promote the adoption of healthier lifestyles in the population, particularly among the more economically disadvantaged. One example is the construction of recreational infrastructure. In Brazil, for instance, neighborhoods with parks or other places dedicated to physical activity tend to have a lower proportion of people with overweight (Velásquez-Meléndez et al., 2013). Another example is the implementation of programs promoting the use of bicycles for commuting and recreation.

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5 In principle, this correlation could also reflect the fact that higher-income cities may also have had more testing capabilities, particularly at the beginning of the pandemic. However, this does not appear to be the main driver of the observed result. The effect of city income did not significantly shrink over time—as access to testing became more available throughout the national territory—and its magnitude remains very similar when it is calculated comparing only cities belonging to the same state, even though testing regimes were significantly more homogeneous within than across states (Chauvin, 2021b).

The *Muevete en Bici* program implemented in Mexico City increased vigorous physical activity by 71 minutes/week (Medina et al., 2019), and estimates suggest that the costs-benefits of the construction of bike lanes are positive in various cities, including Bogotá (3.23–4.26), Medellín (1.8), and Guadalajara (1.02–1.23) (Montes et al., 2012).

Air and noise pollution have also been addressed through circulation restrictions, but evidence of their effectiveness is more mixed. For instance, the *Hoy No Circula* program from Mexico City, which bans the use of cars on specific days based on the plate's last digit, created incentives for richer households to purchase additional vehicles, resulting in an increase of the total volume of circulating cars, and no reductions in air pollution levels (Davis, 2008). Similar effects were found in Colombia, where the *Pico y Placa* program has not improved air quality but has led to increases in gasoline consumption and vehicle ownership in Bogotá (Bonilla, 2019), and to changes in commuting departure times in Medellín (Ramos et al., 2017). An exception is Quito, where a similar circulation restriction program led to improvements in the concentration of carbon monoxide during rush hours (Carrillo et al., 2016). According to more extensive review by Blackman et al. (2018) and IADB (2020), a robust enforcement combined with low cost-effective public transportation becomes critical to successfully implement these programs.

Another policy frequently pursued by local governments that has been shown to have positive effects on health outcomes is slum upgrading programs. For example, in Mexico and El Salvador, the TECHO program, which helped improve the quality of construction in informal dwellings, reduced by 27 percent the under-five incidence of diarrhea, which is similar to the impact of water and sewage connections (Galiani et al., 2017).

Policies seeking to improve local health conditions, however, under some circumstances can also lead to undesired consequences. Bancalari (2020) provides a good illustration of this by studying 6,000 sewage projects implemented in Perú between 2005 and 2015.

Completed projects reduced infant mortality by 33 percent. Nevertheless, unfinished projects were associated with a 5 percent increase in infant mortality, as they exposed communities to water cuts and excavations-related accidents. This highlights that the effect of local interventions depends not only on choosing a technically adequate solution but also on how this solution is implemented.

8.3.6 Conclusion

In Latin America and the Caribbean, there are significant spatial disparities in health outcomes across and within cities. This article has provided an overview of the existing evidence regarding the magnitude of these disparities, what drives them, and what policymakers can do to address them.

A first conclusion is that spatial inequality in health outcomes is large in Latin America. The incidence of non-transmittable diseases, such as hypertension and obesity, can be more than three times higher in some cities in the region than in others, and the gap in life expectancy can reach more than eight years. Part of these figures reflect national-level differences, but for some diseases, more than half of the variation is driven by within-country differences. These large within-country spatial differences in health outcomes were also observed during the COVID-19 pandemic. In Brazil, for example, a city in the top quartile of confirmed COVID-19 cases per capita, reported about 3.5 times as many confirmed cases as in the cities in the bottom quartile during the first year of the pandemic.

The data and literature reviewed in this article also suggest that part of these geographic inequalities are explained by the fact that socioeconomically vulnerable individuals—who also tend to face more health challenges—tend to spatially cluster. However, the analysis also points to multiple local characteristics that, in turn, shape the ultimate health outcomes of each locality. These include aspects of the natural environment, such as the presence of tropical diseases, differences in temperature and altitude, and vulnerability to natural disasters, as well as aspects of the built environment that can be shaped through policy.

Local policymakers can play a key role in addressing spatial health inequalities. In addition to the construction of water and sanitation infrastructure, for example, they can promote the reduction of urban pollution and congestion externalities by investing in public transit systems and promoting physical activity among their population. Programs primarily motivated by other policy objectives, such as slums upgrading programs, can also have a significant impact on local health outcomes. Spatial inequality is an issue in which many opportunities exist to make a meaningful difference through deliberate and evidence-based local action.

KEY FINDINGS

Life expectancy, the burden of non-communicable diseases, and, more recently, the impact of COVID-19 all exhibit large geographic disparities both across and within cities.

Part of these geographic inequalities are explained by the fact that socioeconomically vulnerable individuals—who have, on average, poorer health—tend to spatially cluster.

However, characteristics of the local environment—including access to health services, infrastructure that favors healthy lifestyles, water and sanitation, and atmospheric conditions—can improve or further deteriorate health outcomes.

Existing policy tools available to local and national governments can be effective in reducing health inequalities by creating healthier built environments and reducing negative externalities, particularly in places where socioeconomically vulnerable communities reside.

Bogotá, Colombia

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PART 1

BOX II

8.4 GENDER VIOLENCE IN CITIES: AN URBAN PERSPECTIVE ON VIOLENCE AGAINST WOMEN

Bogotá, Colombia

8.4 Box II: Gender Violence in Cities: An Urban Perspective on Violence against Women

Nora Libertun, IADB (CSD/HUD)

There is no question that preventing violence against women will lead to enormous and positive consequences on human health and well-being for this and future generations.

However, only recently has violence against women been recognized as a public health issue that has roots in individual, cultural, and environmental factors. In light of this recognition, there are numerous commitments to stop violence against women. This purpose is explicitly upheld in SDG-5, in line with the United Nations Declaration on the Elimination of Violence against Women adopted by the United Nations General Assembly in 1993. Many Latin American and Caribbean countries have enacted similar laws and declarations, such as Argentina in 1980, Trinidad and Tobago in 1986, Costa Rica in 1984, Mexico in 1989, Barbados in 1992, Haiti in 1994, Colombia and Ecuador in 1995, Honduras in 1997, and Brazil in 1998, among others (CEPAL, 2021). Despite this impressive body of laws, violence against women is endemic in the region. Sadly, the LAC region has the highest rates of femicide in the world (CEPALSTAT, 2020). It is estimated that nearly one in three women has been the victim of violence at least once in their lifetime (UN Women, 2021). Moreover, the incidence of violence against women increased sharply after the imposition of quarantine measures to prevent the spread of COVID-19 (Sánchez et al., 2020; Berniell and Facchini, 2020).

The fact that the home is most often where gender violence takes place does not mean that public space is not relevant in its dynamics. Not only do behaviors in public and private spaces influence each other, but there is also plenty of evidence that exposure to violence in the home during childhood raises the risk of other forms of violence later in life (Bott et al., 2012). In addition, particularly in low-income and informal housing settlements, the physical boundaries between public and private spaces are not clearly delineated. For example, increasing opportunities for alcohol consumption in public spaces can sometimes lead to increasing violence against women in domestic places (Libertun de Duren, 2020). Finally, as conceptualized by early urban and gender scholars, while violence against women occurs across cultural contexts and income levels, it decreases with women's economic independence (Hayden, 1982). Limited access to public space undermines women's ability to work and earn income. For example, women tend to reject job opportunities that demand they commute in situations that they perceive to be dangerous. In addition, not fully participating in job markets makes women more vulnerable as victims of violence at home. Women who are economically dependent on a partner are less likely to leave that partner even when suffering abuse by that partner (Andersson 2007).

From the perspective of public health, policies should focus on making changes in social, behavioral, and environmental factors that lead to violence (Saltzman et al., 2000). Multiple and complex factors are behind the persistence of violence against women. Some of these factors manifest at the individual and at the family level, while others are connected to cultural and social dynamics. Among the latter, cities play a central role because unequal access to and distribution of resources, such as the layout and distribution of public transportation networks, often lead to increased vulnerability to and risk of violence (Sauerborn et al., 2021). Spatial configurations can also provide or decrease opportunities for violent actions. The way cities are designed, built, and managed plays a significant role in preventing violence against women. In the LAC region, where more than 80 percent of all residents live in cities, urban policies should be at the forefront in the prevention of violence against women (IADB, 2020). With that purpose in mind, let's focus on three urban dimensions that can change violence levels in the region.

Housing

Access to housing is harder for women than for men. That is, women have less access to housing tenure, housing credit, and housing located in areas with urban services than do men, thus they are disproportionately affected by housing deficits. Only one in four people living in urban areas has access to adequate onsite sanitation facilities (WHO/UNICEF, 2017); only three in five people living in urban areas worldwide have access to safe, readily available water at home (WHO/UNICEF, 2017). These deficits put an extra burden on women, who are overrepresented among those living in substandard housing and who face increased risks of sexual assault at night when using sanitation facilities located outside their homes.

Because of differential treatment by law or by custom, most land titles are still registered under men's names. UNICEF estimates that women account for only 25 percent of the landowners in Latin America (Chant and McIlwaine, 2015). There is evidence that security of tenure correlates with a decline in gender-based violence, either because of a change in men's attitudes (Amaral, 2017) or because women are more inclined to leave abusive relationships when they have secure housing (Moser, 2017). Housing location also affects women's safety and development. When cities expand without adequate planning, poor households headed by women are the most disadvantaged as they tend to be in precarious neighborhoods with limited access to efficient means of public transportation and long commutes (Libertun de Duren, 2017). In addition, these women usually make long journeys at early or late hours, when the frequency of public transportation is very low, increasing their exposure to sexual violence in their daily commute (Libertun de Duren et al., 2018).

Mobility

Lack of gender-responsive mobility planning can make traveling more complicated, more expensive, and more dangerous for women than for men. Women generally rely more than men do on public transportation. In LAC, women are the majority of public transportation users. However, most of the existing public bus routes and sidewalks in the region are not designed with the needs of women in mind. These limitations on women's access to safe transportation are considered a hurdle for the full participation of women in the labor market; a lack of safe transportation is estimated to be responsible for reducing by 15.5 percentage points women's participation (ILO, 2017). Typically, women make more multipurpose trips, combining their daily work commute with trips to school, childcare facilities, and health care centers, and for shopping purposes. Data show that having a young child in the house will increase the number of trips a woman makes. Women are also twice as likely as men to be victims of gender-based violence on public transportation, which prevents them from enjoying equal access to mobility (IADB, 2015).

Public Spaces

Women tend to experience sexual harassment in public places more frequently than men do (UN Women 2017). Dark areas, isolated parks, empty and poorly lit streets, underground parking lots, and pedestrian underpasses provide opportunities for criminal activities and cause fear and insecurity for women (Libertun de Duren, 2020). To avoid these spaces, many women make difficult decisions over the trade-off between economic opportunity and personal security (Dominguez Gonzalez et al., 2020).

No society can progress without addressing violence against women as a violation of basic human rights and a limitation on social prosperity. At the national level, sound normative frameworks are essential to ensure the basic rights of women, especially regarding housing rights and inheritance laws, land policy and security of tenure, and laws against gender-based violence. At the local level, gender-responsive regulations and interventions are required, particularly in the design and management of housing, transport mobility systems, and public spaces. Meaningful participation of women in decision-making processes should be increased in all levels of government while establishing effective, accountable, and transparent governance mechanisms and data information systems to ensure that cities are built to provide opportunities for all.

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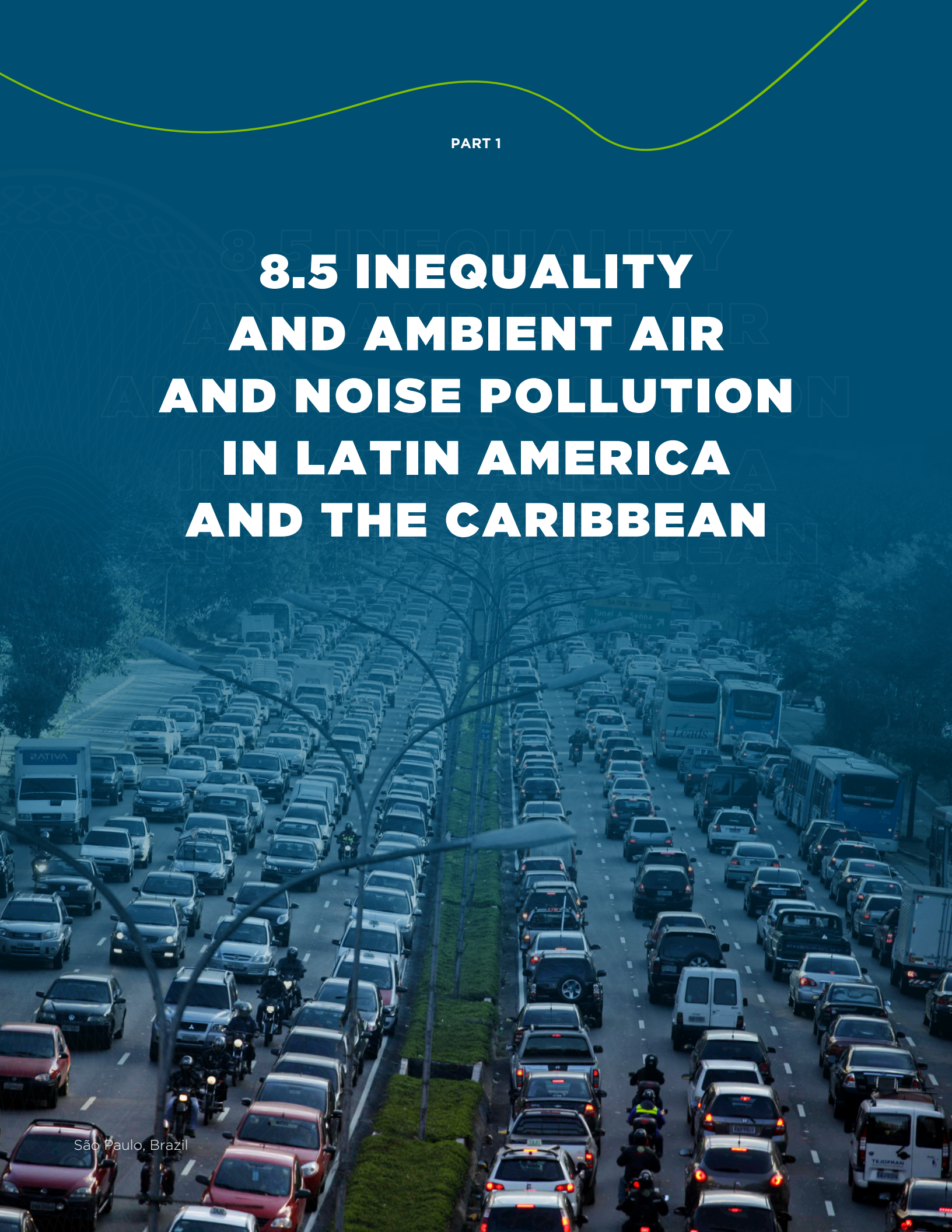
PART 1

8.5 INEQUALITY AND AMBIENT AIR AND NOISE POLLUTION IN LATIN AMERICA AND THE CARIBBEAN



São Paulo, Brazil

8.5 Inequality and Ambient Air and Noise Pollution in Latin America and the Caribbean

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8.5.1 Abstract

Looking beyond the pandemic, exposure to ambient air and noise pollution will be among the most pressing public health issues in urban settings in Latin America and the Caribbean. This paper explores the inequality in exposure to air and noise pollution by summarizing the empirical evidence available and presenting simple graphical correlations using Santiago, Chile as a case study. We find differences in exposure with disadvantaged sociodemographic groups exposed to higher levels of air pollution. We do not find consistent, strong relationships between social-demographic proxies and noise pollution. Further, we find some evidence that indicates that higher exposure is also correlated with lower access to health care. Differences in exposure to air and noise pollution and access to health care across sociodemographic groups likely leads to unequal negative health impacts that could exacerbate other inequalities. Greater importance should be placed on reducing air and noise pollution to improve health and quality of life in LAC cities and alleviate inequalities in LAC cities.

8.5.2 Trends and levels of ambient air and noise pollution in Latin America and the Caribbean

Public health experts estimate that 25 percent of the burden of disease is due to environmental risks (WHO, 2011). Two of the top environmental risks are air pollution and noise pollution. Air pollution has been recognized as one of the most important global public health issues for decades, and recent literature documenting the link between long-term air pollution exposure and COVID-19 mortality reinforces the importance of air quality (Bonilla et al., 2021). The World Health Organization declared air pollution to be the biggest environmental risk to health and estimated that approximately 3 million lives were lost to ambient air pollution in one year alone (WHO, 2016a). While air quality has improved in some large cities in Latin America and the Caribbean (LAC), it remains a serious threat to the health of citizens in LAC (Jorquera et al., 2019). Over 100 million people in LAC are exposed to air quality that does not meet the World Health Organization's Air Quality Guidelines (Aparicio et al., 2019)geographically concentrated industrialization, and biomass burning. This paper focuses on a relatively understudied consequence of this pollution-intensive development process: its gender impact. The analysis provides systematic evidence across the region on the impact of in utero exposure to air pollution on infant health and well-being, a period when the medical literature suggests male fetuses are more delicate than female fetuses.

Health at birth is known to have long-term consequences, so this investigation seems warranted and aids the understanding of future gender gaps in socioeconomic development. The empirical analysis combines satellite and survey data from three countries in the region: Bolivia, Colombia, and Peru.

Based on sibling comparisons, the analysis finds that a 10% increase in pollution exposure in utero reduces the male–female birth weight gap by approximately 50 g. This weight reduction is equivalent to the impact of smoking five cigarettes a day (versus none).

Although noise pollution was always considered a nuisance, recognition of its importance as a public health concern has grown among policymakers, researchers, and the public. The World Health Organization ranked traffic noise as the second most important environmental threat to public health in Europe, second only to air pollution (WHO, 2011). Further, noise pollution is rising because population growth, urbanization, and globalization of transportation networks, while other types of pollution have been falling (Carruthers, 2017; Gray 2017; Mohamed et al., 2021; United Nations Economic Commission for Europe, 2013; WHO, 2011).

Air and noise pollution are linked to factors that impact human capital and economic outcomes, such as lower productivity and difficulty concentrating, and a wide range of mental and physical health outcomes (Chang et al., 2016; Currie and Neidell, 2005; Currie et al., 2009; Graff Zivin and Neidell, 2012, 2013; He et al., 2019; Inoue et al., 2020; Janke, 2014; Jun and Min, 2019; Lichter et al., 2017; Neidell, 2008; Pope and Dockery, 2006; Pope, 2000; Ren et al., 2019; Schlenker and Walker, 2016; WHO, 1999, 2005, 2011, 2016a, 2018).

Exposure to ambient air and noise pollution are particularly severe in urban settings where noise and air pollution share important sources, notably traffic, and recent studies have shown spatial correlations between noise and air pollution (Ross et al., 2011). With 81 percent of the population living in urban areas (Economic Commission for Latin America and the Caribbean, 2020a), air and noise pollution affect the vast majority of the population of LAC. However, there is significant inequality in exposure and impacts that perpetuates and exacerbates current inequalities.

8.5.3 Health impacts of ambient air and noise pollution

Numerous studies have established a causal link between air pollutants and negative health outcomes. Particulate matter (PM), especially fine particulates (PM2.5), poses the greatest health risk. Elevated levels of PM leads to increases in cardiovascular emergency department (ED) visits, hospital admissions for chronic obstructive pulmonary disease (COPD), respiratory symptoms, worsening of lung function, and premature mortality (Bell et al., 2004; Environmental Protection Agency, 2009). Among other pollutants, exposure to a high concentration of NO_2 over short periods of time can aggravate respiratory diseases, and longer-term exposure may contribute to the development of asthma and potentially increase susceptibility to respiratory infections (Environmental Protection Agency, 2016). Short-term health effects of O3 are related to increases in mortality from respiratory diseases (Faridi et al., 2018), increases in hospital respiratory admissions (Ghanbari Ghozikali et al., 2016), pulmonary function changes, and airway inflammation (Katsouyanni, 2003). There is also evidence of links between short-term peaks in O3 exposures and lung epithelial damage (Broeckaert et al., 2000). Elevated levels of CO outdoors can be a particular concern for people with heart disease conditions. In elevated CO-level scenarios, those with heart disease conditions could suffer from reduced oxygen to the heart accompanied by chest pain (Environmental Protection Agency, 2016).

Exposure to high levels of air pollution is particularly dangerous to children's health and development. Children are at greater risk than adults from the adverse health effects of air pollution, principally during their fetal development and earliest years (WHO, 2018). Children's respiratory systems are vulnerable to polluted air since they are still maturing, and their lungs are more vulnerable to inflammation and other damage caused by pollutants.

The Institute for Health Metrics and Evaluation (IHME) from the Global Burden of Disease (GBD) ranked air pollution (outdoor and indoor) as one of the leading risk factors for poor health across the world measured by disability-adjusted life-years (DALYs) lost. According to the IHME, 213.28 million DALYs, or years in good health, were lost from air pollution in 2019 (Ritchie and Roser, 2021). In addition to shortening lifespans, air pollution also has a large effect on quality of life (Ritchie and Roser, 2019).

Epidemiological evidence indicates that noise pollution is a threat to public health, as well as an environmental nuisance (WHO, 2011). One in three individuals is annoyed during the daytime, and one in five has disturbed sleep at night because of traffic noise (WHO, 2011). The potential health effects of noise pollution are persistent and medically and socially significant (Goines and Hagler, 2007). Noise pollution, particularly road traffic and aircraft noise pollution, is related to hypertension, and ischemic heart diseases as cardiovascular endpoints in developed countries (Chang et al., 2012; Münzel et al., 2018; WHO, 2011). Unfortunately, the link between noise pollution and health outcomes has not been sufficiently explored in LAC countries since there is no systematic measurement of noise pollution in the majority of those countries.

Noise exposure-response relationships are used to estimate the effects of noise on an individual's health problems. According to the World Health Organization, environmental noise from planes, trains, and vehicles, are linked to disability-adjusted life years (DALYs) lost because of noise levels exceeding the standard ones. In several countries in Europe,[6] the WHO estimated that DALYs lost from environmental noise are 61,000 years for ischemic heart disease, 45,000 years for cognitive impairment of children, 903,000 years for sleep disturbance, 45,000 years for tinnitus, and 587,000 years for annoyance based on the environmental burden of disease methodology (WHO, 2011). The evidence indicates that in total at least 1 million healthy years of life are lost each year in Europe because of noise pollution (WHO, 2011).

8.5.4 Inequality of exposure to air and noise pollution

There is substantial evidence that exposure to air pollution is negatively correlated with demographic and socioeconomic indicators within countries and cities, but much of this evidence is from the United States, Canada, and Europe (Fairburn et al., 2019; Hajat et al., 2015). Air pollution is higher in neighborhoods with lower socioeconomic status in Canada. In Hamilton, Ontario, income, home values, and unemployment are all important predictors of neighborhood levels of air pollution (Jerrett et al., 2001). Similarly, in the United States, levels of fine particulate matter have fallen over the past few decades and the gaps between high pollution areas and low pollution areas have decreased substantially (Colmer et al., 2020). However, the relative disparity in exposure to fine particulate matter by sociodemographic characteristics has largely persisted across decades despite reductions in levels of fine particulate matter in neighborhoods that are economically and socially advantaged (Colmer et al., 2020).

Although the literature on inequality in exposure to noise pollution by demographic or socioeconomic status is not as extensive as that on the relationship between exposure to air pollution and demographic and socioeconomic characteristics, there is evidence that disadvantaged populations have greater exposure to noise pollution. For instance, there is a strong correlation between economic indicators and exposure to noise pollution in Montreal, Canada (Dale et al., 2015). Similarly, there is evidence from Germany and Switzerland that lower socio-economic status is linked to high exposure to airport noise and traffic noise (Hoffmann et al., 2003; Huss et al., 2010). Another study from Germany provides additional evidence on perceptions. Kohlhuber et al. (2006)if yes, how perceived exposure to noise and air pollution is influenced by socioeconomic status in Germany. We used data from a large-scale population-based survey. In this survey, data on perceived exposure to noise and air pollution and on socioeconomic status and housing conditions were collected on an individual basis. The study population consisted of 7275 adults aged 17–98 years (40% women found that individuals with lower socioeconomic status report a greater perceived burden of traffic noise. Further, evidence from Hong Kong indicates that wealthier and better educated residents have lower exposure to traffic noise (Lam and Chan, 2008).

The body of rigorous evidence for LAC is smaller, but the evidence that exists suggests that similar patterns in inequality of exposure to air and noise pollution may be present in the region. Areas of Santiago, Chile, with lower socioeconomic status have 21 percent more days with unhealthy air quality than other areas of the city (Rose-Pérez, 2015). However, not all studies find evidence of unequal exposure to air pollution by socio-economic characteristics. In particular, Romero-Lankao et al. (2013) did not find that lower socioeconomic characteristics were associated with greater air pollution exposure or health risks in Bogota, Mexico City, and Santiago.7 Unfortunately, because there is little systematic measurement of noise pollution in LAC, there is almost no systematic evidence on exposure to noise pollution across income and wealth levels in LAC.

In addition to inequality in exposure to air and noise pollution by income or wealth, there are also inequalities in exposure to air or noise pollution by demographic characteristics, such as race and age. Many studies document racial disparities in air pollution exposure based on residential location in the United States, with Black and Latino populations exposed to higher levels of air pollution (Bell and Ebbisu, 2012; Colmer et al., 2020; Woodruff et al., 2003). In the United States, racial disparities in children's exposure to air pollution has been documented both at home and in school (Chakraborty and Zandbergen, 2007). In many areas of Latin America, older adults have greater exposure to poor air quality (Gouveia et al., 2019). This is particularly concerning because older adults also have greater health risks from air and noise pollution (Medina-Ramon and Schwartz, 2008; Simoni et al., 2015; Carrier et al., 2016; Liu et al., 2017).

6. More specifically, the European Union Member States and other western European countries.
7. The opposing results found for Santiago in Romero-Lankao et al. (2013) and Rose-Pérez (2015) may be due to different time periods or geographical samples for the analysis and/or different measures of socioeconomic status.

8.5.5 Inequality in exposure to air and noise pollution leads to health inequalities

Unequal exposure to air and noise pollution contributes to unequal health outcomes. Exacerbating the problem, the non-linear relationship between pollution and health outcomes implies that even relatively small differences in exposure can lead to large differences in health outcomes (Shen et al., 2017). As a result, these environmental inequalities exacerbate existing inequalities in health, education, and income.

Unequal access to health care and health status compounds the differential impacts of air and noise pollution by socioeconomic and demographic characteristics (Perel et al., 2006). With less access to health care, lower-income citizens do not have the same opportunities to manage risk factors or chronic conditions (Almeida-Filho et al., 2003). Further, independent of differences in access to health care or exposure to air pollution, income and socioeconomic characteristics are an important determinant of risk factors and health status (Perel et al., 2006; Deguen and Zmirou-Navier, 2010; United Nations Economic Commission for Europe, 2013).

Further, high exposure to air and noise pollution during childhood and inequalities in exposure for pregnant women and children is especially concerning because they contribute to inequality in many long-term outcomes, such as health and educational attainment. In the United States, there is evidence that differences in average yearly fine particulate matter at the neighborhood level can explain as much of the disparity in pre-term births between Black mothers and white mothers as established demographic characteristics such as maternal age and education (Benmarhnia et al., 2017). Pre-term birth is associated with long-term health and developmental deficiencies, implying that differences in air pollution exposure across subpopulations before birth contributes to differences in health and educational outcomes throughout life (Moster et al., 2008; Saigal and Doyle, 2008).

8.5.5.1 Case of Santiago, Chile

As a case study, we analyze the unequal exposure to air and noise pollution in the comunas of the metropolitan area of Santiago, Chile,8 with a focus on simple graphical correlations to display visual evidence of the relationship between exposure to high levels of ambient air and noise pollution and proxies of socioeconomic characteristics and access to health care at the neighborhood level. This analysis does not provide causal evidence and cannot rule out that the correlations are driven by an unidentified third factor.

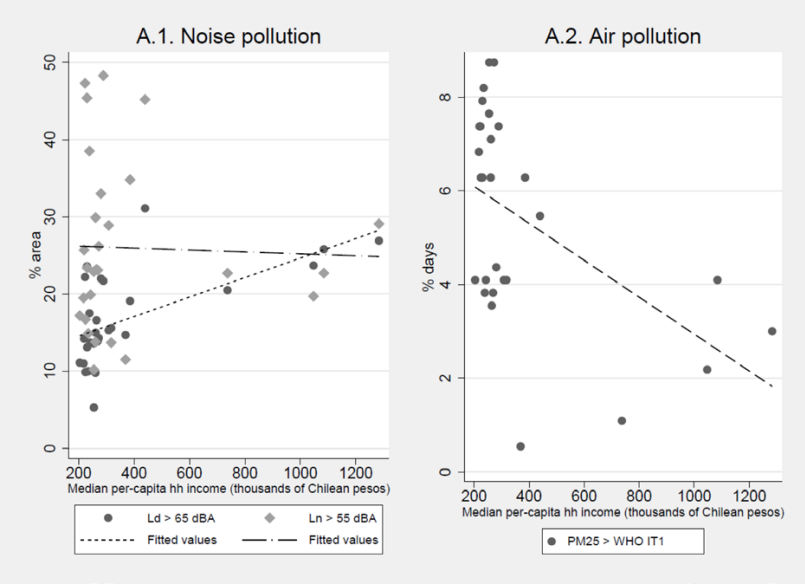
Within this region, 13 air quality monitoring stations collect hourly data on different pollutants. We created pollutant-level data series at the hourly level for each comuna using a distance-weighted average of all monitoring stations' data series within a 15 km radius of the centroid of the comuna. We defined exposure to air pollution by comuna, creating a variable for the percentage of days in 2016 with at least one hour above WHO thresholds. We focus on 2016 because noise pollution data are also available for this year. Also, we focus on the IT1 WHO threshold because this level corresponds to the highest mean concentrations reported in studies of long-term health effects. The IT1 PM2.5 threshold has been shown to be associated with significant mortality in the developed world (WHO, 2005). To quantify noise exposure, we used noise pollution maps from the Ministry of Environment of Chile. They build a variable that reflects the percentage of the comuna area exposed to high noise pollution levels based on the Organisation for Economic Co-operation and Development (OECD) recommendations: daytime noise exceeding 65 dB and nighttime noise exceeding 55 dB.

8 We focus on Santiago, Chile, because it is one of the only cities in LAC to collect systematized noise pollution data. The comunas are the smallest basic administrative division in Chile. It corresponds to what in other countries is known as a municipality.

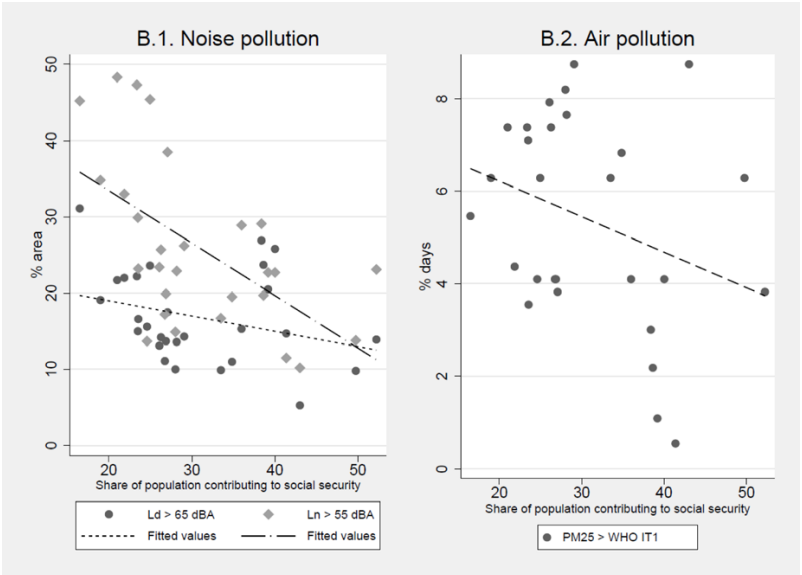
Figure 28 Noise and air pollution vs socioeconomic status

Source: IDB staff calculations based on data from the Ministry of Environment and the Encuesta de Caracterización Socioeconómica Nacional (CASEN) from the Ministry of Social Development and Family of Chile.
Notes: Panel A depicts the correlation between per-capita household income and noise and air pollution. Panel A.1. correlates per-capita household income with the percentage of the comuna area exposed to noise pollution levels above OECD recommendations. Panel A.2. correlates per-capita household income with the percentage of days in 2016 with at least 1 hour above the WHO PM 2.5 IT1 threshold. Panel B depicts the correlation between the share of population contributing to social security and noise and air pollution. Panel B.1. correlates the share of population contributing to social security with the percentage of the comuna area exposed to noise pollution levels above OECD recommendations. Panel B.2. correlates the share of population contributing to social security with the percentage of days in 2016 with at least 1 hour above the WHO PM2.5 IT1 threshold. The OECD recommendations consider daytime noise levels exceeding 65 dB (Ld > 65 dBA) and nighttime noise levels exceeding 55 dB (Ln > 55 dBA) to be high. The data on per-capita household income and the share of population contributing to social security are based on the CASEN survey.

A. Per-Capita household income



B. Share of population contributing to social security



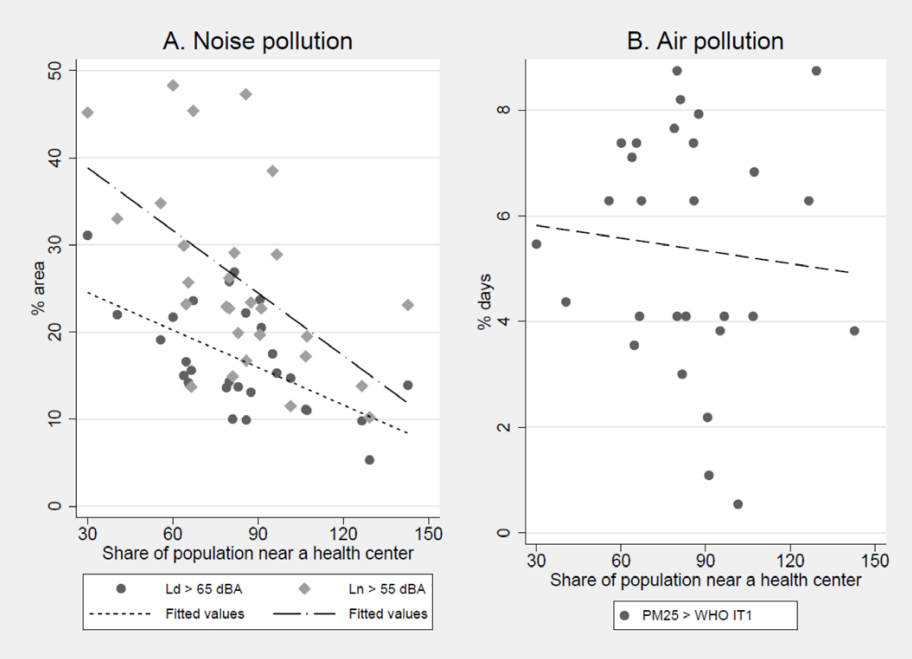
We find an unequal exposure to environmental pollution by socio-economic status at the neighborhood level. For instance, the richest comunas, measured by per-capita household income, are less exposed to higher air pollution levels (see Panel A.2 of **Figure 28**). However, we do not see the same pattern for noise pollution (see Panel A.1 of Figure 28). Likewise, comunas with a higher percentage of the population working in formal employment, another proxy for higher socioeconomic status, are less exposed to air and noise pollution (see Panels B.1 and B.2, Figure 28). These results are consistent with several studies showing a negative correlation between air pollution and socially and economically advantaged populations (Hajat et al., 2015; Rose-Pérez, 2015; Fairburn et al., 2019) and with other studies showing a weak association between noise exposure and socioeconomic position (Brainard et al., 2004; Fyhri and Klaeobe, 2006).

Our correlation exercises are in line with this literature and demonstrate the need to study these issues further in LAC. Understanding how environmental pollution exposure differs by socioeconomic characteristics of the population is important for environmental policy and public health, not only to reduce the average risk across people but also to ensure that no population subgroup is more affected than others (Beevers et al., 2018).

Next, we look at the correlation between access to health care and exposure to high levels of ambient air and noise pollution at the neighborhood level. According to **Figure 29**, comunas with higher exposure to noise and air pollution have lower health center coverage measured as the share of population near a health center, although the relationship between air pollution exposure and health center coverage is relatively weak. This is evidence of unequal access to health services, particularly in places where people would need it most because of their high exposure to unacceptable noise and air pollution levels.

Figure 29 ***Noise and air pollution vs health centers***

Source: IDB staff calculations based on data from the Ministry of Environment and the Encuesta de Caracterización Socioeconómica Nacional (CASEN) from the Ministry of Social Development and Family of Chile.
Notes: Panel A depicts the correlation between the percentage of the comuna area exposed to high levels of noise pollution, based on OECD recommendations for daytime noise (Ld > 65 dBA) and nighttime noise (Ln > 55 dBA), and the share of population near a health center. Panel B shows the correlation between the percentage of days in 2016 with at least 1 hour above the WHO PM 2.5 IT1 threshold and the share of the population near a health center by comuna. The data on the share of population near a health center is based on the CASEN survey. Specifically, we use a question related to whether the respondent lives within 2.5 km of a health center. However, the CASEN survey is not representative at the comuna level so for some comunas the share of population near a health center could exceed 100.



8.5.6 The path forward: measurement, planning, and policies

8.5.6.1 More and better measurement

The first step in the management of air and noise pollution is measurement. Policymakers need accurate information on their citizens' exposure to air and noise pollution collected by comprehensive monitoring systems. A few cities are leading the way in comprehensive monitoring of air and noise pollution. London has one of the most comprehensive regulatory air quality monitoring networks, which has been collecting data using reference-grade monitors for decades (Breathe London, 2021; London Assembly, 2019). In 2018, the city launched Breathe London, a hyperlocal air-quality project, to improve spatial and temporal air quality monitoring by combining data from affordable and easy-to-install and maintain monitors with the data from the reference network (Breathe London, 2021; Environmental Defense Fund, 2021). Chicago leads US cities in monitoring a wide range of metrics. In 2016, Chicago launched the Array of Things, a network of 500 high-quality multi-purpose sensors installed on streetlights across the city (Mitchum, 2016). These sensors collect data on temperature, humidity, sound, air pollution levels, and vehicle and pedestrian traffic, among others (C40 Cities Climate Leadership Group, 2021). The Array of Things project has expanded into numerous cities across the United States and the world through collaborations between universities and governments (Array of Things, 2020; C40 Cities Climate Leadership Group, 2021).

In LAC, the coverage of air pollution monitoring needs to be expanded, the range of pollutants that are measured should be standardized, and data should be publicly accessible. As of 2016, only 17 of the 33 LAC countries had any ground-level air pollution monitoring, with few Caribbean or Central American countries having air pollution monitoring systems. Further, in most countries with air pollution monitoring systems, only a few of the largest cities have ground-monitoring stations (Riojas-Rodríguez et al., 2016). Overall, only 20 percent of the LAC population lives in cities with ground-level air quality monitoring systems (Riojas-Rodríguez et al., 2016). Within LAC, Chile is relatively advanced in its monitoring capabilities. Chile has 216 air quality monitoring stations across the country and is developing a noise monitoring network (Ministerio del Medio Ambiente, 2021; SINCA, 2021). To date, Chile is the only country in LAC that has established a noise monitoring network (Boyer et al., 2019).

8.5.6.1.1 Air pollution

Air pollution is measured from both ground station monitoring networks and satellite data. These two sources of data have different advantages and disadvantages and complement each other. Air pollution data from ground monitoring stations show the level of exposure to a particular pollutant for the population living near a monitoring station. For this reason, the air quality monitoring based on ground monitoring stations requires a large number of stations to cover most of the city or country. Currently, most of the monitoring stations are located in urban areas. Thus, they provide no information about pollution levels in rural areas. A clear advantage of the ground monitoring stations is the availability of data on different pollutants and the frequency of measurement. In contrast, satellite data are available worldwide and has greater geographic coverage than the data from a network of ground monitoring stations. However, air pollution satellite data are available for few pollutants, do not consider weather conditions such as wind and rain, and are more accurate when calibrated using ground-level monitoring stations. Therefore, using only satellite data can lead to inaccurate air quality measurements (Awe et al., 2017).

Considerable advances have been made in air quality monitoring in developed countries by expanding ground monitoring networks and using satellite and other remote sensing technologies (Awe et al., 2017). However, most low- and middle-income countries have not expanded their monitoring capabilities to the same extent as developed countries.

Furthermore, air pollution measurements and regulations are not standardized across all countries. For instance, the main pollutants regulated in LAC countries are $PM_{10,}$ NO_2, and SO_2 (Riojas-Rodríguez et al., 2016). Some Caribbean countries do not regulate any air pollutants. The WHO Air Quality guidelines (2005) offer global guidance on thresholds and limits for key air pollutants that pose health risks. It is necessary for governments to consider some of the well-established WHO thresholds and carefully analyze the local context and characteristics to adopt them. Also, the air quality regulatory framework should be regularly updated to reflect current knowledge on health effects (Riojas-Rodríguez et al., 2016). Without making substantial investments in air quality measurement systems, governments will not be able to mitigate pollution's adverse health effects.

8.5.6.1.2 Noise pollution

Very few cities collect systematic data on noise pollution. The starting point for implementing action plans to reduce noise pollution is the production of strategic noise maps (Picaut et al., 2020). In Europe, the Directive 2002/49/EC declaration introduces many rules related to the assessment and management of noise environments where noise mapping is crucial for implementing action plans to reduce noise pollution. However, the literature has shown that the noise maps methodology has certain limitations. Other environmental monitoring tools have been implemented based on the Internet of things (IoT) to develop low-cost sensors for acoustic measurement (Bello et al., 2018; Botteldooren et al., 2013; Offenhuber et al., 2018; Socoró et al., 2017). For road traffic noise, Socoró et al. (2017) discuss the importance of removing the anomalous noise events unrelated to road traffic from the noise map computation and introducing an anomalous noise detector in real time that uses a Wireless Acoustic Sensor Network (WASN). This methodology's main objective is to develop affordable solutions to the noise mapping procedure's limitations, maintaining the acoustic measures' reliability while improving the system's scalability. Some WASN-based systems have been designed across Europe. The Barcelona noise monitoring network in Spain, the Cense project in France, and the Intelligent Distributed Environmental Assessment (IDEA) project in Belgium are good examples of this type of sensor (Alías et al., 2019; Socoró et al., 2017).

Similarly, in the United States, the Sounds of New York City (SONYC) project linked WASN-based systems to machine learning techniques and collaborative and social computing to address significant gaps in the process of urban noise mitigation (Bello et al., 2018). None of these acoustic sensors have been implemented in Latin American countries to the best of our knowledge. Nevertheless, the implementation of noise mapping procedures has already started. For instance, in Santiago de Chile, the Ministry of Environment developed an environmental noise monitoring network consisting of 14 monitoring stations. The data generated by these stations is used to create noise maps of the city's urban areas (Ministerio del Ambiente-Chile, n.d.). Later, with improvements in technology, those noise maps could be transformed into smart acoustic sensors like the ones previously discussed.

8.5.6.2 Higher priority and better planning to reduce air and noise pollution

Greater importance should be placed on reducing air and noise pollution to improve health and quality of life in LAC cities. High rates of urbanization in LAC and the presence of mega-cities make managing air and noise pollution challenging because of transport emissions and congestion from high rates of motorization (Bai et al., 2017; Blakanov et al., 2016; Jaitman et al., 2015). Further complicating the management of pollution, many cities in LAC have topographies that limit air flow and contribute to thermal inversions (Escobedo et al., 2008). However, the current situation can be improved by integrating noise and air pollution considerations into the urban planning process and elevating their priority in policy design and urban planning.

A wide range of policies to decrease air and noise pollution will pass a cost-benefit test, and even relatively costly policies can be cost effective. In Latin America, Bell et al. (2006) found that air pollution control policies would avert adverse health outcomes, including over 156,000 deaths, 4 million asthma attacks, 300,000 children's medical visits, and almost 48,000 cases of chronic bronchitis in Mexico City (Mexico), Santiago (Chile), and Sao Paulo (Brazil) over a 20-year period. Although Bell et al. (2006) does not estimate the costs of the air pollution control policy, the authors estimate that the health improvements that result are valued at nearly US$567 million in the first year alone, demonstrating the immense benefits of such policies. Similarly, economists argue that although it is not possible to precisely calculate the costs and benefits of the Clean Air Act, primarily "command and control" regulations implemented in the United States, there is general agreement that over the past 50 years the benefits have greatly exceeded the costs (Currie and Walker, 2019).

Decision-makers should include inequality considerations, such as unequal improvements in air pollution exposure, in the process of deciding which policies to implement. Plans and policies to reduce air and noise pollution need to be developed with a joint focus on reducing exposure to air and noise pollution and promoting equity. For example, in the United States, air quality improvements due to the National Ambient Air Quality Standards in the 1970s and 1980s disproportionately benefitted higher income groups and white populations (Gelobter, 1992). Similarly, Richmond-Bryant et al. (2020) consider the reduction in operation of coal-fired power plants in the United States and finds that improvements in air quality are greater for populations above the poverty line and white populations.

Further, the unequal health impacts of air and noise pollution in LAC cities described above illustrate that policies to reduce air and noise pollution have the potential to alleviate other sources of inequality in LAC. Improvements in transport, particularly public transport is an area of opportunity in LAC. Roadways, railways, and airports are significant sources of air and noise pollution (Beelen et al., 2009; Burroughs Peña and Rollins, 2017; European Environment Agency, 2019; Foraster Maria et al., 2014; Huss et al., 2010; Jacyna et al., 2017; Sørensen et al., 2020; United Nations Economic Commission for Europe, 2013; WHO, 2011)"plainCitation":"(Beelen et al. 2009; Huss et al. 2010; WHO 2011;

Foraster Maria et al. 2014; Burroughs Peña and Rollins 2017; Jacyna et al. 2017; European Environment Agency 2019; Sørensen et al. 2020. Developing sustainable and comprehensive public transit solutions that provide greater links across neighborhoods can decrease air and noise pollution while promoting more equitable access to employment opportunities (Heres et al., 2014; United Nations Economic Commission for Europe, 2013).

In general, the marginal health impacts of air pollution are higher in lower- and middle-income countries than in high-income countries (Adhvaryu et al., 2019; Alberini et al., 1997; Arceo et al., 2016; Barwick et al., 2018; Colmer et al., 2020; He et al., 2015). One reason is that lower- and middle-income countries have higher levels of air pollution and the health impacts of air pollution are non-linear (Burroughs Peña and Rollins, 2017; Carson et al., 1997; Chriscaden and Osseiran, 2016; Health Effects Institute, 2020; Mannucci and Franchini, 2017; Shen et al., 2017; Yu and Chien, 2016). But higher-income countries also tend to have better population health and health care access and quality, which lowers the negative impacts of air pollution (Colmer et al., 2020). Therefore, lower- and middle-income countries can reduce the negative health impacts of air pollution by reducing air pollution levels, by fostering economic development, and by improving their populations' health and access to health care.

Many governments have developed air pollution reduction and management plans. Given the substantial health impacts of noise pollution, there is a clear need for policies and regulations to manage and reduce noise pollution too. However, over the past few decades, air pollution has become a significant public health concern for policymakers and citizens of LAC, but noise pollution has not received the same consideration. To the best of our knowledge, no government in LAC currently has a comprehensive noise pollution reduction or management plan.

To improve public health and environmental quality, governments should develop noise pollution reduction and management plans in the same way that they have developed plans to manage and reduce air pollution. These plans could set short-, medium-, and long-term noise pollution targets and include regulations to decrease noise pollution sources, plans for investments in infrastructure, and policies to encourage behavior change (Den Boer and Schroten, 2007; WHO, 1999). Further, these plans should specifically consider noise levels at key locations, such as hospitals, schools, playgrounds, and residential areas; incorporate noise into the planning processes for transportation and land use; and differentiate between daytime and nighttime noise levels (WHO, 1999).

Prior research and best practices point to some concrete steps to decreasing noise pollution. Pope et al. (2014) describe a toolkit for the design of cities that provides 23 specific "tools" for improving the urban sound environment. These plans will likely rely on new urban infrastructure, new policies and programs, and new regulations. As one example, noise emission from vehicles could be regulated the way that air pollution emissions from vehicles is often regulated, and porous asphalt for roadways could be used to reduce noise pollution (Den Boer and Schroten, 2007).

8.5.6.3 Policies to reduce air and noise pollution deliver co-benefits

Many policies to improve air and noise pollution provide substantial co-benefits that improve the quality of life in cities. For example, urban forests reduce local air and noise pollution while providing myriad other benefits, such as shade, recreational opportunities, wildlife habitats, local temperature moderation, reduced energy usage by nearby buildings, and carbon sequestration (Dwyerl et al., 2003; Escobedo et al. 2008; Margaritis and Kang, 2017; Tyrvainen and Miettienen, 2000; Ulrich, 1986; WBG, 1994). Many cities in LAC, including Mexico City, Mexico, Santiago, Chile, and Sao Paulo, Brazil, have policies and programs to integrate trees and vegetation into their cityscapes, particularly along roadways, and Santiago, Chile, has a specific policy goal of using street trees and green spaces to remove PM10 from the air (Escobedo et al., 2008). Despite the fact that Santiago's municipal urban forests require active management to maintain in the semi-arid climate (Escobedo, 2004), urban forests are a cost-effective approach to reduce air pollution in Santiago (Escobedo et al., 2008).

In urban areas of LAC, road traffic is one of the primary sources of noise pollution and a significant contributor to air pollution (Bai et al., 2017; Blakanov et al., 2016; Calatayud et al., 2021; Jaitman et al., 2015). Policies that facilitate modal shifts in transportation from private cars to public transit and bicycles reduce noise pollution and air pollution while providing important co-benefits for climate change and traffic congestion (Van Renterghem et al., 2019). In a similar vein, hybrid and electric vehicles, combined with renewable electricity generation, will improve both noise pollution and air pollution, while mitigating climate change (Can et al., 2020). Further, reducing speed limits and redesigning intersections from traffic light intersections to roundabouts can reduce noise pollution and contribute to traffic safety (Chevallier et al., 2009). Traffic flow models, originally developed to manage congestion, can be used to evaluate the impact of speed reductions or changes in traffic patterns on noise pollution and air pollution simultaneously (Fernandes et al., 2019; Sampaio et al., 2019).

8.5.6.4 Toward a better future

Latin America and the Caribbean face substantial challenges to reducing air and noise pollution to levels in line with guidelines established by the World Health Organization. Current levels and patterns of exposure imply that citizens experience substantial negative health impacts of air and noise pollution and that these health impacts are unequal, exacerbating inequality in the region. In a region characterized by economic inequality (Economic Commission for Latin America and the Caribbean, 2020b), the unequal health impacts are particularly worrisome. Fortunately, research on air and noise pollution and the development of best practices has accelerated and expanded, providing policymakers with more guidance on these issues.

The first step to achieving better air quality and quieter cities is to elevate the priority of air quality and noise as public health and environmental objectives. From this point, better data systems and measurement can be used to identify effective regulations and cost-effective policies to reduce air and noise pollution while delivering additional benefits that improve the quality of life in cities.

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BOX III

8.6 AIR POLLUTION FROM SMALL-SCALE BRICK KILNS IN CIUDAD JUÁREZ HAS SEVERE ADVERSE HEALTH EFFECTS, PARTICULARLY AMONG HOUSEHOLDS WITH LOW INCOMES

Ciudad Juárez, Mexico

8.6 Box III: Air Pollution from Small-Scale Brick Kilns in Ciudad Juárez, Mexico, Has Severe Adverse Health Effects, Particularly among Households with Low Incomes

Allen Blackman, IADB (CSD/CSD)

When it comes to the environmental performance of polluting firms in the cities of LAC, small is not necessarily beautiful. Certain types of microenterprises create severe pollution problems (Blackman, 2006). Those engaged in leather tanning, electroplating, metalworking, brick and tile making, printing, auto repair, wood and metal finishing, mining, charcoal making, textile dyeing, dyestuffs manufacture, and food processing have received the most attention.

Dirty small firms can have environmental impacts that belie their size for a number of reasons. They are often quite numerous; many cities support thousands. They typically lack pollution control equipment and sometimes do not even have access to basic sanitation services such as sewers and waste disposal. They are generally highly competitive (since barriers to entry are relatively low) and therefore are under intense pressure to cut costs regardless of the environmental impact. And finally, they are often a significant source of employment and situated in mixed-use neighborhoods comprising both businesses and homes. As a result, many people are exposed to their emissions. Unfortunately, the resulting adverse health effects are generally disproportionately borne by people with low incomes, who comprise the lion's share of those employed in dirty microenterprises and those who live nearby.

8.6.1 Small-scale brickmaking in Latin America and the Caribbean

Brickmaking offers a prime example of this phenomenon. Cities throughout the LAC host kilns clustered into brickyards. Colombia is home to more than 17,000 kilns; Brazil, 6,800; Chile, 2,400; and Mexico, 2,200 (Climate and Clean Air Coalition, 2015). Most brick kilns are small scale, low technology, and labor intensive.

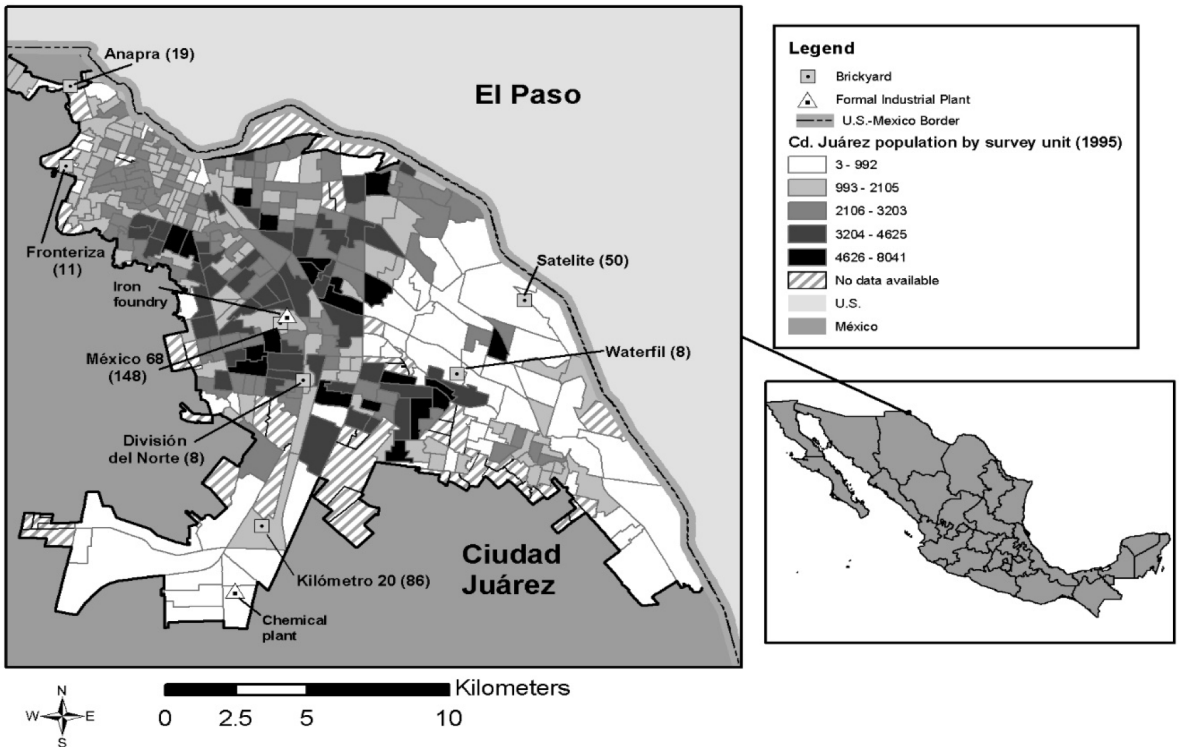
Bricks are generally molded by hand from clay and mud, sun dried, and then stacked inside a rudimentary brick or adobe structure atop a fire box. Fired for days at a time, kilns often use highly polluting fuels such as creosote, scrap wood, used tires, and plastic waste. They generally have no smoke stacks or low ones.

8.6.2 Brickmaking in Ciudad Juárez, Mexico

Ciudad Juárez is home to approximately 350 small-scale informal brick kilns (Blackman et al., 2006). The average kiln is a 10 meter square adobe structure that holds 10,000 bricks, employs five or six people, and is fired two to three times a month with scrap wood, sawdust, and other rubbish. Most of these brick kilns use no pollution control devices whatsoever. They are clustered in seven poor *colonias* (neighborhoods) scattered throughout the city (**Figure 30**). When brickmakers squatted in these *colonias* decades ago, all were situated on the outskirts of the city. Today, however, most have been enveloped by urban sprawl.

Figure 30 ***Brickyards, formal industrial facilities, and population in Ciudad Juárez***

Source: Blackman et al., 2006.



Although Ciudad Juárez is home to over 250 maquiladoras—foreign-owned plants that have located in the city to reduce labor costs—somewhat surprisingly, brick kilns have historically been the city's leading source of industrial air pollution.

In the 1990s, they contributed 16 percent of all particulate matter pollution, and 43 percent of all sulfur dioxide (Blackman et al., 2006).

8.6.3 Effects on human health

Blackman (2004) and Blackman et al. (2006) report on a set of studies that used a suite of air dispersion, epidemiological, and regression models to examine the effects on human health of the particulate matter pollution (PM10, particulate matter smaller than 10 microns in diameter) emitted by brick kilns in Ciudad Juárez, and to compare these effects to those generated by two formal sector facilities that are also leading sources of air pollution in the city—an iron foundry and a chemical plant.

The main findings are as follows. First, because they have low or no smoke stacks, brick kiln emissions mostly affect PM10 concentrations within 500 meters. As a result, their adverse effects on human health are highly localized geographically.

Second, brick kilns emissions are responsible for serious health damages including over a dozen premature mortalities per year (**Table 4**).

Table 4 ***Annual health effects of uncontrolled PM10 emissions from brick kilns (mean values and 95% confidence intervals)***

Source: Blackman et al., 2006.

Health endpoint	Number of cases		
	Low	Mean	High
Mortality	3	14	33
Respiratory hospital admissions	4	15	29
Cardio. hospital admissions	2	6	13
Emergency room visits	0	605	1,690
Adult respiratory symptom days	79,900	379,400	828,600
Work-loss days	122,100	549,900	1,173,000
Adult restricted activity days	1,854	84,620	225,500
Child restricted activity days	1,240	56,650	150,900
Asthma attacks	8	782	2,075
Child chronic bronchitis	0	1,632	4,248
Child chronic cough	0	1,901	5,087
Adult chronic bronchitis	0	95	242

Third, because brick kilns have such significant effects on human health, the net benefits (annualized benefits minus costs) of controlling their emissions typically exceeds net benefits for formal industrial facilities. **Table 5** presents estimates of net benefits from three strategies for controlling PM10 emissions from brick kilns (substituting clean burning natural gas for dirty fuels, upgrading kilns using a low-emissions design created by New Mexico State University, and relocating kilns to less populated areas) and from the two representative formal sector facilities (assuming alternatively that their emissions are completely uncontrolled or controlled to half of US standards). The net benefits of controlling emissions from brick kilns exceed those from formal factories by a considerable margin, although the size of this margin depends critically on the actual level of pollution abatement in formal factories.

Table 5

Annual net benefits of pollution control strategies for brick kilns and formal industrial facilities (benefits less costs in millions of 1999 $US; mean values and 95% confidence intervals)

Source: Blackman et al. 2006

Scenario		Brick kilns		Iron foundry		Chemical plant	
	Natural gas	NMSU kilns	Relocation	Baseline = no controls[a]	Baseline = 50% US controls[b]	Baseline = no controls[a]	Baseline = 50% US controls[b]
High	159.69	158.88	90.77	11.13	5.56	61.99	31.00
Mean	52.81	52.52	30.11	4.63	2.31	23.41	11.70
Low	6.24	6.24	3.50	0.97	0.49	4.14	2.07

a Net benefit of installing and operating PM10 control equipment standard in a similar US plant assuming baseline is no controls.

b Net benefit of installing and operating PM10 control equipment standard in a similar US plant assuming baseline is equipment sufficient to achieve 50% of abatement that would result from US-level controls.

And finally, brick kiln pollution disproportionately affects people with low incomes. A census tract-level univariate regression of average annual PM10 concentration (micrograms per cubic meter per year) attributable to brick kilns onto a measure of poverty (the percentage of the labor force earning less than two times the minimum wage) indicates that PM10 from brick kilns is positively correlated with poverty (Blackman, 2004). The same is not true of PM10 from the two representative formal sector sources. The reason is that, as noted above, PM10 emissions from brick kilns mostly settle within a half kilometer of the brickyards, areas that tend to be located in low-income residential neighborhoods.

What are the implications of these findings for policy? They suggest that environmental regulatory and municipal governmental authorities should expand the scope of their efforts to control pollution to include clusters of small-scale dirty enterprises. Doing so could help to reduce the disproportionate impacts of pollution borne by people with low incomes.

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PART 2

9. URBAN POLICIES FOR HEALTHY CITIES

Mexico City, Mexico

PART 2

BOX IV

9.1 LOCAL PUBLIC CHOICES AND PUBLIC HEALTH

Medellín, Colombia

9.1 Box IV: Local Public Choices and Public Health

William Savedoff, Social Insight

Throughout human history, cities have had a mixed effect on human health. In certain periods, urban residents have had similar or better health than those in rural areas. However, at other times, people living in urban areas have been less healthy, with greater exposure to infectious disease, crowded living conditions, limited access to fresh foods, and demanding work conditions (Costa and Steckel, 1997, Fogel et al., 1983; Meinzer et al., 2019). For example, in Scotland during the 1860s, urban life expectancy at birth was 35.5 years for women and 32.6 years for men, about 8 years less than the national average.[9] Indeed, the roots of modern urban planning and public health as we know them today emerged in 18th- and 19th-century Europe as a way to address concerns over pollution, pestilence, and poverty.[10]

Since the mid-20th century, cities in LAC have generally supported healthier populations on average than those living in rural areas. This difference can be ascribed to a variety of contributing factors, such as higher incomes, access to education, health care services, and potable water, as well as better sanitary conditions.

Nevertheless, health conditions vary substantially even within the region's cities—usually in association with differences in socioeconomic status. For example, one study found that women live 10 years longer if they reside in areas with the highest socioeconomic levels relative to the lowest, while for men the difference was 8 years. Similar gaps ranging from 2 to 10 years were documented in Santiago, Mexico City, Belo Horizonte, and Buenos Aires. In the same study, only San José, Costa Rica, exhibited a difference of less than one year (Bilal et al., 2019).[11]

Cities play a key role in the health of people living in LAC for a number of reasons. First, the region is highly urbanized—more than 80 percent of the region's population, or 529 million people, live in urban areas—so national health measures are, in many ways, urban health measures (IADB, 2020). Second, people living in cities generally have better access to health care services because of the greater concentration of specialized and hospital services. For example, many health programs in the last three decades have focused on increasing rural access to the kinds of prenatal and hospital services that urban populations consider routine. Third, for many years now, the major causes of ill health in the region have been chronic illnesses rather than infectious diseases; chronic illnesses accounted for 77 percent of all deaths and 71 percent of disability-adjusted life years (DALYs)[12] in 2019. The risk factors for chronic disease are strongly associated with environmental factors and social behaviors, which are intimately tied to urban living, whether pollution from particulate matter or unhealthy diets.

9. Urban life expectancy at birth in the early 1860s was around 35.5 years for women and 32.6 years for men, compared with 43.1 years for women and 40.5 years for men in the entire population. This gap of approximately eight years reduced to about three years by the late 1910s, when urban life expectancy at birth was around 48.5 years for women and 45.4 years for men, and total life expectancy was 51.4 years for women and 48.6 years for men. The gap or disadvantage in life expectancy relative to the rural population was considerably higher (Torres, Canudas-Romo, and Oeppen, 2019).
10. This is not meant to imply that urban planning and public health were first invented in Europe. Historical and archeological records clearly show sophisticated understanding of the interactions between urban living and health in the early civilizations of China, the Middle East, India, and Latin America.
11. Areas with the highest socioeconomic levels in the study were defined as census tracts at the 90th percentile in terms of the share of residents over 25 years old who have completed secondary education. The lowest socioeconomic levels were the areas at the 10th percentile (Bilal et al., 2019).
12. The Global Burden of Disease (GBD) study uses DALYs, which are the sum of years of life lost to premature mortality (YLL) and years lived with disability (YLD). In the GBD lexicon, "disability" refers to any short-term or long-term health loss other than death. By contrast, the IDB's Diversity Action Plan promotes the social model of disability recognized by the UN Convention on the Rights of People with Disabilities, which defines disability not as a medical condition but as the result of an interaction between people with impairments and the external barriers that limit their effective participation in society.

Finally, living in urban areas continues to be risky for infectious disease, particularly in peri-urban and poor neighborhoods where sanitation, reliable potable water, and crowding may be common (Corburn and Sverdlik, 2019). The COVID-19 pandemic has highlighted the unequal nature of infectious disease, with higher rates of infection, greater severity of illness, and greater likelihood of death for those in lower socioeconomic categories (Corburn and Sverdlik, 2019).

While COVID-19 is an unusual disease for its high rate of transmissibility, the emergence of a new infectious disease is not rare. In just the last two decades, we have experienced serious outbreaks of Ebola, H1N1, zika, Middle East respiratory syndrome (MERS), and severe acute respiratory syndrome (SARS), as well as continuing outbreaks involving well-known diseases like dengue, chikungunya, yellow fever, and measles.

For all these reasons, local public policy choices in urban areas have a significant impact on health, even greater than many national policies. Cities play a significant role in controlling infectious diseases in some of the most unglamorous ways. The unsung heroes of most municipal offices are the people who build, operate, and properly maintain sanitation systems; assure the quality of potable water; manage to collect and properly dispose of solid waste; and license and regulate markets, grocery stores, and restaurants. Without them, foodborne and waterborne diseases would be endemic.

City zoning affects many health conditions, ranging from respiratory illness to cancers, by influencing the proximity of industrial sites and highways to residences and schools. Establishing and enforcing building codes reduces mortality and morbidity from fires, earthquakes, and extreme weather (World Bank, 2015). And indoor air quality improves when people use nonpolluting stoves (Barnes et al., 2015).

City transportation affects health through accidents and by affecting exercise, access to social services, and access to social activities. Fewer traffic accidents happen when road designs take human behavior into account, reduce sharp turns, and limit interactions between buses, cars, bicycles, and pedestrians (Martinez et al., 2018). People are more likely to get exercise from walking when urban development plans create mixed-use residential and commercial areas with sidewalks, paths, and car-free zones (Mackett and Thoreau, 2015). Conventional (e.g., buses) and innovative (e.g., cable cars) public transit in urban areas improves access to schools, health facilities, social services, and healthier food options. For example, locating services within walking and biking distance of communities or improving public transit options can offset the disadvantages experienced by households with low income in their access to health services and schools (Jirón and Mansilla, 2013; Sarmiento et al., 2020; Villanueba, 2010). Evidence from surveys in 11 Latin American cities also shows that people with better access to mass transit or less congested roads are less likely to experience depression (Wang et al., 2019).

The challenges and resources of a metropolis with more than 10 million people, like São Paulo or Mexico City, are of a different order than in urban areas with half a million, such as Kingston, Jamaica, or 50,000 like Tinga Maria, Peru. Yet the policy choices and administrative efficiency of any of these urban areas plays a critical role in determining the life chances of its population. Urban areas benefit from economies of scale, greater wealth, past infrastructure investments, and capable people. By recognizing the interdependence of people concentrated in small areas and making smart choices, the urban areas of LAC can remain healthier and become more equitable places to live, work, and play.

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PART 2

9.2 HEALTH IN ALL URBAN POLICIES: EVIDENCE FROM LATIN AMERICAN CITIES

Panama City, Panama

9.2 Health in All Urban Policies: Evidence from Latin American Cities

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City and neighborhood environments can have a profound impact on the health of their residents (Galea et al., 2005; Diez Roux, 2016).

In highly urbanized Latin America, researchers have found wide variability across cities and urban neighborhoods in major indicators of health and well-being, including infant and adult mortality patterns and life expectancy, as well as chronic disease and risk factors (Bilal et al., 2019; Bilal, Hessel, et al., 2021; Braverman-Bronstein et al., 2021; Mazariegos et al., 2021; Ortigoza et al., 2020). Many city and neighborhood-level factors are linked to a wide variety of health outcomes in the Latin American context. These include social characteristics like educational attainment, socioeconomic status, and women's political representation, as well as physical characteristics related to housing quality, access to basic services, including clean water and sewage connections, transit options and traffic delays, among others, (Bilal et al., 2019; Bilal, Hessel, et al., 2021; Braverman-Bronstein et al., 2021; Carvajal et al., 2020; Hessel et al., 2020; Mazariegos et al., 2021; Ortigoza et al., 2020; Wang et al., 2019). Urban environmental features that cut across these many policy domains present opportunities for policymaking to improve health and reduce health disparities in cities.

Traditional ways of thinking about the root causes of health outcomes fail to explain patterns in population health and health disparities, both in Latin America and globally; individual-level behaviors and characteristics, as well as access to medical care, may not be wholly (or even primarily) responsible for the majority of health outcomes (Marmot, 2005; Marmot and Allen, 2014). An abundance of research has shown that individuals with lower socioeconomic status and lower income are at higher risk of noncommunicable diseases and other health risks than those with high socioeconomic status (Marmot and Bell, 2019). Actions to improve health through targeting individual behavior and access to health care neglect to recognize the fact that poverty and economic inequality are central challenges to urban health equity in the Latin America region and elsewhere.

Poverty in Latin America is an even more extreme crisis in the context of the COVID-19 pandemic: between the beginning and end of 2020, the proportion of people in the region living in poverty rose from 30.5 percent to 33.7 percent, an increase of 22 million people over the course of one year (Economic Commission for Latin America and the Caribbean, 2021b). In urban areas more specifically, 26.9 percent of the population living in cities (roughly 145 million people) was living in poverty in 2019, a number that surely increased in 2020 during the COVID-19 pandemic (Economic Commission for Latin America and the Caribbean, 2021a). Poverty and inequality in Latin America are often coupled with higher exposure to harmful urban environmental features: unplanned and unsafe housing and neighborhood quality (McTarnaghan et al., 2016), lack of access to efficient transportation (Yañez-Pagans et al., 2019), higher risk of exposure to the harmful effects of climate change (Islam and Winkel, 2017), obesogenic environments (Miranda et al., 2019), and more frequent experiences of violence and injury (Heinemann and Verner, 2006), among others. This has also been true during the COVID-19 pandemic, during which low-income populations in Latin American cities have experienced the harshest social, economic, and health impacts of the disease (Bargain and Aminjonov, 2021, p. 19; Bilal, Alfaro, et al., 2021; Diez Roux et al., 2020; Millán-Guerrero et al., 2021, p. 19; *The Lancet*, 2020, p. 19).

Siloed policy action across urban sectors that does not take health into account may miss opportunities to promote health while reducing these harmful urban health impacts (World Health Organization, 2013). The integration of a Health in All Policies approach can support cities and countries in tackling the urban social determinants of health such as poverty and economic inequality through policies that cut across all aspects of city life. Health in All Policies (or HiAP) is an approach for promoting population health and health equity by ensuring that health implications are considered when planning new policies or policy changes within all sectors (such as education, employment, environment, urban planning, housing, and others) (World Health Organization, 2013). The core tenets of the HiAP approach were outlined in 2013 by a global consortium of public health practitioners and researchers (World Health Organization, 2013), and the World Health Organization and the Pan American Health Organization have since developed action plans to support the adoption of this approach by country governments worldwide (Pan American Health Organization, 2016; World Health Organization, 2014b). Despite HiAP's broad support among international organizations, a recent scoping review found that when describing and justifying urban-specific policies, a number of large international organizations[13] are not including health as a consideration in the vast majority of cases (Lein et al., 2020). Furthermore, when health is mentioned as a driver of urban policy, it is almost never accompanied by scientific evidence.

This article summarizes the available scientific evidence of the health and health equity impacts of a variety of place-based urban policies and interventions implemented in Latin American cities that cut across many parts of the urban environment, while also identifying gaps in the evidence that should be filled through future research: transportation and mobility options and interventions, housing and neighborhood quality and formality, interventions to promote climate change mitigation and climate resilience, violence and injury prevention, and urban governance.

Through this summary, this article seeks to support a HiAP approach in Latin American cities by compiling existing evidence and highlighting relevant gaps in understanding of the impact of urban policies and interventions on health outcomes. Latin America is a hub of urban policy innovation that has produced unexpected benefits across health, social welfare, and environmental sustainability, and lessons from the region can inform efforts across the global south and beyond to develop policies that promote health and health equity.

9.2.2 The available evidence for Health in All Policies in Latin American cities

9.2.2.1 Mobility and transportation

The health of city-dwellers can be enhanced or impaired by transportation-related policy and planning decisions. Globally, car-oriented urban planning has prevailed during recent decades. The exposure to transportation-related air pollution, car-oriented transportation infrastructure within urban communities, traffic congestion, and traffic crashes have led to several population-wide health consequences. The construction of car-oriented infrastructure (such as the expansion of busy roads and construction of highways) may create separation within communities, increasing exclusion and isolation. This phenomenon of "community severance" may induce loneliness and social isolation, which in turn have been associated with premature mortality (Holt-Lunstad et al., 2015). Traffic noise has also been linked to sleep disturbance, annoyance, and chronic stress (Ising and Kruppa, 2004). Perceptions of high traffic volume and high vehicle speeds are reported barriers to walking for transportation, and these perceptions negatively correlate with well-being (Anciaes et al., 2019). Those who use public transportation in cities may also suffer from poor service quality and commuting delays. Longer commuting time and traffic delay are associated with higher probability of depression in Latin American cities (Wang et al., 2019), lower probability of cooking at home, and higher consumption of ultra-processed foods (Christian, 2012; Morris et al., 2020).

Latin American cities and countries have taken action to increase active transportation, improve mass transit options and service, reduce transport-related emissions and air pollution, reduce vehicle crashes and related injuries and deaths, and provide safe spaces for women on public transport. In some cases, these policies have been evaluated to assess their health impacts.

13. The United Nations Human Settlements Program (UN-Habitat), the United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC), the World Bank (WB), the Inter-American Development Bank (IDB), and the Development Bank of Latin America (CAF).

9.2.2.2 Transport-related initiatives and their documented impact on health in Latin American cities

9.2.2.2.1 Active transportation for children and adults

Urban policies that promote active transportation (walking, cycling, and other modes that require physical exertion) may induce large health benefits, with active travelers reporting significantly higher total physical activity (Flint and Cummins, 2016), while smaller though population-wide benefits may accrue via reductions in air pollution and noise (de Nazelle et al., 2011). Along with increasing life expectancy, if physical inactivity were eliminated globally, 6 to 10 percent of cases of major noncommunicable diseases (including cardiovascular disease, breast and colon cancer, and diabetes) would be eliminated (Lee et al., 2012).

Despite potential population health benefits, evidence documenting the health effects of active travel-related initiatives in Latin American cities is lacking (Gomez et al., 2015). Emerging evidence from Bogotá shows that a school program (*Al colegio en bici*) consisting of bicycle training and education (including bicycle maintenance, riding safety, and more), coupled with education on civic skills, was successfully implemented. The program trained 3,194 students and distributed 2,031 bicycles during its first cycle (Hidalgo et al., 2016). Similarly, an innovative study in Chile suggests that *rutas bakanes* (cool routes to school) may increase physical activity while addressing social determinants of health (Sagaris and Lanfranco, 2019). Despite the success in the uptake of these programs, no documented health evaluations could be identified.

Latin American cities have also implemented initiatives to promote active transportation and physical activity across all age groups. *Ciclovías Recreativas*, implemented to date in at least 27 cities in Latin America, temporarily close streets to motorized vehicles to allow cyclists, joggers, and walkers to engage in physical activity, providing an exercise opportunity to city residents (Sarmiento et al., 2010).

A small number of evaluations have found that these programs provide a health benefit and are cost-effective (Montes et al., 2012; Torres et al., 2013). Additionally, a small number of Latin American cities have implemented bicycle-sharing programs and have documented an increase in the number of cyclists (Dias Batista, 2010). An important critique of both *Ciclovía Recreativa* and bicycle-sharing programs is that they have mainly been implemented in higher-income neighborhoods, potentially further exacerbating inequalities in access to recreation and health (Gomez et al., 2015). Again, more evaluation and research is needed to understand the health and health equity impacts of both ciclovias and bike shares in cities in the region.

BOX

A Public-Bicycle Sharing Program (Ecobici) in Mexico City: A Case Study from the SALURBAL Project

Ecobici, the largest bicycle-sharing program in Latin America, was launched in 2010. As of 2018, more than 6,800 bicycles had been installed at 480 stations in eight neighborhoods, with more than 276,000 users registered. Additionally, in 2020 and 2021, the Mexico City government added more than 50 kilometers of high quality bike lanes on high occupancy roads, which were initially intended to be temporary but have now become permanent.

The SALURBAL EcoBici study aims to:

1. capture short- and long-term changes in bicycle ridership after the implementation of cycling infrastructure expansions;
2. determine which types of transportation people stop using when they start bicycling;
3. observe differences in overall and transport-related physical activity between Ecobici users, other bicycle users, and non-bicycle users; and
4. explore specific questions about Ecobici, its users, and behavior, including:
    - variations in Ecobici users' demographics (such as age groups and gender participation) over time,
    - the contribution of Ecobici to meeting physical activity recommendations among users, and
    - neighborhood-level social and built environment characteristics associated with utilization of stations.

Researchers are collecting data using questionnaires, street audits, GIS data, GPS data, accelerometry, and direct observation. They have worked directly with the Secretariat of Mobility to gain access to Ecobici's historical database to analyze ridership and usage patterns over time.

Preliminary results suggest that temporary bike lanes prevented more extreme declines in bicycling than would have occurred during COVID-19 by providing an alternative transportation mode during this period (LAC-Urban Health, 2020).

Figure 31 ***Mexico City, May 19, 2018: Ecobici Public Service bike racks parked in Mexico City next to the central mall***

Source: Aberu.Go / Shutterstock.com

9.2.2.2.2 Bus Rapid Transit

Bus Rapid Transit (BRT) systems were first implemented in Curitiba, Brazil, in the 1970s and are now popular globally but especially in Latin American cities. These systems reserve road lanes exclusively for buses, with fare collection occurring in off-board stations to improve efficiency. Bus trips tend to increase the number of steps taken by commuters walking to and from bus stations, generating incidental physical activity. An evaluation of BRT implementation coupled with a complete streets intervention in Mexico City found that users walked 29 more minutes per week post-intervention (Chang et al., 2017). The study also showed significant reductions in carbon monoxide, nitrogen oxide, and particulate matter emissions (Bel and Holst, 2018). Additionally, in Bogotá, an evaluation of the Transmilenio BRT system revealed that among riders living in higher-income households, those with access to the system were less likely to own cars, which could contribute to higher levels of physical activity (Combs and Rodríguez, 2014). Though evaluations of BRT have revealed higher levels of physical activity in the case of Mexico and lower ambient air pollution, evidence is still lacking in terms of how BRT may impact more concrete health outcomes.

9.2.2.2.3 Cable cars for mass transit

Cable cars are well known at tourist attractions around the world. However, Latin America is one of the few regions where cable cars are being used as a mass transit option (Sierra Valdivieso et al., 2020; ***The Economist***, 2017). Cable cars are uniquely well-suited to Latin American urban landscapes because patterns of urbanization driven by a series of political, economic, sociocultural, and geographic forces, have led informal and self-built settlements and "slums" to be common across the region. These settlements are often located on hillsides and steep, mountainous terrain on city outskirts, and present multiple challenges to connectivity and mobility (Innovations for Poverty Action, 2015). Cable cars can overcome transportation challenges specific to these communities, which can help marginalized communities access jobs, services, and education and lead to better health and quality of life.

One example of this is the Metrocable in Medellin, Colombia, where researchers found a 66 percent lower homicide rate and a 75 percent lower rate of reported violence in neighborhoods that had access to the cable car, compared to neighborhoods without access (Cerdá et al., 2012).

BOX

A cable car system for low-income communities in Bogota (TransMiCable): A case study from the SALURBAL project

A new cable car was inaugurated in 2018 in Ciudad Bolívar, a low-income area in the periphery of Bogotá. This new service, called "TransMiCable," allows easy travel up and down the steep hillsides and connects the area to the city's BRT.

Integrating active community member and policymaker participation throughout the research process and a combination of quasi-experimental and mixed-methods approaches, the SALURBAL study is exploring impacts on social determinants of health as well as physical activity levels and health outcomes (Sarmiento et al., 2020).

Preliminary findings from this evaluation (Guevara et al., 2020) suggest that after the launch of TransMiCable:

1. travel times for all trips among TransMiCable users decreased by 22 minutes per trip on average;
2. residents of Ciudad Bolívar report engaging in an increased number of leisure activities in their time outside of work;
3. travelers using TransMiCable were exposed to much lower levels of particulate matter (PM2.5), black carbon (eBC), and carbon monoxide (CO) in cable car cabins than travelers using other modes;
4. levels of physical activity are higher among TransMiCable users than users of other modes; and
5. health related quality of life increased in Ciudad Bolívar, especially among women.

Figure 32 **TransMiCable cable car operates over Ciudad Juárez, Bogotá, Colombia**

Source: Olga Lucía Sarmiento, 2018

9.2.2.2.4 Air quality

Latin American cities experience unacceptably high levels of air pollution (Gouveia et al., 2021). Exposure to air pollution has been linked to exacerbated asthma (Yang and Omaye, 2009), cardiovascular mortality and morbidity (Samet and Krewski, 2007; Shah et al., 2013), all-cause mortality (Samet and Krewski, 2007; Yang and Omaye, 2009), diabetes (Cervantes-Martínez et al., 2021), and restricted physical activity (Künzli et al., 2000). Because of transport-related emissions' contribution to both poor health and environmental impacts, Latin American countries and cities have taken action to attempt to improve air quality through transportation policies.

Some of the air pollution Latin American cities experience is due to large diesel-powered vehicles transporting both goods and people in trucks and buses. São Paulo city experienced high levels of diesel emissions for many years, as the main transit route for large vehicles went through the city's downtown, causing severe traffic congestion (He et al., 2017). The opening of a beltway that redirected large vehicles out of the city center reduced traffic congestion in the city center for a short time, until passenger vehicles filled the void left by the heavy vehicles (He et al., 2017). Despite the return of traffic, He et al. (2017) found that many of the air quality benefits of the opening of the beltway remained as heavy diesel-powered vehicles were replaced by gasoline–ethanol passenger cars.

Improving the efficiency of mass transit options can also lead to a reduction in emissions from passenger cars. Evaluations of the TransMilenio BRT system in Bogotá and the MetroBus BRT system in Mexico City found that these new transportation systems were linked with major reductions in pollutants such as CO, NO_X, and PM10 (Bel and Holst, 2018; Hidalgo et al., 2013).

Regarding emissions from personal vehicles, a few examples of policies in Latin America have aimed at decreasing emissions by banning car owners from driving on specific weekdays according to their cars' license plate number. An evaluation of this policy in Mexico City did not show any decrease in air pollution or increase in public transportation use. On the contrary, the evaluation observed an unintended increase of high emitting vehicles in circulation, suggesting a pattern of adaptation after the policy was put in place (Davis, 2008). Conversely, another study of a comprehensive set of approaches (including banning cars from driving on alternating days, retrofitting vehicles, regulating fuel qualit, and carrying out inspection and control measures) implemented in Mexico City, São Paulo and Santiago, Chile showed a decrease in particulate matter, sulfur dioxide, nitrogen dioxide, and carbon monoxide, though these reductions were insufficient for these cities to meet global air quality guidelines (Lacasaña-Navarro et al., 1999). These policies often depend on public support for their continued implementation and success; there is evidence that residents of Latin American cities with higher levels of air pollution are more likely to support policy intervention to reduce traffic congestion (Wang et al., 2021).

Despite these many documented examples of air quality improvement from this variety of policies, evaluations of concrete health impacts of the air quality improvements from these interventions remain scarce.

9.2.2.2.5 Road safety

Latin America is experiencing an ongoing epidemic of road traffic crashes, which killed nearly 125,000 people in the region in 2013 (Martinez et al., 2019). Road traffic deaths were the fifth-leading cause of disability-adjusted life years (DALYs) lost in global burden of disease rankings in Latin America (Hay et al., 2017).

Actions to reduce traffic crashes have been implemented across the region, though few studies have examined their impacts on health outcomes. In Mexico, evaluations of interventions, such as the creation of guidelines for cyclists, road safety audits, and the adoption of standards for helmets showed mixed results. In Mexico between 2011 and 2015, 10,856 deaths of motor vehicle occupants were potentially prevented; however, over these four years the number of pedestrian and motorist deaths increased overall (Híjar et al., 2018). Another study examining traffic crashes in Guadalajara-Zapopán and León showed a decrease in crashes while no significant differences were found in the number of injuries or deaths (Chandran et al., 2014). These findings are somewhat contradictory and highlight the need for additional research. A case study from Salvador, Brazil, found that simple roadway interventions, such as painted or separated bicycle lanes, painted crosswalks, speed cameras, and speed bumps were associated with a 54 percent decrease in the number of road traffic deaths in the city in 2017 (Pan American Health Organization, 2020a). In Uruguay, the adoption and implementation of 15 laws over 11 years led to a 30 percent reduction in road traffic deaths (Pan American Health Organization, 2020b). These laws mandated helmet use among motorcyclists, seat belt use among car passengers, a reduction of the maximum alcohol blood content limit allowable for drivers, and the establishment of speed limits.

BOX

Speed limit reductions in Mexico City: A case study from the SALURBAL project

As one of the largest metropolitan areas in the world in a country with the seventh-highest number of road traffic related deaths in the world (Leal Vallejo and Vadillo Quesada, 2015), Mexico City committed to the Vision Zero initiative in 2015 and subsequently implemented stricter speed limits, monitoring, and enforcement. By 2017, this strategy had successfully reduced traffic deaths by 18 percent, with 24 percent fewer deaths among pedestrians and 77 percent fewer among people biking (Ballesteros, 2018). Uncertainty regarding potential unintended adverse consequences of these interventions has arisen; for example, driving at slower speeds may lead to more idling, congestion, and higher levels of air pollution (Tang et al., 2019). SALURBAL researchers are evaluating the impact of Mexico City's Vision Zero policy on crashes, fatalities, and air pollution.

Starting in 2018, study researchers began using data from various sources, including public security and health databases and the city's Atmospheric Monitoring System, to examine trends in:

1. collision rates,
2. fatal collision rates, and
3. air pollution (NO_2 and PM2.5).

In January 2019, the new government administration made additional changes to road traffic regulations in Mexico City, notably the removal of the economic fines for speeding that had been introduced in 2015. In response, the research team adjusted this study to incorporate an evaluation of the potential impact of these policy changes.

Preliminary findings suggest that while the 2015 road traffic regulations had no effect on the number of collisions nor the number of collisions resulting in injury, a decline in road traffic mortality was indeed observed. After the regulations were changed in 2019, road traffic mortality began to increase back toward previous levels.

Figure 33 **Famous Mexico City traffic**

Source: Matthew Rutledge, 2011. CC-BY 2.0. https://flic.kr/p/99Hgn4

9.2.2.2.6 Combating gender-based violence and harassment on public transportation

Additionally and importantly for the region, sexual harassment experienced by women and gender minorities in public spaces and public transport is socially normalized and particularly widespread in Latin America (Jaitman, 2020; Larkin, 1997; Onetto and Onetto, 2019). Evidence from Barranquilla, Colombia, reveals that overcrowded buses have the greatest negative effect on the perceived risk of experiencing harassment (Orozco-Fontalvo et al., 2019). Experiences of harassment increase fear of victimization, limiting women and gender minorities' access to movement within the city, public spaces, and economic and social opportunities (Jaitman, 2020; MacMillan et al., 2016).

Despite the implementation of a few methods for separating women from men while in transit to prevent harassment (some of which are described below), the root problem—widespread violence and harassment against women in public and private—remains. However, these interventions provide needed safety and relief for women in Latin American cities who live within a society where violence against women is a long-standing epidemic, where harassment is pervasive and largely unaddressed by local or national governments.

Some initiatives to combat women's experiences of harassment and violence on public transportation in Latin American cities have been documented to date, but evidence of the impact of these interventions is scarce. So-called "pink transportation" where adult men are excluded and only women, children, and older adults can board special cars on the city subway and BRT system has been implemented in Mexico City and in Rio de Janeiro, Brazil (Tamara Davison, 2019). "Pink" taxis had also briefly been common in various cities in Latin America, where women taxi drivers would only pick up women passengers, but most of these programs seem to be defunct as of 2020 (Maya Kroth, 2017). With the rise in ride-sharing and taxi-hailing mobile applications, women-only options have emerged—in Brazil for example, two competing apps, FemiTaxi and LadyDriver offer women ride sharing options where they know that the driver will be a woman and any other passengers will be women or children (Haupt, 2017). One program that has experienced continued success began in San Salvador, El Salvador, called Línea Rosa ("Pink Line"), has achieved coverage of 70 percent of the city during rush hour and as of December 2020 was working to expand service throughout the country (Abarca, 2020; Libertun de Duren et al., 2018). Evaluations of the impacts of these programs are scarce. One evaluation of Mexico City's "pink transportation" initiative on the city's metro and BRT system found that gender segregation seemed to be successful at reducing sexual harassment toward women by nearly 3 percent, but men reported 15.3 percent more instances of aggression on public transportation (such as insults and shoving) (Aguilar, 2018). Though there are a few examples of documented changes in experiences of harassment, no documented evaluations of concrete health impacts of these interventions could be identified.

9.2.2.3 Housing and neighborhood revitalization

The growth of urban slums (Ezeh et al., 2017) in which inhabitants lack adequate housing quality and durability has been a major characteristic of Latin America's urbanization over the past 70 years (Muggah, 2018). These slums are usually unconnected to basic services and utilities, frequently experience overcrowding and have no formal residential tenure. As of 2018, more than 20 percent of the urban population of Latin America and the Caribbean lived in slums (World Bank, 2020). In countries where social housing programs have been implemented for low-income residents, available homes may be built on the outskirts of the city, thereby promoting socioeconomic segregation and reproducing the same degraded characteristics of slums (Libertun de Duren, 2018; Ruprah and Marcano, 2007).

There is strong evidence that the characteristics of neighborhoods and quality of housing can have important impacts on health outcomes across the lifespan, both directly as well as indirectly through impacts on the social determinants of health (Comarú and Westphal, 2004; Diez Roux, 2001, 2003; Diez Roux Mair, 2010; Diez Roux, 2007; Ezeh et al., 2017; Lilford et al., 2017; Mujahid et al., 2008; Vlahov et al., 2007). Populations living in inadequate housing, without basic services, and in insecure and unhealthy built neighborhood environments experience worse health and social outcomes across the entire lifespan, and tend to be at increased risk of violence, injuries, and the impacts of climate change (Ezeh et al., 2017; Lilford et al., 2017). Recent evidence from Latin American cities suggests that cities in which a higher proportion of residents with access to basic services and better living conditions experienced 14.1 percent lower infant mortality rates (Ortigoza et al., 2020).

9.2.2.3.1 Home and neighborhood built environment interventions and "slum upgrading"

Latin American countries and cities have implemented policies and interventions to improve housing quality and neighborhood environments. These place-based built environment interventions (including housing and neighborhood structure improvements, increased and improved access to services and utilities, road paving, installation of facilities for leisure and sports, and transport connectivity) have the potential to improve the health outcomes of people living in slums, informal settlements, and public social housing, both by directly preventing outcomes such as infectious disease and by indirect impacts through improvements in the social determinants of health (Haines et al., 2013; Henson et al., 2020; Jaitman and Brakarz, 2013; Magalhães and Di Villarosa, 2012; Turley et al., 2013; UN-Habitat, 2012).

Studies implemented in high-income countries have documented the beneficial health impacts of these built environment interventions. Research from low-income countries has also shown some positive results, but this evidence is scarce and generally lacking in scientific rigor (Henson et al., 2020; Turley et al., 2013). Several policies implemented in Latin American cities have been evaluated to assess their health impacts to date (**Table 6**).

Table 6 ***Health impacts of housing and neighborhood built environment interventions in Latin American cities***

City	Intervention	Description	Documented health impacts
Buenos Aires, Argentina	Aguas Argentinas	Expansion of water network and sewerage network to urban slums	✚ Up to 90% reduction in incidence of diarrhea, reduction in the duration of diarrhea episodes, and severity of diarrhea among children (Galiani et al., 2007).
Belo Horizonte, Brazil	Vila Viva	Comprehensive upgrading of favelas: road infrastructure, green space, community facilities, water and sewage connections, housing improvements; land tenure regularization; social programs	✚ Reduced overall mortality (Friche et al., 2015). ✚ Reduced mortality among young people and adults (Friche et al., 2015). ✚ 29% reduction in homicide rates in areas where interventions were complete (de Salles Dias et al., 2019).
Rio de Janeiro, Brazil	Favela-Bairro Program	Comprehensive upgrading of favelas: housing improvements, connection to drainage and sewer systems, road and lighting improvements, initiation of trash collection	✚ Increase in water (6%) and sewer (16%) access in treated communities in comparison to non-treated. ✚ Reduced number of reported homicides, which cannot be linked directly to the interventions; confounding factors are to be studied (Soares and Soares, 2005).
Salvador, Brazil	Drainage and sewerage improvements	Improvements in water drainage and sewerage systems in low-income urban areas	✚ Incidence of diarrhea in children under 5 in the control group was more than 3 times higher than the incidence in children living in neighborhoods with a sewerage system; those with sewerage experienced half as many episodes of diarrhea as those living in neighborhoods with only drainage (Moraes et al., 2003).
Medellín, Colombia	Metrocable	Installation of cable car mass transit system and improvements to neighborhood infrastructure and addition of community resources	✚ Dramatic decrease in homicides and reported violence. A decline in the homicide rate of the intervened community was 66% higher than in control neighborhoods. Resident reports of violence were reduced 75% more in intervention neighborhoods. (Cerdá et al., 2012).
Mexico	Hábitat	Neighborhood improvements: road paving, sidewalks, medians, public lighting, water and sewage system expansion, community centers, parks, and sports facilities	✚ Reduction in reports of violent assault (McIntosh et al., 2018) ✚ Increased trust between neighbors (Ordóñez Barba and Ruiz Ochoa, 2015)

Coahuila, Mexico	Piso Firme	Replacement of dirt floors with cement floors	Among children (Cattaneo et al., 2009): ✚ 19.6% reduction in parasitic infections ✚ 12.8% reduction in reported diarrhea ✚ 20.1% reduction in anemia ✚ 30.2% improvement cognitive development on MacArthur test Among mothers (Cattaneo et al., 2009): ✚ 15.1% increase in satisfaction with housing ✚ 18.7% increase in reported quality of life ✚ Reduced depressive symptoms ✚ Reduced stress
El Salvador, Uruguay, and Mexico	TECHO	Prefabricated houses provided free to low-income populations	✚ 27% reduction in reported diarrhea among children (Galiani et al., 2017) ✚ Increased feelings of safety (Galiani et al., 2017) ✚ Improved subjective perceptions of wellbeing (Galiani et al., 2018) ✚ Improved perceived quality of life (Galiani et al., 2017) ✚ Improved sleep quality (Simonelli et al., 2013)

Though they are few considering the size of the region and the large proportion of its population residing in slums, these evaluations indicate that providing improvements to housing and neighborhood environments to low-income populations can have an array of positive impacts across many health dimensions. Of all policy domains included in this chapter, housing and urban redevelopment is certainly the domain most evaluated for concrete health and related impacts.

In the 1980s, Chile faced a housing crisis that resulted in the construction of large numbers of social housing units in the peri-urban areas of some of its large cities. These social housing blocks or villas, which incorporated over 75 thousand households, failed to meet minimum habitability standards for housing conditions, neighborhood environment quality, transportation, and connectivity to services and facilities.

To address this problem, the Chilean Ministry of Housing and Urban Planning (MINVU) launched the *Programa de Regeneración de Conjuntos Habitacionales* (Regeneration of Housing Complexes Program) to enhance the quality and safety of these neighborhoods and homes. The program includes the creation of green spaces, construction of recreation facilities, repaving of streets and sidewalks, installation of bus stops, and construction of new housing units.

SALURBAL researchers at the Pontificia Universidad Católica de Chile are working with local partners and MINVU to evaluate the impacts of these housing and neighborhood interventions on general health, respiratory conditions, mental health, and quality of life of inhabitants. The study is taking place in Brisas del Mar and Nuevo Horizonte II, in the metropolitan area of Viña del Mar, and Marta Brunet, a community within the Santiago Metropolitan Area, communities that were both established in the 1990s.

The study uses a multi-methods approach with a prospective cohort design that includes household surveys, including a guideline to examine housing conditions such as temperature and humidity levels, qualitative methods with semi-structured interviews and focus groups, and Systematic Social Observation (OSS) methods to document the use of recreational areas. Results are presented with the goal of influencing policy making and providing evidence to guide adjustments to the program so it may better suit the population's health and well-being needs.

BOX

The Regeneración Urbana, Calidad de Vida y Salud (RUCAS) study in Chile: A case study from the SALURBAL project

In the early 1990s, the city of Belo Horizonte, the sixth-largest city in Brazil, created a Municipal Housing Policy aimed at addressing housing and neighborhood issues in precarious settlements within the city, known as "vilas" or "favelas" (slums). Under the federal government's Growth Acceleration Plan, referred to in Belo Horizonte as PAC-Vila Viva, or the Vila Viva Project, comprehensive interventions were implemented to integrate these slums into the "formal city" through a process of land tenure regularization and built environment upgrading to promote communities' socioeconomic development. The intervention has been in progress since 2005, with approximately 127 thousand households impacted by the Vila Viva Project over the course of 15 years.

The Observatory for Urban Health in Belo Horizonte (OSUBH) at the Federal University of Minas Gerais, in partnership with the Belo Horizonte Urban Development Company (URBEL) and the Municipal Health Secretary have had an ongoing evaluation of the Vila Viva Project since 2012 to assess the initiative's impact on deaths, asthma, mosquito-borne disease, and risk factors related to noncommunicable diseases, among other outcomes. Five slums (approximately 20 percent of all slum inhabitants in Belo Horizonte) that received Vila Viva's interventions were selected to be part of the study (Aglomerado da Serra, Morro das Pedras, Vila São José, Pedreira Prado Lopes, and Vila São Tomaz) and compared to five areas that did not undergo project interventions (de Salles Dias et al., 2019; Friche et al., 2015). The evaluation is a multiphase and multimethod study that has gathered data using questionnaires, semi-structured interviews, systematic social observation, and georeferenced health data on mortality and morbidity from the city's Unified Health System (SUS). The evaluation seeks to generate evidence of Vila Viva's effects on community residents' health and to provide information that may be useful in the design of similar interventions.

Preliminary findings suggest that the Vila Viva program may have influenced a decline in homicides in intervened areas.

Figure 34 **A woman pushes a stroller behind a block of social housing units in Chile**

Source: CEDEUS.

BOX

The Vila Viva Project in Brazil: A case study from the SALURBAL project

9.2.2.4 Climate change mitigation and resilience

Climate change has direct and indirect health impacts, and these impacts are intensified in urban areas (Araos et al., 2016; Revi et al., 2014). The most severe impacts of climate change are concentrated in already vulnerable populations (Islam and Winkel, 2017), and climate change will continue to exacerbate existing inequalities in particular across the global south (Araos et al., 2016). Frequent and severe exposures to heat and cold, water scarcity, and extreme storms and other natural disasters cause illness, injury, and death. These changes also drive other health impacts related to infectious disease, air pollution, disruptions to food systems, inadequate housing, and forced migration (Smith et al., 2014).

In addition to concentrating the impacts of climate change, cities are directly or indirectly responsible for over 70 percent of global greenhouse gas (GHG) emissions (Seto et al., 2014, 2017) and therefore play a critical role in action to mitigate and adapt to climate change. Cities and local governments in Latin America have developed their own mitigation and adaptation targets, policies, and programs to respond to and prepare for climate change (Appleby, 2018). Many interventions designed to address climate change have co-benefits for human health and for promoting health equity—transportation policies can both reduce GHG emissions and reduce human exposure to air pollution (Fagliano and Diez Roux, 2018), active transport contributes to emissions reductions while increasing physical activity (Fagliano and Diez Roux, 2018), and "greening" and general improvements to urban built and natural green and blue environments can improve health and quality of life while mitigating GHG emissions and reducing vulnerability to extreme events (Fagliano and Diez Roux, 2018).

Figure 35 **Renovated housing blocks built through the Vila Viva program in Belo Horizonte**

Source: Divino Advincula for the Prefeitura de Belo Horizonte. https://flic.kr/p/bm6SMB. Public domain.

Improved and expanded evaluations of these co-benefits can provide important leverage for driving action to address climate change and improve health and health equity (Winkler et al., 2013).

In Latin America, several case studies are providing evidence of these connections (see **Table 7**).

Table 7 ***Examples of urban climate action with health co-benefits in Latin America (C40 2020)***

City	*Intervention*	*Climate and health co-benefits*	*Impacts*
Medellín, Colombia	*Corredores Verdes*, interconnected green spaces along roads and waterways, constructed between 2016 and 2019	These green or ecological corridors reduce the urban heat island effect and mitigate demand on cooling systems, providing green space for recreation and active transport, improving air quality, mitigating the risks of extreme weather events, and promoting biodiversity in the city (C40, 2020a, 2020b). Some criticism has arisen regarding the implementation of this initiative and inequities in the distribution of health and other benefits (Anguelovski et al., 2019).	In the first three years of implementation, green corridors extending across 65 hectares in the city have helped mitigate the city's heat island effect, reducing temperatures by more than 2°C (C40, 2020a, p. 40).
Santiago, Chile	Renewal and electrification of bus and taxi fleets	The ongoing electrification of Santiago's bus fleet will improve local air quality, reduce noise pollution, and avoid accidental deaths and deaths related to air pollution. The city has committed to achieving a fully electric fleet by 2035 (World Bank, 2017).	To date, approximately 800 zero-emission electric buses and 1,500 high-efficiency diesel Euro VI buses are circulating in the city (Galarza, 2020). This transition is projected to prevent 1,370 premature deaths by 2030 (Withana et al., 2019).
Fortaleza, Brazil	Urban mobility planning to prioritize low-carbon public and active transport infrastructure	Urban interventions in Fortaleza, including expanding bus and bicycle lanes, introducing bicycle and electric car-sharing programs, and planting trees, reduce greenhouse gas emissions and promote active transport.	The city has created over 100 km of dedicated bus lanes, implemented shared bicycle programs, and constructed over 250 km of bike lanes. These measures improved access to public transport and decreased road fatalities by nearly 42% between 2014 and 2018. As of 2020, these interventions were estimated to mitigate approximately 265,000 tons of CO_2 annually (C40, 2020a).

Bogotá, Colombia	Creation of emergency bike lanes and additional traffic safety measures	Bogotá was one of the first cities in the world to develop emergency bike lanes as a response to the COVID-19 pandemic. Over 80 km of "pop-up" bike lanes encouraged the use of active transport and were accompanied by a reconfiguration of over 17,000 square miles of street space to facilitate social distancing and promote pedestrian mobility. These efforts reduce crowding and person-to-person contact on public transit and have led to reduced congestion and improved traffic safety. Over half of the cycle lanes remain in use, with 28 km established as permanent cycling infrastructure.	Together with speed management and other road safety measures, these interventions were shown to reduce traffic deaths by 28 percent in 2020. Bicycle usage increased four-fold on some major roads, and citizen's willingness to use cycling for transport doubled (World Health Organization, 2020).
Buenos Aires, Argentina	360-hectare *Reserva Ecológica Costanera Sur*, a converted landfill site	The converted landfill now serves as a nature reserve and wetland habitat, in addition to providing public urban green space. The natural reservoir mitigates flood risks and soil, air, and water pollution; promotes biodiversity; and reduces the urban heat island effect, in addition to increasing the well-being of local residents (C40, 2020a, p. 40).	This urban park supports biodiversity and has become a focus point for environmental conservation and education, and as of 2005 was included on the Ramsar List of wetlands of international importance.

Though cities are taking action to mitigate climate change and address health-related climate impacts, evidence of the co-benefits and effectiveness of these actions in reducing carbon emissions and improving health is scarce.

Figure 36 ***The Buenos Aires skyline as viewed from its "Reserva Ecologiac Costanera Sur," a converted landfill site***

Source: CC-BY, 2011. https://flic.kr/p/awF9jH

9.2.2.5 Violence prevention

Experiences of violence can have a variety of health outcomes for victims, perpetrators, and the communities in which victims and perpetrators live (Rivara et al., 2019). Beyond the potential physical trauma of violence, these crimes can also cause increased risk of depression, anxiety, post-traumatic stress, suicide, cardiovascular disease, and an overall increased risk of premature mortality, especially among populations who experience multiple or recurring episodes of violence and who may accumulate increased health effects of these experiences over time (Rivara et al., 2019). Incidence of violence is associated with lack of employment opportunities, lower income, access to drugs and weapons, lack of recreational opportunities, public infrastructure deterioration, residential instability, and neighborhood segregation, among other factors (Inter-American Development Bank, 2012). Over the past decade, the Latin America and Caribbean region has maintained the highest homicide rate in the world (28.5 per 100,000 compared to the global average of 6.7 per 100,000) (World Health Organization, 2014a). While this suggests violence is a widespread regional problem, insecurity and violence are experienced at different rates across cities within Latin American countries, and within neighborhoods across specific cities (Vilalta et al., 2016). In 2015, 47 of the 50 most dangerous cities in the world were in Latin America and the Caribbean (Vilalta et al., 2016). However, other cities managed to maintain lower rates of violence and homicide, showing that insecurity and violence is highly variable within the region (Vilalta et al., 2016). To understand crime patterns and root causes of crime, and formulate successful interventions and programs, it may be necessary to study how violence and crime rates differ across neighborhoods and blocks (Weisburd et al., 2009).

There are many examples of community-driven interventions to fight crime and violence in Latin American cities. Some Latin American countries have implemented interventions to modify the built environment characteristics in neighborhoods with high violence and criminality rates. For example, Argentina, Chile, Colombia, and Mexico have implemented variations of an intervention called ***Barrio Seguro*** (Safe neighborhoods) (Alcaldia de Santiago de Cali, 2021; Cerdá et al., 2012; Frühling and Gallardo, 2012; Municipio de Peñalolén, 2010; Secretaría de Desarrollo Agrario, Territorial y Urbano, 2020; Subsecretaria de Prevencion del Delito y la Violencia de Argentina, 2018).

In *Barrio Seguro* programs, the municipal governments focus on improving public spaces by installing pedestrian bridges, installing street lighting, opening recreational centers, and adding police patrols and stations in disadvantaged and insecure neighborhoods.

These interventions help create safe spaces, leading to community cohesion, more positive social interaction, and lower criminality rates (Morazzani Diaz, 2021). There are other interventions that have been implemented in some neighborhoods with high rates of crime and a history of distrust in the police, such as ***alarmas vecinales*** and community policing (Neild, 1998). However, community policing imposes certain risks, as citizens may want to take matters into their own hands, triggering more violence and civil rights violations, and criminal gangs may see community policing initiatives as an opportunity to take control (Neild, 1998). Additionally, in an effort to reduce gun violence in cities, Mexico, Colombia, Venezuela, and Nicaragua developed programs aimed at civilians in possession of firearms whereby, with no questions asked, gun owners can exchange these weapons for money or grocery vouchers (Alcaldia de Medellin, 2010; CDMX, 2020; Ley Para El Desarme y Control de Armas y Municiones, 2013; Reglamento de La Ley Para El Desarme y Control de Armas y Municiones (II)—Pandectas Digital, 2014).

In an effort to create safe and inclusive environments that deter crime and promote healthy behaviors, cities in Latin America are also making an effort to create and recover green public spaces, promoting sport activities and free pedestrian traffic (Bogar and Beyer, 2015; Ou et al., 2016).

Though many examples of initiatives to reduce violence and crime exist and have been documented, the evidence of the effects of the implementation of these programs on health is scarce, or nonexistent.

9.1.2.6 Governance

Governance is, put simply, the process through which decisions are made, formally and informally. Urban governance, therefore, relates to the systems and processes that guide the management of cities (UN-Habitat, 2002; United Nations, 2016). Urban health scholars have acknowledged the implications that a city's governance system may have on the health and well-being of city residents (Caiaffa et al., 2015; Vlahov et al., 2007), as well as climate-related co-benefits in cities (Oliveira et al., 2015). Some evidence has emerged from low- and middle-income countries of the impact governance structures can have on health outcomes, including infant nutrition and mortality, immunization rates, life expectancy, maternal mortality, self-reported health, prenatal care, and mental health, among others (Ciccone et al., 2014).

Though documented evidence of the health impacts of different governance approaches in the region are scarce, a few examples have emerged and present promising results. Participatory budgeting, for instance, has been implemented in several cities, beginning in Brazil and gaining adherence in other cities around the world, and its health impacts are being examined by urban health researchers (Campbell et al., 2018; Touchton and Wampler, 2014). This mechanism of urban governance allows citizens to participate directly in the allocation of a share of municipal public funds. Evaluations of participatory budgeting in Brazil have found some evidence of reduced infant mortality, reduced poverty, and increased access to piped water and sewerage (Campbell et al., 2018). Councils composed of mixed stakeholders, and more recent approaches making use of online participatory consultation, or "e-participation," can also contribute to transparency, accountability, and participation in urban governance contexts, which may have subsequent positive effects on health outcomes (Coelho et al., 2005; Naranjo Zolotov et al., 2018).

9.2.3 Conclusion and priorities for future research

This article has presented examples of unique policy approaches to address some of the main challenges that Latin American cities face: informal transit and housing, violence, and climate vulnerability among others. Some of these approaches have been evaluated to determine their impacts on health outcomes, but most have not. Evidence for the health impacts of urban policies across sectors within Latin American contexts remains scarce.

The small amount of available evidence suggests that health can be improved through intervention and integration of action across several policy sectors. The availability of BRT and cable cars for transportation has been linked to increased physical activity, reduced air pollution exposure, and less violence. Improved housing and neighborhood infrastructure may lower the incidence of infectious and noncommunicable disease, reduce mortality across age groups, improve mental and physical well-being, and decrease violence and homicide. Interventions to lower greenhouse gas emissions and mitigate the impacts of climate change are believed to have reduced health risks from weather events, improved air quality, and lowered the incidence of road traffic injuries and fatalities. Participatory governance approaches in cities have been linked with reduced infant mortality and improved health. While the small number of documented evaluations have been implemented examining the health impacts of a variety of unique interventions and policies, this evidence is generally specific to one country or city and may not be entirely applicable to other country or city contexts. Additionally, most of these evaluations have been implemented within the largest cities of the region, and research findings produced by these studies may not translate well to small or medium-sized Latin American cities.

Future research to support the further integration of health into all urban policies can be targeted to fill gaps in the available evidence. Some research questions that could be explored within Latin American urban contexts include the following:

- How have the installation of new and enhanced mass transit and active transportation options in ***small and medium-sized*** Latin American cities improved health and promoted environmental sustainability?
- Have there been any policies or interventions to improve housing conditions among those living in slums in ***small and medium-sized*** Latin American cities, and how have they impacted health and well-being?
- What are the long-term impacts of housing and comprehensive urban development interventions on chronic and noncommunicable diseases and conditions?
- What are effective approaches for reducing harassment of women and gender minorities in public spaces and on public transportation in cities?
- What are effective approaches to reduce violence, gender-based violence, harassment, crime, assault, and homicides in cities of all population sizes?
- What are the health impacts of urban policies and interventions designed to reduce GHG emissions and reduce climate change vulnerability?
- Have participatory governance approaches been implemented in Latin American countries and cities outside Brazil, and how have they impacted health and wellbeing?
- Have interventions and policies implemented to mitigate COVID-19 had measurable effects on health outcomes and the social determinants of health in Latin American cities of all sizes?
- What are the potentially negative or unintended health consequences of policies implemented across all sectors?

Despite the questions that remain, available evidence and knowledge can still guide policymakers to take immediate action to promote health, health equity, and environmental sustainability. Indeed, within the context of the COVID-19 pandemic, which has had an enormous negative impact on health and well-being across the region—especially among low-income and marginalized populations—it is essential that policymakers move forward as quickly as possible with available research to protect health and well-being in Latin American cities. The pandemic has highlighted how vital a HiAP approach is for ensuring health and security of populations in Latin America. Overlapping and reinforcing dysfunction across multiple urban systems in Latin American contexts has generated a "perfect storm" for highly unequal and severe COVID-19 impacts among the most vulnerable: high levels of poverty and financial insecurity, food insecurity, overcrowded and poor housing conditions, informal or insecure employment without access to healthcare or paid time off, crowded informal and mass transportation and long commutes, unequal and low access to green space for outdoor and socially distanced leisure or physical activity, and consistently high levels of exposure to air pollution (Diez Roux et al., 2020). These conditions are generated by policy decisions across all sectors of urban policy, and all have likely contributed to high rates of COVID-19 transmission, increased severity of COVID-19 symptoms and outcomes, and higher death rates.

As the region works toward a recovery from the COVID-19 pandemic, a HiAP approach can provide essential guidance to promote health and well-being in Latin American cities in both the near and long term, which may also protect the region from the impacts of future pandemics. Future research examining the health impacts of existing and new urban policies and interventions will strengthen policymakers' ability to implement policies that promote health, well-being, and health equity.

KEY FINDINGS

This chapter summarizes the available scientific evidence of the health and health equity impacts of a variety of place-based urban policies and interventions implemented in Latin American cities that cut across many parts of the urban environment, while also identifying gaps in the evidence that should be filled through future research: transportation and mobility options and interventions, housing and neighborhood quality and formality, interventions to promote climate change mitigation and climate resilience, violence and injury prevention, and urban governance. Through this summary, this chapter seeks to support a Health in All Policies approach in Latin American cities by compiling existing evidence and highlighting relevant gaps in understanding of the impact of urban policies and interventions on health outcomes. Latin America is a hub of urban policy innovation that has produced unexpected benefits across health, social welfare, and environmental sustainability, and lessons from the region can inform efforts across the global south and beyond to develop policies that promote health and health equity.

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BOX V

9.3 HOUSING AND HEALTH

Quito, Ecuador

9.3 Box V: Housing and Health

Nora Libertun, IADB (CSD/HUD)

The evidence for the relationship between housing quality and household health is plentiful and robust (Swope and Hernández, 2019).

The facts that residing in an adequate housing unit contributes to improved household health and that residing in inadequate housing can lead to declining health are both well documented. As the World Health Organization (WHO, 2018) recently stated, "Improved housing conditions can save lives, prevent disease, increase quality of life, reduce poverty, help mitigate climate change and contribute to the achievement of the Sustainable Development Goals (SDGs), including those addressing health (SDG 3) and sustainable cities (SDG 11). Housing is becoming increasingly important to health due to demographic and climate changes." Because housing should be considered as a platform for households to access a bundle of services—including shelter from the elements, clean water, safety from crime, and health and education services—there are multiple mechanisms behind the powerful association between housing and health.

An example of the multiplicity of factors linking health outcomes and housing conditions are the challenges residents in informal neighborhoods face daily. These neighborhoods, which hold more than 105 million Latin American and Caribbean households (World Bank, 2020), lack access to one or many basic municipal services, including electricity, water, and sanitation; safe public spaces; and suitable education and health management services. For example, in Argentina, it is estimated that more than 98 percent of households in informal neighborhoods lack access to municipal sewerage services, and almost 94 percent lack a connection to water services (RENABAP, 2020). The inadequate sanitary infrastructure in these neighborhoods makes them hotbeds for endemic diseases, such as malaria, zika, and dengue. For example, a georeferenced study of dengue cases in Rio de Janeiro identified a correlation between the presence of informal neighborhoods and the main loci of infections (Rodriguez-Barraquer et al., 2019). Likewise, in Salvador de Bahia, the risk of leptospirosis for households lacking sanitation is four times the risk elsewhere (Hagan et al., 2016). These shortcomings made informal neighborhoods ill prepared for coping with the COVID-19 pandemic; poor housing conditions make self-quarantine impractical and the rapid spread of infection highly likely (Corburn et al., 2020).

In addition, residents of informal neighborhoods are particularly vulnerable to environmental hazards and climatic events. For example, while waste collection in LAC has a relatively high level of coverage (90 percent of regular neighborhoods), only a few large cities, such as Rio de Janeiro, Mexico City, and Buenos Aires, use transfer stations. In these cities, transfer stations cover only about half of their collection. Overall, lack of transfer stations increases the likelihood of the possibility of dumping wastes in open areas and in open-air dumps, which harm human health and pollute water and soil (Hettiarachchi et al., 2018). Poorly managed landfills are particularly harmful to informal neighborhoods and coastal communities (IADB, 2019). Moreover, these neighborhoods are often located on hillsides, ravines, or riverbanks, which are vulnerable to landslides and floods (Romero-Lankao, Wilhelmi, and Chester, 2018). Likewise, they are often on, or near hazmat sites associated with increases in the rate of respiratory and skin diseases, among others (Auyero and Swistun, 2009)

Housing deficits also affect households living in formal, consolidated neighborhoods. The most current data in the region show that deficits affect 55 million LAC households (Bouillon, 2012). In urban areas, about three-quarters of these deficits are due to some qualitative issues affecting the housing unit, most often overcrowding (more than three people per room), but also lack of adequate property titles. In rural and peri-urban areas, the most prevalent type of housing deficit is use of inadequate building materials and a lack of basic infrastructure. Households residing in these conditions are highly vulnerable to what have been called the "neglected diseases of neglected populations," including vector-borne and soil-transmitted illnesses, such as chagas, chikungunya, and trachoma (WHO, 2003).

A number of housing policies have aimed to improve living conditions for affected households, including neighborhood upgrading programs and support for affordable housing. Neighborhood upgrading programs focus on providing basic services to improve the well-being of low-income communities, including a range of infrastructure interventions frequently undertaken in conjunction with social interventions, such as the regularization of tenure and improvement of public spaces, among others (Field and Kremer, 2006). Empirical studies on the impact of neighborhood upgrading programs in extremely poor neighborhoods in El Salvador, Mexico, and Uruguay show that they led to a positive effect on the overall housing conditions and general well-being of local residents (Galiani et al., 2017). Similarly, an impact evaluation of the Favela Barrio program in Rio de Janeiro, Brazil, found a positive impact on access to water, sanitation, and garbage collection services (Atuesta and Soares, 2016). These results are sustainable as long as there are institutional mechanisms to ensure effective coordination with citizen security and environmental resiliency programs (Libertun and Osorio, 2020).

Building codes can effectively improve housing quality. Housing codes tend to successfully regulate and improve sanitary and climatic standards in new formal housing stock (WHO, 2018). However, this implies that both existing formal housing stock and informal housing units are not improved, one because rebuilding is unlikely to occur and the other because happening outside municipal regulations. Fortunately, recent innovations have lowered the overall cost of code enforcement and data collection. Drones, for example, help collect highly detailed geospatial information from which to infer the quality of the housing stock and thus facilitate the targeting of efforts to enforce regulations. In Kigali, Rwanda, drones have been used to map the quality of roofs and toilets in low-income neighborhoods to rapidly identify housing units in need of upgrades and to prioritize enforcement of building codes, one of the key challenges in the way of profiting from them (Gevaert et al., 2018). Important health effects are also achieved by improving some aspects of residential areas. Increasing the safety of public spaces leads to higher use, which renders important benefits to population health (Ward Thompson et al., 2012). There is a strong correlation between access to parks and healthy body weight, especially among low-income households (Rigolon, 2016).

Empirical studies on housing programs show that improving housing quality decreases the frequency of illnesses in the household and that female housing ownership improves household health. For instance, improving the building quality of the housing unit to reduce dampness and mold helps reduce the incidence of respiratory diseases and asthma, particularly in small children (Keall et al., 2011). An impact evaluation of Mexico's Piso Firme program to install cement floors in the housing stock of the 50 Indigenous municipalities with the lowest Human Development Index score showed that it had significantly reduced the incidence of diarrhea in children five years old and younger (Cattaneo et al., 2009). Likewise, studies on housing programs in Ecuador, Ghana, India, and Tanzania found a correlation between an increase in women's housing ownership and a reduction in intimate partner violence (Pereira, Peterman, and Yount, 2017). In addition, a study in Ethiopia found that female housing ownership correlates with shorter periods of illnesses as women invest more in food and health care (Muchomba, 2017).

There are also other important vectors connecting housing and health. Housing that is poorly built can expose people to several health risks. For example, structurally deficient housing, because of poor construction or maintenance, can increase the likelihood that people slip or fall, creating the risk of injury (WHO, 2018). Also, housing that is damp or polluted negatively affects the health of its residents. In 2016, household air pollution from the use of solid fuels for cooking led to 3.8 million deaths globally (WHO, 2018), and indoor dampness is associated with a 15 percent rise in asthma in European children. In addition, as weather patterns change so does the importance of housing to provide protection from cold, heat, and extreme weather events (Pachauri et al., 2014.).

In sum, housing has implications for individual and public health through multiple mechanisms, including some that depend on the quality of the housing units, some on its location, and some on the services it receives. There is a strong correlation between low income, substandard housing conditions, and poor health. Healthy housing implies an array of features, including a well-built dwelling that uses adequate and sturdy materials, that counts with access to basic municipal services such as water, electricity and sanitation, and whose environment is safe, has access to social services and work opportunities, is resilient to climate change impacts, and is free of dangerous pollutants, among many others. These aspects need to be understood integrally, as households' health is the outcome of the synergies among all these elements.

Therefore, public health policies should be fully territorial and deeply coordinated with housing policies because the conditions of homes could be sources of both illness and health for their residents.

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PART 2

9.4 RESHAPING INFORMATION SYSTEMS AND DELIVERY OF PRIMARY HEALTH CARE TO IMPROVE ACCESS TO HEALTH SERVICES IN A LOW-INCOME URBAN SETTING IN ARGENTINA: THE CASE OF GUAYMALLÉN, MENDOZA

Mendoza, Argentina

9.4 Reshaping Information Systems and Delivery of Primary Health Care to Improve Access to Health Services in a Low-Income Urban Setting in Argentina: The Case of Guaymallén, Mendoza

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9.4.1 Abstract

The Ministry of Health of Argentina implemented a roadmap to achieve effective universal health coverage (UHC) throughout the country. Between 2017 and 2019, 22 of 24 provinces developed their plans to accomplish specific targets aligned with UHC. The health strategy began as a pilot project in Guaymallén, a low-income urban department in the outskirts of Mendoza city.

This strategy was focused on several pillars, the most innovative one being the employment of a national digital health network based on primary health care centers and referral hospitals.

The project provided the following results: between 2018 and 2019, the number of identified people who used public health services at least once in the last year increased 54 percent in Guaymallén versus 19 percent in the rest of the departments. Additionally, there was also a 51 percent increase in periodic health checks in Guaymallén as compared to the provincial average, which was 30 percent.

This article discusses the process of implementing effective UHC in a low-income urban department and its scaling-up to become a provincial prioritized public health policy.

9.4.2 Introduction

Although health facilities and personnel are concentrated in the urban areas, effective access to adequate health care in all urban populations continues to be a pressing public health policy concern in developing countries, particularly in low-income neighborhoods (Fosu et al., 2020). One way to improve this situation is through the use of health information technologies.

According to the Astana Declaration in 2018, the use of technology can improve access to health care, enrich the provision of health services, and improve the quality of services and patient safety, as well as increase efficiency and coordination of attention (Global Conference on Primary Health Care, 2018).

The aim of this article is to present the progress towards UHC in Guaymallén City, Argentina, via a pilot program aimed to adopt electronic clinical records (ECR) in the city's health system. To introduce the local context, the strategy deployed, the implementation process and the results, the article is organized into five sections.

The first section presents the national framework in which the intervention was implemented. The second section introduces the roadmap designed by the province of Mendoza to make progress on the implementation of UHC, focused on strengthening health information systems for improvement at the primary health care (PHC) level.

The third section describes the pilot experience in Guaymallén.

Finally, the fourth and fifth sections present some results and lessons learned during the implementation stage.

9.4.3 Going through Universal Health Coverage (UHC) in Argentina

According to the World Health Organization's definition, UHC implies that all people have access to the health services they need, when and where they need them, without financial hardship. It includes the full range of essential health services, from health promotion to prevention, treatment, rehabilitation, and palliative care (WHO, 2021). Most countries are implementing actions toward UHC to improve the access to and quality of health services as a way to reduce poverty by 2030; in agreement with the United Nations Sustainable Development Goal 3.8.[14]

In 2016, the national government in Argentina established UHC as one of its main policies to help to close the gaps of inequity in access to health services between jurisdictions and between different types of coverage (public, private, and social security).

Although all inhabitants of Argentina are entitled to receive free health care in public facilities, UHC is aspirational and implicit rather than explicit, which does not necessarily translate into effective or quality care. In effect, two-thirds of Argentina's population of 45 million also have social health or private insurance, leaving one-third (16.5 million people) with no explicit coverage. Therefore, the public sector, funded by taxes, serves as a protector for the whole population (Rubinstein et al., 2018).

There are many gaps in access to diagnostic services and in health outcomes among jurisdictions and types of coverage (public, private, social security) (Ministerio de Salud de la Nación, 2018a). Moreover, there are significant spending, development, and capacity gaps among jurisdictions, which lead to differences in access to health services and health outcomes. For instance, in 2018 the infant mortality rate had a national average of 8.8 per 1,000 births but a twofold difference between poor and rich provinces, and the maternal mortality rate had a national average of 2.9 per 10,000 women but an eightfold difference between poor and rich provinces (Dirección de Estadísticas e Información en Salud, 2017).

In summary, the main health problems in Argentina are related to equity and efficiency (Rubinstein et al., 2018).

The goal is therefore to provide effective and not aspirational UHC,[15] improving not only health outcomes but also its distribution among different groups, ensuring better quality and equity irrespective of the place of residence, their socioeconomic status, or their type of health coverage.

14. Goal 3.8: Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality, and affordable essential medicines and vaccines for all.
15. Effective coverage means that people have actually received prioritized health care services.

KEY ACTIONS TO ACHIEVE UHC

The national Ministry of Health, in agreement with 22 of 24 provinces,[15b] defined in 2018 the following three strategic axes to achieve UHC.

Family health: The assignment of population to family and community health teams, through the expansion of georeferenced health coverage in primary care center's catchment areas, starting first in small pilot areas and later scaling up to larger areas. It included the delimitation of each area, the nomination of the population served in each catchment area (with focus on the population with exclusive public coverage), and the assignment of this defined population through a process of empanelment to core family health teams.

Digital health: The development and strengthening of integrated, structured, and interoperable health information systems to ensure timely diagnosis and treatment of patients and to improve the quality of health services through the creation of a National Digital Health Network.

Health quality: The improvement of health quality, defining explicit clinical care pathways with indicators and quality targets to close the gaps in health outcomes on prioritized conditions, especially related to noncommunicable diseases.

Empanelment: These three strategic components—family health, digital health, and health quality—aimed to reduce the gaps in access and quality of health services through assigning responsible health teams to specific locations (Ministerio de Salud de la Nación, 2019). This process is called empanelment, and it consists of systematic, intentional, and continually refined processes to identify and assign people to specific PHC facilities, teams, or primary care providers. Empanelment enables PHC systems to move from reactive care oriented around visits to proactive care. By supporting health systems and providers in defining and learning about the population to be served, empanelment allows for delivery of the right care at the right place and at the right time (Bearden et al., 2019d).

15b. Resolution 1013/ 2018 - Memorandum of Understanding to adhere to UHC.

This roadmap began as a pilot project in Guaymallén and was later expanded to other urban districts such as Godoy Cruz, Maipú and Las Heras, covering most of the greater Mendoza and reaching a population of 1 million inhabitants.

9.4.5 First steps in Guaymallén

Guaymallén became a pilot area for the adoption of the digital health strategy through ECR and interoperability, and for the expanding georeferenced health coverage in its 22 PHC facilities catchment areas. It is one of the 18 jurisdictions of the province of Mendoza, located in the North metropolitan health region, in the outskirts of the capital department. It has a population of 312,000 inhabitants, and about 55 percent relies exclusively on public health coverage. The public health services in Guaymallén are provided through 22 PHC facilities and one hospital (Instituto de Salud Pública y Gestión Sanitaria, 2018).

In 2018, public PHC facilities of Guaymallén were overburden; lack of continuity with primary care doctors, late referrals, long waiting lists for specialists, the need to visit different health providers in multiple facilities to solve a single episode of illness, and unnecessary diagnostic tests and procedures were typical (Facultad Latinoamericana de Ciencias Sociales, 2018).

The pilot program improved the health information system through ECR, the definition and digitization of health responsibility areas of the public health facilities, and the identification of the population served in each catchment area (with a focus on the uninsured). These actions were the basis for the assignment of defined population, through a process called ***empanelment***, to core family health teams as a building block in the organization of a health care model based on primary care. Each of these processes is explained in detail in the following sections.

9.4.5.1 Improvement of health information systems

The Argentinian Ministry of Health, in its mission to effectively implement UHC throughout the country, considered that the best way to ensure quality, access, diagnosis, and treatment was through the implementation of health information systems (Ministerio de Salud de la Nación, 2019b). To make it possible, it published the National Digital Health Strategy, 2018–2024, with the guidelines to put it into practice, in addition to improving the quality of care.

The National Digital Health Strategy will make it possible for health professionals, when treating patients in the office, regardless of whether the patient is outside their usual health center, to enter their clinical data in the ECR. However, because of the impossibility of creating a national health database, it was decided to implement an ecosystem of interconnected information to overcome fragmentation and segmentation.

The implementation of the National Digital Health Network was carried out in two consecutive phases. Phase 1 (2018–19) was focused on defining the technical, regulatory and policy framework with the participation of the relevant actors. Phase 2 (2020–24) focused on obtaining support from the jurisdiction for digital health tools and functional improvement of information systems (Rizzato Lede et al., 2020).

Therefore, according to this conception and to the national agenda, the first steps in Guaymallén were as follows:

1. Equiping PHC facilities with computers and national identity document readers.
2. Developing and implementing the MPI to get univocal identification of each patient. The MPI records contain health service users' data: names, surnames, type and ID number, and date of birth. In addition, HL7 FHIRs were used to share the information. Properly identifying the population became an essential activity to implement ECR and assign them to health teams.
3. Developing an interoperable ECR, which incorporates SNOMED CT standard for clinical vocabulary and HL7 FHIR as the technical standard for transfering documents to the interoperability bus.
4. Developing a telephone shift call center to avoid long waits in PHC facilities.
5. Using telemedicine, starting with dermatology and cardiology, with the aim of increasing the resolution capacity of the first level of care to reduce referrals to hospitals.

To execute these work lines, implementation teams were created to work periodically with health teams in the facilities. The implementers were 13 professionals from different health areas (psychologists, dentists, nutritionists), as well as advanced medical students. Their role was to guide the process of ECR adoption, shift management, and the MPI, providing continual training to both health personnel and the administrative sector. The inclusion of new work tools resulted in a process of organizational and cultural change that included medical, administrative, organizational, technical, and technological aspects.

9.4.5.2 Definition and digitalization of the primary health care facilities catchment areas

The first step toward empanelment was the delimitation and digitalization of the responsibility/influence areas. A health catchment area is a health and geographical responsibility area assigned to a public health facility whose delimitation usually responds to criteria of accessibility and population size. These areas are not static and can be modified for reasons such as changes in the population distribution, services supply, available resources, and prioritized health actions, among other reasons.

To map them properly, the areas, defined by digital cartography, should be exhaustive, mutually exclusive, univocal, and dynamic. Exhaustive means that all catchment areas must cover an entire territory (jurisdiction, department, locality) populated or not. Mutual exclusion means that the areas should not overlap; univocal means that there must be only one PHC facility responsible for each area, and dynamic indicates that areas must be available for modifications (Ministerio de Salud de la Nación, 2018b). These areas usually converge in larger areas according to the health system complexity organization.

To undertake this task, the authorities created a working group integrated by the Metropolitan North General Directorate, Departmental Coordination of Health of Guaymallén, Planning Directorate of the Municipality of Guaymallén, Information Technology Directorate of the Ministry of Health, Spatial Data Infrastructure, REDES program, and SUMAR program (both national health programs supported by international banks).

The province of Mendoza did not have regulations that defined the areas of influence, and the information available on the limits of PHC establishments was out of date.

For the delimitation of the 22 PHC facilities' catchment areas in Guaymallén, geostatistical units or census radio data were retrieved from the National Institute of Statistics and Censuses (INDEC). Health promoters and community health workers (CHW) from each PHC facility also contributed to the delimitation of the responsibility areas, based on the proximity of the population home addresses to the health facilities and the location of high-risk or vulnerable groups. Likewise, those areas in which there was already more than one health establishment (exclusion) were noted.

In **Figure 37**, both images show the delimitation of the health facilities areas of responsibility in Guaymallén. One view in a usual map and the other is a digital map.

Figure 37 ***Health facilities areas of responsibility maps***

Source: Ministry of Health, Mendoza.

In this first stage of development, the purpose was to ensure that every person living within the defined polygon would belong to the responsibility area of the health facility (geographical proximity/spatial distance). The Planning Directorate of the Municipality of Guaymallén contributed to the georeferencing data of the facilities based on the cadaster register and with the creation of the required digital cartography to define the responsibility polygons.[16]

By the end of November 2020, the Guaymallén health catchment areas digitalization process was complete. Each PHC facility is georeferenced and has its defined population, the information about services provided, the health teams, and contact information made public. During this process, health facilities gradually defined their core family health teams to serve a defined panel of people.

This strategy also helped to measure the gaps between resources and needs across catchment areas, since it was possible to identify health facilities with restricted schedules or fewer human resources, as well as the most vulnerable areas.

9.4.5.3 Allocation of population to health facilities

The next process was the allocation of population to health facilities. Two criteria were considered: geographical location and use of health services.

To determine the correct location, the population addresses were obtained from the national health Program SUMAR dataset and matched to each area, according to geographical location.

For this purpose, an API (Application Programming Interface) called Open Street View was used to identify the population according to their addresses and thus associate them with the defined health facilities areas (Ministerio de Salud de la Nación, 2019a).

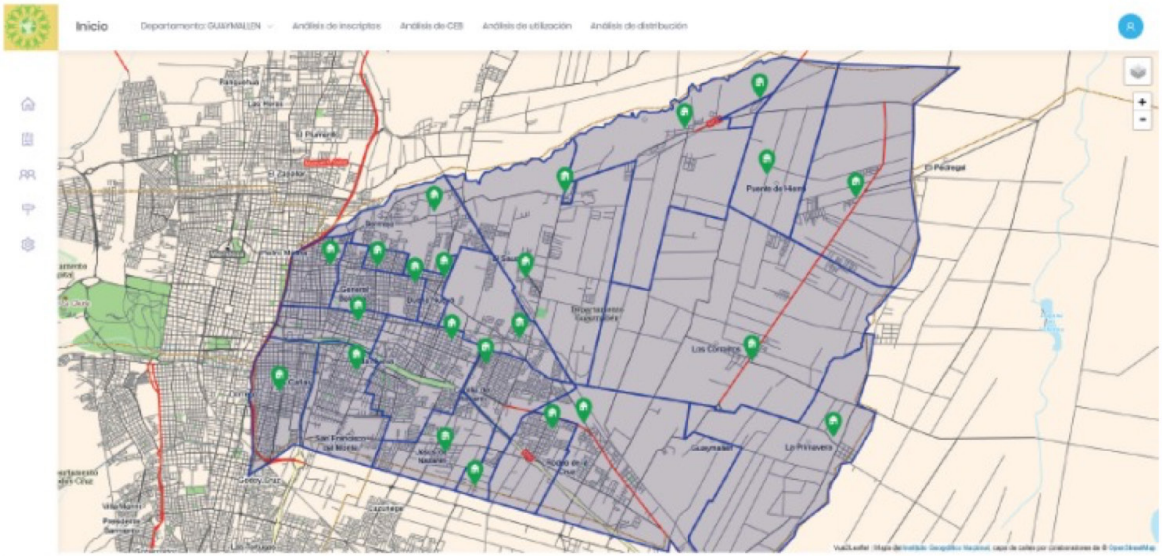
In addition to geographic location, the rate of use of health services was included as an additional criterion. With this in mind, we sought to prioritize the location preferences of the PHC center and the quality of care perceived by patients. However, the criteria for the use of services do not make it possible to identify residents who never or rarely received medical attention, and they often turn out to be the most vulnerable. As a result, 62 percent of 128,337 nominalized SUMAR Program beneficiaries were identified as the reference population of the 22 PHC facilities in Guaymallén. The remaining 38 percent required more accurate location data.

The map in **Figure 38**, taken from the GIS platform, shows the delimitation and location of 22 PHC facilities.

16. The geographic information system used was Aeroterra: https://www.aeroterra.com.

Figure 38 ***Guaymallén map from GIS platform***

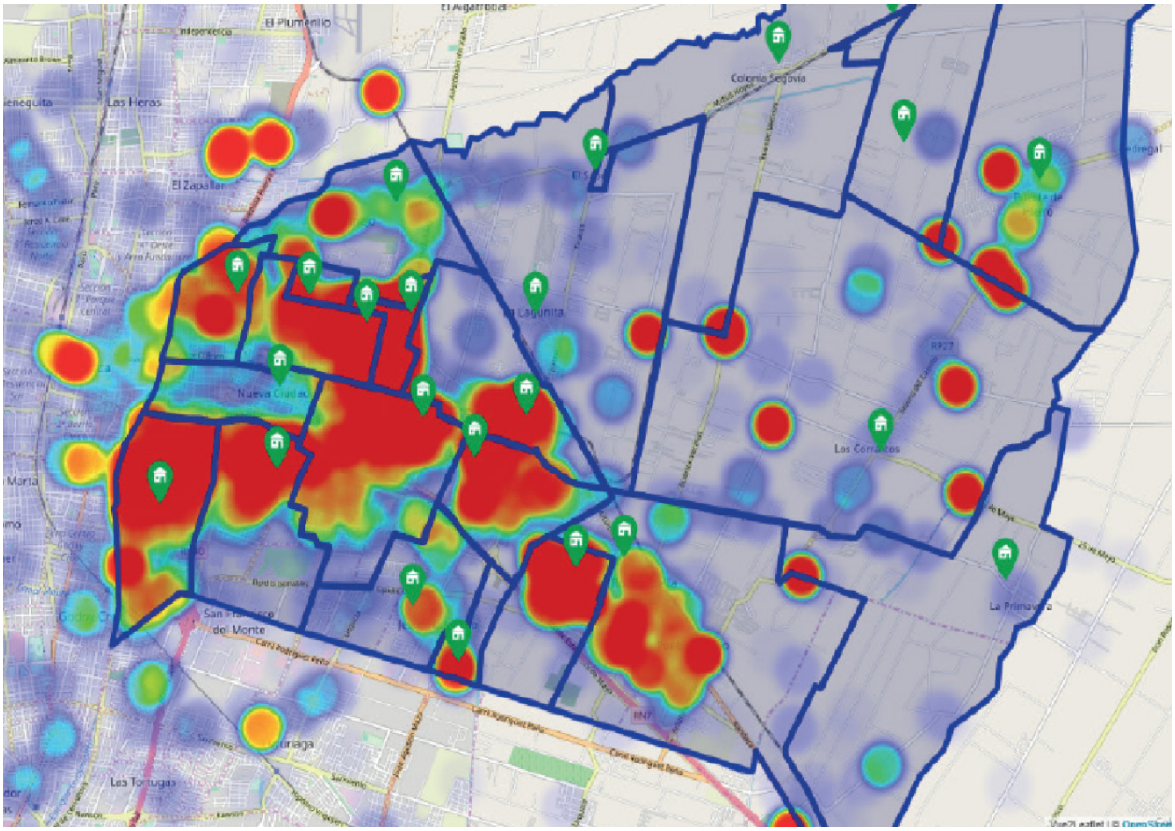
Source: SUMAR Program



This intervention made it possible not only to assign health facilities to each patient but also to analyze strategies to improve population health coverage according to disease risk (taking into account age and number of visits to the doctor). Heat maps were drawn, which allowed visualization of the areas where active search strategies for the risk population groups should be implemented. The map in **Figure 39**, from the GIS platform, allowed for the analysis of effective health coverage of the SUMAR Program provided in Guaymallén. As can be seen, health facilities with higher numbers of users with basic effective coverage are shown in red.

Figure 39 **Guaymallén heat map**

Source: SUMAR Program



The geographic location criterion consists of assigning a spatial location to people, usually at their homes, through a coordinate system, and associating the location with a health facility. The identification of the population through this method requires the definition of areas of responsibility, formally defined and digitized for each health facility previously, being established for the geographic scope of coverage for each of them. On the other hand, public health system users also seem to choose their providers for different factors, such as the perceived quality of care. In this regard, this criterion consists of identifying the reference population, taking into account the health facilities they use, regardless of whether or not it has a defined area of responsibility. Identification of the reference population through this method requires a broader set of definitions, such as the evaluation period, type and amount of health services provided, and criteria that resolve ambiguities of people who have received health care from various health facilities (Ministerio de Salud de la Nación, 2019a).

To sum up, it was highly likely that a strategy that consider both aspects (use of services and geographical location) should be the most appropriate. It would allow for having information regarding the population in the neighborhood, and it would make it possible to determine why people choose some health centers over others located nearby. The combination of these two strategies would help to better identify the population within the responsibility areas but would also allow for updating areas in relation to users' behavior (Ministerio de Salud de la Nación, 2019a).

9.4.5.4 Public health services users' assignment process to family and community health teams

Once the target population of each PHC facility was defined, the process of training the family health teams in charge of that population began. Core and expanded health teams were defined. According to the Ministerial Resolution No. 32/2019, each core team should be ideally have one doctor with a specialty in general or family medicine, as well as a nurse and a community health worker (CHW).

For every two core teams, an expanded team is formed, with a social worker, a psychologist, a dentist, an administrator, an obstetrician, a nutritionist, a physical therapist, and other disciplines, as well as other medical specialties.

Figure 40 ***Family and community health strategy organization***

Source: National Health Ministry, Argentina

9.4.6 Main Results

By the end of 2018, one year after the implementation of the pilot program, the Latin American Faculty of Social Sciences (FLACSO) of Argentina carried out an assessment[17] (Facultad Latinoamericana de Ciencias Sociales, 2018). At that time, the Guaymallén project had already begun with the ECR adoption process, the call center implementation, the population registration, and facilities renovation and refurbishment. However, the empanelment process was still incipient.

This assessment concluded that the experience of Guaymallén was qualified as a health policy built across different levels: national, provincial, and municipal.

However, the evaluation detected some limitations, hurdles, and resistance in its implementation. Structural aspects included the weak connectivity infrastructure, and there were human resources restrictions in quantity and quality, as well as economic or financing issues. The fear of change was also a factor that several participants referred to, especially health teams.

It is important to analyze the different participants' perspectives. At the central level (both national and provincial, political and technical), UHC was conceived as having clear health objectives of universality and a reduction of gaps in access, and as prioritizing some clinical pathways to improve effectiveness and quality. Among health teams UHC was perceived as a change exclusively linked to the incorporation of computer tools, such as the ECR and telephone shifts. In other words, the political dimension of the UHC (as a public health policy) was not present in most of the members of the health teams.

However, the introduction of new logistics of work organization in PHC facilities were present mainly with doctors, placing them in a more open information system to improve the clinical decision-making process.

Regarding the users' perspective, more than a half (57 percent) of the sample18 experienced changes in the overall functioning and health services delivery in the preceding six months.

Such modifications were appreciated in amelioration of the problems with the scheduling system and improvements in waiting time from the time of registration for the visit until the health service was delivered, as well as health facilities infrastructure and comfort and health services delivery from both health professionals and reception administrative personnel.

A high level of satisfaction about health professionals' performance was registered: 6 out of 10 interviewees (60 percent) report that they were very satisfied, and just over a third (34 percent) felt satisfied. In addition, almost half said that the consultation time was longer than before (from 15 to 29 minutes) and 20 percent answered that it was 30 or more minutes. The admission process at the front desk was also experienced as an improvement, with expedited admission and less waiting time.

Users detected some innovations such us the use of ECR and more computers in admission desks and providers' offices.

After the first-year implementation, the strategy continued making progress. By December 2019, 60,000 interoperable ECR were opened. As Mendoza joined the National Digital Health Network, these records could be retrieved in other jurisdictions that also belong to the Network.

It is important to note that during this period 77 percent of the health facilities organized their health teams according to the national guidelines for core family health teams: one doctor, one nurse, and four community health workers for every 800 families, approximately. Health personnel were also trained in the family health strategy implementation.

In addition, 100 percent of health facilities in Guaymallén had digital maps of their responsibility areas, and 62 percent of 128,337 nominalized SUMAR Program beneficiaries were identified as the reference population of the 22 PHC facilities.

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17. The SUMAR program requested the assessment, and its final report is an internal document of the program, it has not been published. An evaluation was carried out with a mix-method approach using qualitative and quantitative methodology. The qualitative strategy included the systematization and analysis of the in-depth interviews with national and provincial authorities, those responsible for Guaymallén health facilities selected for the study, and focus groups with health teams and users. For the quantitative evaluation, an exit poll of 513 users in 10 selected health facilities of Guaymallén was carried out.
18. The sample consisted of 513 users of primary health care facilities in Guaymallén: 37.3% were adult women ages 20 and over, 32% were children ages 0 to 9 years, 15.2% were adolescents ages 10 to 19, and 15.7% were adult males ages 20 and over. The average age of the interviewees was 25.9 years.

Although most of these interventions take some time to impact health indicators, it has been possible to verify a very important effect on the number of users who received health services in Guaymallén's health facilities. According to SUMAR Program, between 2018 and 2019, the number of identified people who used public health services at least once in the last year increased 54 percent in Guaymallén versus 19 percent in the rest of the departments (see **Table 8**).

This indicator, called ***basic effective coverage*** (CEB, in Spanish), represents improvement in access to health services as a result of the health team's proactivity, as well as an increase in the health facilities response capacity.

Table 8

Percentage increase in basic effective coverage in the departments of Mendoza

Source: SUMAR Program

Department	March 2018 Public health users	August 2019 Public health users	% increase
Capital	21.046	26.863	28
General Alvear	6.298	7.118	13
Godoy Cruz	19.971	22.230	11
Guaymallén	**27.634**	**42.632**	**54**
Junín	1.984	2.987	51
La Paz	1.007	1.481	47
Las Heras	23.183	25.507	10
Lavalle	5.172	6.156	19
Luján de Cuyo	8.574	9.419	10
Maipú	18.601	19.211	3
Malargüe	3.769	3.891	3
Rivadavia	5.570	6.307	13
San Carlos	6.936	6.930	0
San Martín	12.719	18.377	44
San Rafael	18.909	17.137	-9
Santa Rosa	2.340	3.056	31
Tunuyán	8.540	8.787	3
Tupungato	4.550	5.666	25
Total	***196.803***	***233.755***	***19***

Table 9

Basic effective coverage, by age groups and gender 2018 and 2019 in Guaymallén

Source: SUMAR Program

Age Groups	March 2018 public health users ***N*** (% of adults)	August 2019 public health users ***N*** (% of adults)
From 0 to 19 years	20.759	33.187
From 20 to 64 years (women)	5.741 (84%)	7.447 (79%)
From 20 to 64 years (men)	1.134 (16%)	1.998 (21%)
Total	**27.634**	**42.632**

Analyzing the composition by age groups in Guaymallén (**Table 9**), the group under 19 years have the highest percentage of basic effective coverage (75 percent in 2018 and 78 percent in 2019).

Stratifying the population over 20 years old by gender, there is a clear preponderance of consultations by women in primary care services. This situation is usual in PHC facilities, because women usually make appointments for prenatal and children health checks at PHC centers and therefore have more opportunities to access to health services.

However, it is important to note that the percentage of men older than 20 years increased from 16 percent to 21 percent between 2018 and 2019. This may be due to the scaling up of noncommunicable diseases prevention and control programs in adults at the primary care level.

Additionally, there was also a 51 percent increase in periodic health checks in Guaymallén as compared to the provincial average, which was 30 percent. The age groups that increased their health checks the most between 2018 and 2019 were children between 6 and 9 years old and adults between 20 and 65 years old. The increase in health services delivery in the adult group is also reflected in the provincial statistics (see **Table 10**).

Table 10 ***Public health services delivery by age groups, 2018 and 2019***

Source: SUMAR Program

Scope	Age groups	Number of consultations in public health services		% increase
		2018	2019	
Guaymallén	Under 6 years	19.736	29.640	50
	From 6 to 9 years	2.647	4.340	64
	From 10 to 19 años	4.916	7.229	47
	From 20 to 64 años	3.623	5.686	57
	Total	***30.922***	***46.895***	***51***
Mendoza (total province)	Under 6 years	163.565	188.738	15
	From 6 to 9 years	26.520	30.431	15
	From 10 to 19 años	37.745	48.818	29
	From 20 to 64 años	43.882	84.946	94
	Total	***271.712***	***352.933***	***30***

Between the first semester of 2018 and the last semester of 2019, gynecological visits by adolescents increased 82 percent, cardiovascular risk consultations increased 48 percent, and overweight and obesity consultations more than tripled with respect to the baseline measures.

It is also important to mention that the strategy has already been scaled up. At the time of writting, 45 PHC facilities were implementing interoperable ECR in Godoy Cruz, Maipú and Las Heras departments, covering most of the greater Mendoza and reaching a population of 1 million inhabitants. It is also expected that the digital strategy will start operating in the capital department and San Martin over the next few months.

The COVID-19 pandemic challenged the health information system. The province defined and re-functionalized some health facilities exclusively for COVID-19. In contrast to paper-based clinical records, ECRs made timely retrieval of clinical data possible in those health facilities dedicated to COVID-19 medical care, ensuring continuity of care of those patients.

In addition, ECR will allow for building prioritization lists of people based on health risks to operationalize the local vaccination strategy against COVID 19.

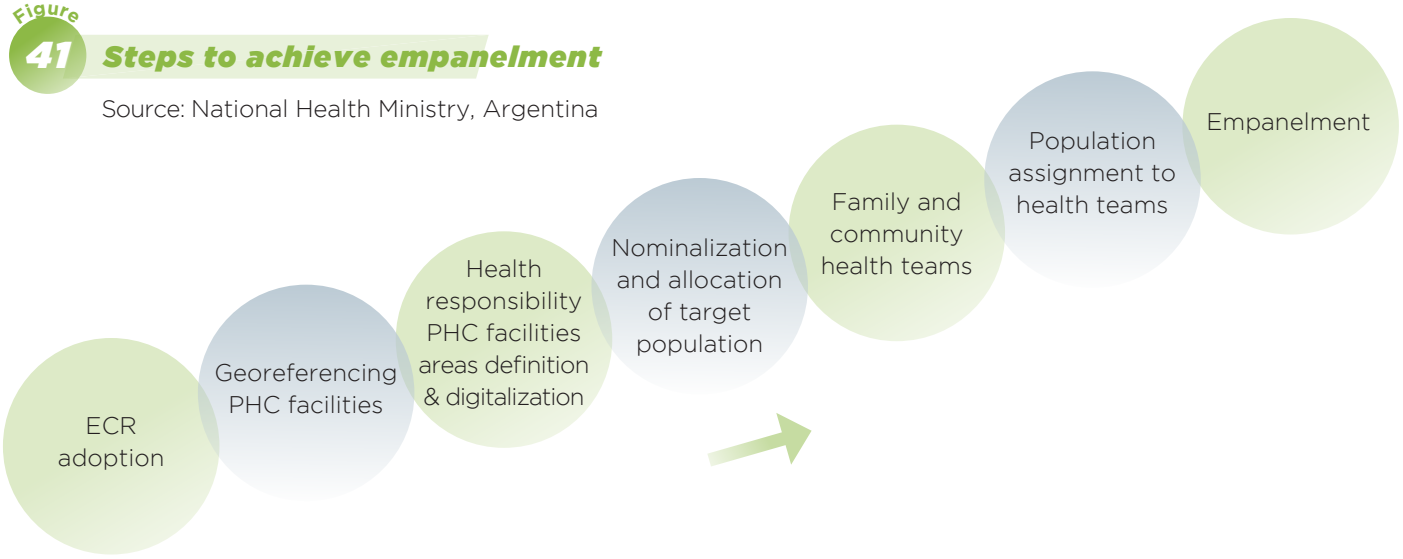
Advances in telemedicine also contributed to the health management of COVID 19, as well as many chronic diseases in the province, through moving in-person consultations at PHC centers to virtual consultation and remote management. Such is the case of the tele-rehabilitation program that continued offering services to patients without interrupting their recovery. The rest of the programs already developed, such as tele-dermatology and tele-cardiology, also expanded their use.

9.4.8 Lessons learned and challenges

Improvements in health access in the department of Guaymallén involved a process composed of many sequential and parallel steps, such as ECR adoption, georeferencing, definition and digitization of health responsibility areas of the public health facilities, nominalization, and allocation of a defined population, as well as core family health team's organization. All these changes were the most important building blocks for the empanelment process.

Figure 41 **Steps to achieve empanelment**

Source: National Health Ministry, Argentina



As was explained, empanelment is a key strategy for building or improving access to health services based on PHC to achieve effective UHC and reduce health disparities.

Nevertheless, there is little international literature for defining empanelment or understanding how to implement empanelment systems in low and middle-income countries (Bearden et al., 2019). Hence, it is doubly important to have been able to systematize this experience.

Although these are the first steps, several lessons can be shared for those who are following similar paths.

As mentioned in the previous section, at the time the first assessment was conducted, health teams did not know much about UHC objectives and the empanelment strategy. The delimitation of health responsibility areas, georeferencing, the core health teams, and the definition of prioritized clinical pathways revealed that there were no effective internal communication strategies for them or the public health services users. One of the lessons learned relates to the importance of developing a targeted communication strategy to involve health workers from the outset in the overarching goals of UHC, one of which is to improve access to health services.

In relation to the implementation process, it is also important to mention the incorporation of implementers to support health teams and accompanying the organizational change process in the PHC facilities, understanding the fact that there is a gap between the strategic decision-making process and the effective implementation of the policies.

Another extremely important aspect was the synergy and collaborative work between the national, provincial, and local level, showing defined common objectives and standards based on scope of work agreements. This was also vital to align human and financial resources.

Several challenges occurred in relation to the next steps. Improvements in data quality for users georeferencing must be mentioned since 38 percent of the population lacked accurate data of their addresses.

One of the most significant strategic challenges in Guaymallén dealt with the training and deployment of the family health teams so that the population was not only assigned to PHC facilities but also to PHC teams, who would take care of them in defined georeferenced responsibility areas.

Although human resources received initial training and all PHC facilities in Guaymallén carried out community health rounds to actively search for people at increased health risk, there is still a long way to go in terms of organizing their work. In relation to this point, a mobile application was developed for CHW to allow georeferencing of households with high-risk patients in order to make home visits.

Despite this application being integrated into the MPI, its implementation is still pending. This tool will probably be very useful for the care of the population.

Using health information for measuring the quality in prioritized lines of care (such as those related to noncommunicable diseases) is also a big challenge and relevant for making decisions and readapting health services to the needs of the population in charge.

Finally, to broaden the entire strategy, it is essential to continue forging alliances within the other departments of the province, as well as with the national level, after the government change occurred in December 2019.

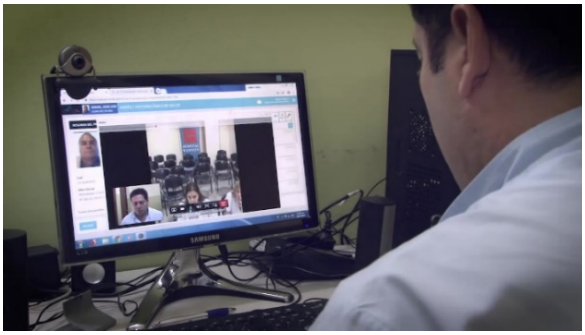
In summary, this case not only contributes to the systematic evaluation of experiences toward UHC, but also shows that the combination of a different organization of primary health care with the adoption of new information and communication technologies in health through geographical information systems and digital cartography improved access to health services in a poor urban setting.

As the implementation of these interventions are being extended to the rest of the province, the results of Guaymallén can be translated into a successful strategy to reduce access gaps between urban and rural populations.

9.4.9 Related images

Figure 42 **Implementation of UHC in Guaymallén**

Source: Ministry of Health, Mendoza.



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PART 2

9.5 UNDERSTANDING THE TRANSFORMATION OF MEDELLÍN INTO A HEALTHY, SAFE, AND MORE EQUITABLE CITY

Medellín, Colombia

9.5 Understanding the Transformation of Medellín into a Healthy, Safe, and More Equitable City

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9.5.1 Abstract

Medellín, Colombia, is recognized for its innovation in planning and for reducing violence since its peak in the 1990s. In this article, we explore some of the specific processes, plans, and policies that contributed to the transformation of Medellín. We focus on the combination of civil society participation, integrated development plans and inclusions of previously marginalized populations and communities. The chapter explores the factors that contribute to a healthier, safer, and more equitable city, and which specific processes, plans and policies in Medellín have moved the city in a healthier and more equitable direction. We also acknowledge that urban transformations like those in Medellín are fragile, meaning they require on-going commitments and investments from government and active civil society engagement. With the COVID-19 pandemic, some of Medellín's achievements in health, inclusion, and safety are under threat, and we emphasize that there are insights from Medellín's response to its crisis of violence in the 1990s for responding to the 2020 pandemic.

9.5.2 Introduction

How does a city turn itself from one of the most violent in the world to a model of inclusion and a City for Life? Once the most violent and unequal city in the world, Medellín was recognized in 2013 as the most innovative city in the world by the *Wall Street Journal* and the Urban Land Institute and received the Lee Kuan Yew World City Prize in 2016.

In the 2000s, when many Latin American cities were struggling with growing levels of urban violence and inequality, Medellín was recognized as an impressive case of urban transformation and a model of successful public initiatives that reduced not only gun violence but also poverty, segregation, and inequality (Freeman, 2019). In this article, we highlight some of the key projects and factors that have contributed to the healthy, but still incomplete, transformation of Medellín from the 1990s through the pre-COVID-19 2000s (Corburn et al 2020; Dutch et al., 2019; Kugel, 2019; Maher and Thompson, 2018).

In 1991, the city of Medellín in Colombia had a homicide rate of 381 per 100,000—among the highest in the world. Gangs, paramilitaries, drug dealers, and guerrillas routinely brought city services to a standstill and fear was widespread among the population. Yet homicides were not experienced equally by all; over 80 percent of victims and perpetrators were young men from the poorest districts, and twice as many were Afro-Colombian than white/mestizo (Muggah et al 2017; World Bank, 2018). The social and economic costs of urban violence were estimated to be significantly limiting Colombia's overall GDP growth and human and economic development in Medellin (Alvarado and Muggah, 2018; Jaitman, 2017). Yet, by 2020 Medellín's homicide rate was about 22 per 100,000, far below cities in Mexico, Brazil, Honduras, and other cities in Colombia that also had extremely high rates of homicides in the 1990s. Not only had violence declined, but inequality, unemployment, and poverty had also reached thirty-year lows. Life expectancy, education, qualities of the built and natural environment, nutrition, and food access had also significantly improved, particularly for the poorest communities or those in the lowest ***estrato***.19 How these transformations happened and the insights from the processes of public participation and planning used in Medellín are the focus of this chapter.

As we will highlight, Medellín's peaceful, healthy, and more equitable transformation didn't happen through ***mano dura*** or heavy-handed militarized policing. As explained below, the transformation of Medellín into a more secure, equitable, and healthy city was the result of concerted and consistent social participation in urban planning, short- and long-range development plans, and investment in the needs of the most violent, impoverished, and unhealthy communities as a first priority (Restrepo-Mieth et al., 2020).

9.5.3 Framework for a Healthy City

Before describing the context and transformation in Medellín, we offer some characteristics of a healthy and equitable city. The first feature of a healthy city is a recognition that health ***starts*** in communities and families, not in the hospital or medical clinic. Thus, a healthy and equitable city must first focus on addressing the drivers of suffering, disease, and premature mortality in our living and social conditions. These are the social determinants of health and include transport, housing, land use planning, public spaces, economic development, education, and a host of other urban sectors that influence whether people will be able to make healthy choices (WHO, 2020). The Pan American Health Organization (PAHO) has long recognized that while there are important regional differences across Latin America and the Caribbean (LAC), a fundamental aspect of health equity is ensuring that marginalized groups, such as Indigenous people, Afro-descendants, women, those with disabilities, and people with low incomes, must participate in decisions that shape their living and working conditions (PAHO, 2019). In the urban context, health equity means removing the barriers for already marginalized population groups and segregated communities to access safe and life-supporting living and working conditions, through updating municipal and regional laws, rules, plans, institutions, and norms of practice. In short, a healthy city must be attentive to the ways decisions are made, who is involved in decision-making, and who benefits, which is what we call ***healthy urban governance*** (Corburn, 2013).

Second, a healthy and equitable city views place not just as a geographic space in the world but as a social and physical place that is shaped by people, policies, programs, and plans. In other words, urban places are actively made and remade by people and, in-turn, people are shaped by places. While action at the international and national scales are important, we recognize that many municipal-scale decisions can reverse hazardous place-based exposures and increase the characteristics of places that can promote health, such as more affordable housing and green space, closer proximity to healthy food, reduced poverty and educational inequalities, and increased opportunities for social interaction, cultural expression, and connections (PAHO, 2019).

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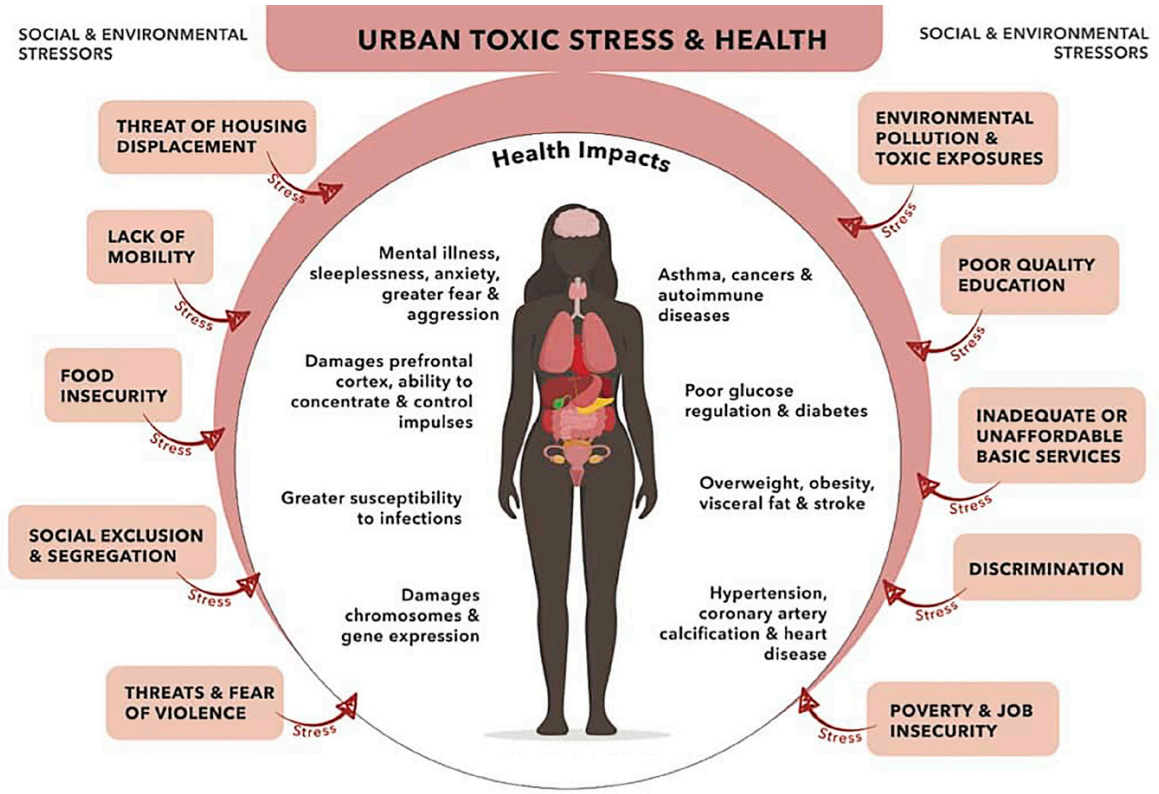
19. Estratos were created in Colombia by a law in 1994 that forced municipalities to rank housing on a scale from 1 to 6, with 1 being the lowest and 6 the highest, based on the structures' building materials and the quality of infrastructure in the area, such as roads and access to education. The Estratos system classifies which areas of the city, and the residents living there, should receive government subsidies to reduce their utility bills; the lower the estrato, the higher your subsidy and the less you pay for electricity, water, garbage collection, and even your cellphone service.

A third dimension of a healthy and equitable city is a focus on alleviating chronic or toxic stressors that influence disease, disability, and death, particularly for women and those facing ethnic and racial discrimination (da Silveira et al., 2021; OECD/World Bank, 2020). Toxic stress is not your everyday anxiety or worry. Rather, stress that becomes toxic is chronic and often starts before we are born; preventing it demands policy, not individual action, and it may be the result of multi-generational inequities. Toxic stress in cities can occur when certain communities experience residential segregation, racism, sexism, exposure to violence, poverty, dangerous or uncertain employment, environmental pollution, constant noise, long commute times, unsafe play spaces, and more. The stress from these inequities results in the prolonged release of fight-or-flight hormones, which disrupt the body's immune system, normal brain development, the regulation of glucose and the accumulation of fat (Corburn, 2017; Geronimus et al., 2020). As shown in **Figure 43**, multiple urban stressors (located on the outside of the circle) contribute to mental and physical changes in the body and can contribute to the chronic and infectious diseases that are the leading causes of morbidity and mortality in Latin America. Thus, a healthy and equitable city cannot be achieved through improved and greater access to medical care alone, since treatment might just send people back into the living and working conditions that are making them sick in the first place (Corburn 2021).

Figure 43 ***Community-based toxic stressors and their impacts on human health***

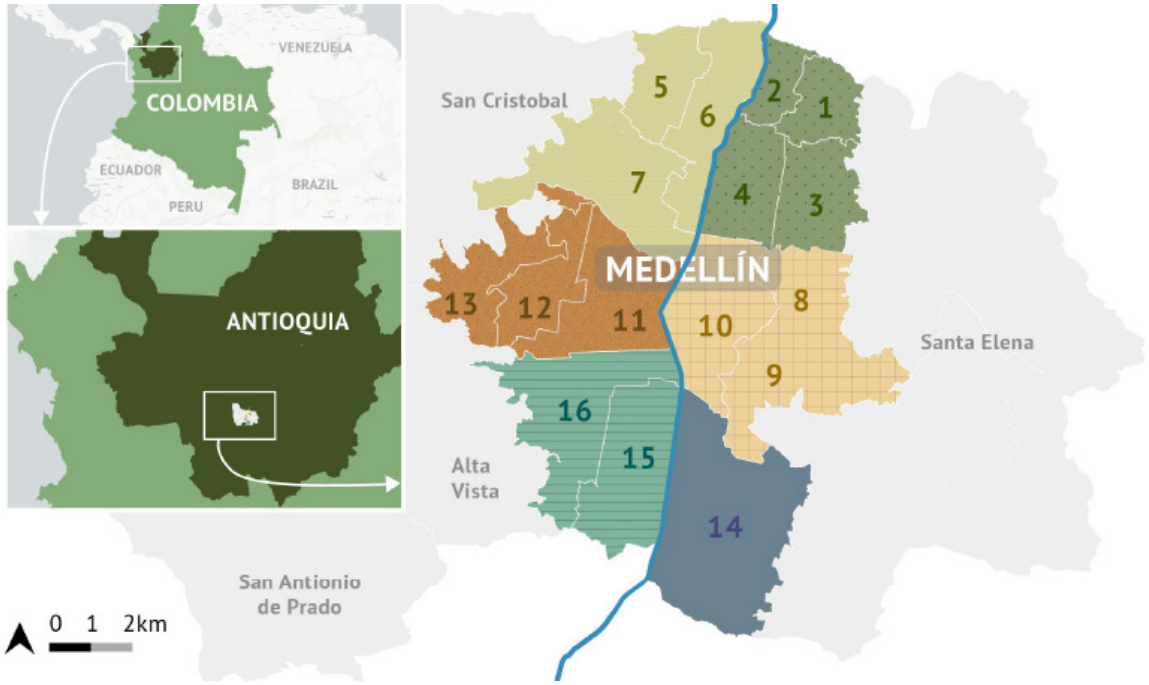
Source: Corburn, 2021, p. 51.



9.5.4 Medellín Context and Brief History

Medellín is the capital of the Department of Antioquia and the second-largest city in Colombia, with a population of about 2.5 million. It is located in the Aburra Valley, a region with steep mountains on its east and west sides with a river snaking along the valley floor (**Figure 44**). Within the region are 10 other municipalities and a total population of about 3.9 million. Early in its development, Medellín built its wealth on gold mining and coffee exports (Hylton, 2007). Medellín once had a thriving industrial and manufacturing center, known by some as the "Manchester of Colombia" (McGuirk, 2014). However, by the 1970s, there was a steep decline in manufacturing, and once thriving textile industries left the city seeking less expensive labor in Asian countries. As Medellín's industrial sector declined and the economy slowed, many migrants could not find formal employment and there was a steep rise in socioeconomic inequality and growth of informal, or slum, communities. At the same time, Medellín was growing very rapidly, from a city of less than 400,000 in 1950 to 1.26 million in 1970 to 2.2 million in 1990.

Figure 44 **Medellín and its districts (comunas)**



Comunas and Corregimientos of Medellín, Colombia

Medellín River

North East Zone
1. Popular
2. Santa Cruz
3. Manrique
4. Aranjuez

North West Zone
5. Doce de Octubre
6. Castilla
7. Robledo

Central East Zone
8. Hermosa
9. Buenos Aires
10. La Candelaria

Central West Zone
11. Laureles
12. America
13. San Javier

South East Zone
14. El Poblado

South West Zone
15. Guayabal
16. Belen

Peri-Urban Corregimientos

Colombia has had armed opposition groups since at least the 1950s. This period in the country's history is known as ***La Violencia***, which included an ideological civil war between the Conservative and Liberal parties. During this period, armed groups emerged as strongholds in certain regions, including the now infamous Fuerzas Armadas Revolucionarias de Colombia (FARC-EP) (Revolutionary Armed Forces of Colombia), and the Ejército de Liberación Nacional (ELN) (National Liberation Army). Other guerrilla groups operated and aimed to control an emerging drug market.

By the 1980s, the political insurgency and drug trafficking guerrillas were operating in urban areas, using kidnappings, bombings, and other violence to influence politics and control land use development and the social dynamics within neighborhoods (Rueda, 2017). Guerillas operating in the country's mountains and forests began forcing people off their land in an effort to grow more coca. The 1970s and 1980s had large-scale internal displacement in Colombia, as millions were driven from rural areas into cities. According to the UNHCR, Colombia has one of the largest populations of internally displaced people in the world (Alsema, 2018; UNHCR, 2020). Further, Antioquia and its capital city Medellín are located in the extreme northwest corner of South America and Colombia, closest to the Darien jungle, which since colonial times has meant a geostrategic connection with the Caribbean as a corridor for various commercial traffic, both legal and illegal.

By the 1980s, paramilitary groups and drug cartels fought over control of space and illicit markets, and rates of violence in the city began to spike well above national levels. Poverty, drug trafficking, and the heavy hand of the military combined to give Medellín the infamous title in the 1990s as the murder capital of the world. In some Medellín neighborhoods, or ***comunas***, youth gangs tried to fill the voids left by the absence of the state by providing some services and even enforcing their own code of justice (Verdad Abierta, 2015). These militias became powerful by being the enforcers of local rules, acting as local police and juries, but also by delivering services and controlling land use development. In the 1990s, an overstretched police force and military responded with arbitrary arrests, torture, executions, massacres, and forced disappearances (Melguizo and Cronshaw, 2001).

On October 16, 2002, ***Operación Orión*** took hold in ***Comuna*** 13, or the San Javier community in Medellín. Orion was a national government military campaign to rid the area of gangs. The conflict lasted four days, and it is estimated that over 1,500 troops entered on foot, in tanks, and from helicopters, killing tens, wounding hundreds, and displacing untold numbers. Months of surveillance in Comuna 13 followed the military campaign. Arrests were frequent and a terror was imposed on the remaining residents.

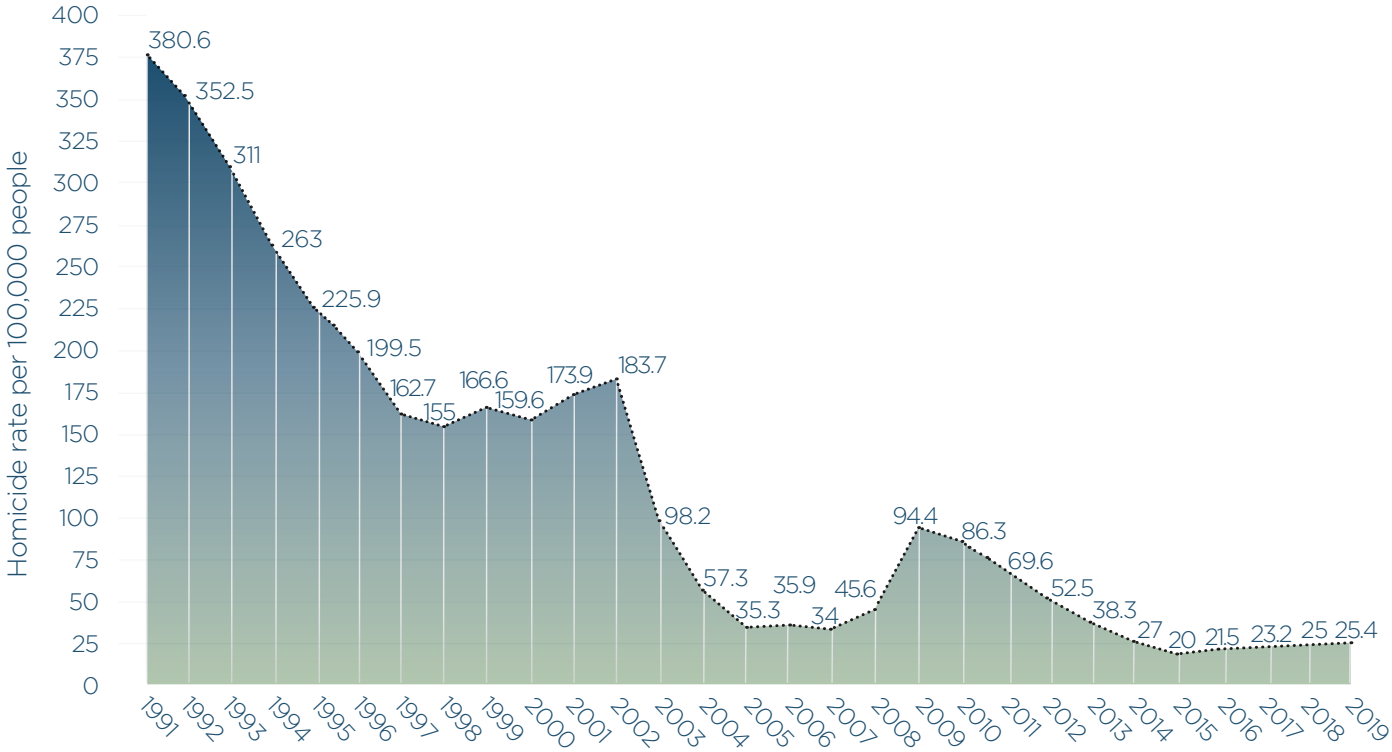
The National Commission for Historic Memory (*Comisión Nacional de Memoria Histórica*) reported that following Operation Orión, the government imposed a new social order, limiting social interactions, and fomenting distrust of one's neighbors.

The scars of Operation Orion are deep in the memories and bodies of local residents and were captured in the National Center for Historical Memory report on the Impacts and Harms Caused by Conflict in Colombia.

Figure 45 highlights the decrease of homicides during a period when the concept of the healthy city was introduced to the country by a declared charter for the Latin American and Caribbean region, starting in 1992, and contributed to the process of rebuilding hope and peace in Medellín.

Figure 45 **Homicide rate per 100,000 inhabitants, Medellín, Colombia, 1991–2019**

Source: Alcaldía de Medellín, 2019.



During the COVID-19 crisis, mortality rates increased dramatically in Colombia.

For example, from 1965 to 2020, there were an estimated 177,307 civilian deaths attributed to armed conflict in Colombia, plus another 40,787 military deaths, for a total of about 220,000 deaths. However, during the 2020–21 COVID-19 pandemic, it is estimated that over 120,000 Colombians died from SARS-CoV-2.

We are unsure how many of these deaths could have been prevented through public health and social supports to vulnerable population groups (Martinez-Herrera et al., 2021). However, the following discussion of the efforts to make Medellín a healthier and more equitable city must be put in the context of the on-going challenges faced by the COVID-19 pandemic.

9.5.5 Out of violence and despair, a plan of hope

Many point to the 1988 decentralization process that allowed for locally elected officials for the first time and changes in the 1991 Colombian Constitution as the key turning points for Medellín's transformation (Dutch et al, 2019; Restrepo-Mieth et al., 2020; Turok 2014). The Constitution defined Colombia as a "social state under the rule of law," or ***estado social de derecho***, which was accompanied by new rules mandating decentralized municipal governance, participatory democracy, and a recognition of ethnocultural diversity, among other reforms. From 1990 to 1995, a new Presidential Council for Medellín (Consejería Presidencial para Medellín) established public forums in which experts, community members, and the private and public sectors came together to discuss the origins of the city's challenges and ways to address them. The Presidential Council for Medellín was given the charge from the Colombian government to "address the social debt and mitigate the historical absence of the State in the city of Medellín" (Consejeria, 1995). Severe inequality was seen as a root cause of violence and a barrier to equitable redevelopment, as the wealthiest 10 percent of Medellín were earning about 50 times the incomes of the poorest 10 percent (Lopéz Moreno, 2014).

The Presidential Council supported a bottom-up methodology, and a major slum upgrading program called the Integrated Slum Upgrading Program of Medellín (Programa Integral de Mejoramiento de Barrios Subnormales en Medellín), or PRIMED, was launched in 1993 and lasted until 2003.

The PRIMED focused on specific barrios or comunas. PRIMED aimed to achieve both physical and social integration—physically integrating the peripheral communities into the city and socially integrating residents by providing education, employment, and other opportunities (Jaitman and Brakarz, 2013). The program built new housing, delivered land rights to some of the urban poor, and extended water, roads, and sanitary infrastructure to previously excluded barrios. According to Betancur (2007), 15 informal areas of the city received upgrading, impacting about 20 percent of the total population living in the barrios. The areas received 4,500 new homes and 500 homes were resettled to safer areas; 12,000 homes received improvements; 2,100 households received legal titles; 60 percent of the area was served with new pedestrian paths; 3 hectares of new parks and 5 hectares of public recreational space were added; 95 percent of households were connected with municipal water and 90 percent connected to the sewer system; 7 communal restaurants and 15 new schools were built; and 14 hectares (70 percent of the area deemed high risk) was recovered and stabilized to prevent landslides. The program conducted its own survey of participants in 1999 and found that 69 percent reported their quality of life had improved. Survey respondents noted that home improvements (66 percent), public spaces (49 percent), and legalization of tenure (36 percent) were the three physical changes with the highest level of satisfaction. Seventy percent of respondents stated their travel time had decreased, 92 percent reported that access to transport had improved and 91 percent that they were better linked to the city; 68 percent indicated that citizen participation had increased, 75 percent believed the community had the capacity to establish organizations to set its own development priorities, and 81 percent reported that relations among neighbors improved and 86 percent that safety had improved (Betancur, 2007).

PRIMED also focused on building social capital and connections within communities and between poor communities and the government (World Bank, 2003). Social capital was noted as one of the most important factors in helping reduce violence and improve quality of life during this period (Moser and McIlwaine, 2000). During this period, Empresas Públicas de Medellín (EPM) and the Alcaldía de Medellín partnered with PRIMED and had their own programs to provide access to potable water and energy supply to these same areas, all of which contributed to increasing the formalization of previously informal barrios.

Also emerging during this time was a new political movement, Movimiento ***Compromiso Ciudadano*** (Citizens' Commitment Movement, 1998). This movement capitalized on the democratic and community-based spirit of the new dialogic process and brought together social movements with leading academics. With the election of Mayor Sergio Fajardo in 2004, the Movimiento ***Compromiso Ciudadano*** gave rise to the social urbanism policy.

Social urbanism is an approach to urban governance that aims to create new forums and institutions for resident-driven problem identification, planning, and co-implementation of solutions with government. While this was a key force in the transformation of Medellín, so too was a related concept called ***urban acupuncture***, which is the process of identifying catalytic and transformative projects, programs, and services with local residents, implementing these catalytic investments with the most stressed population groups and places, and networking these catalytic projects across the entire city through long-range plans to ensure impacts are sustainable and ongoing (Corburn et al 2020).

9.5.6 Taking an integrated approach to peace and resilience

One way social urbanism was put into practice in Medellín was through the the Proyectos Urbanos Integrales, or Integrated Urban Projects (PUIs), co-developed by local architect Alejandro Echeverri, which included forums for resident participation and linked physical and social investments in communities most in need (Magalhães et al., 2016). The PUIs resulted in the co-creation of plans and citizen participation in the implementation of new projects that stimulated the transformation of Medellín. By 2002 the city had completed its long-term comprehensive plan, called the Plan de Ordenamiento Territorial (POT), but the social urbanism approach supported the drafting of complementary short-term implementation strategies called the Planes de Desarrollo Locales, as part of the participatory planning system created during the 1990s. Together these plans would provide a new roadmap for the physical and social redevelopment of the city. Yet the institutions of development in the city also needed to be reformed to achieve the ideals of social urbanism.

A key institutional reform focused on the city's Urban Development Corporation (or EDU). Mayor Fajardo and subsequent leaders created and supported new "social managers" to work in the neighborhoods to facilitate workshops with youth, adults, and different constituencies to imagine what the city could be. These facilitators were often from the comunas where they worked and even engaged with youth gangs and others involved in violence. The dialogues were intended to ensure community residents helped identify the most catalytic projects for their neighborhoods, and the EDU representatives linked these to municipal resources and longer-term planning goals (McGuirk, 2014).

Consistent with the social urbanism ethos of investing in the poorest areas first, all the PUI locations at this time were in the city's lowest-income and most violent neighborhoods, and included spatially connected investments in transportation, infrastructure, education, health care, security, economic, and environmental quality (Fajardo and Andrews, 2014). For example, Comuna 1, or Barrio Popular, not only received the city's first Metrocable but also the pilot experience with the PUI projects, including a new library park, pedestrian bridges, schools, sports facilities, and offices, as well as the famous upgrading Juan Bobo, to help stimulate local economic development called Centros de Desarrollo Empresarial Zonal, or CEDEZOs (**Figure 46**). The CEDEZOs, or Centers of Zonal Business Development, were included at the request of local residents who noted that large-scale government or donor-driven projects rarely resulted in economic gains for the poorest residents, didn't build a locally owned economy or support the large, informal workforce. The CEDEZOs aim to act as catalysts for small, locally owned businesses and are are community offices that bring together such things as technical training and loan support from the government and the private sector. At each CEDEZO, staff help local residents access loans, learn about other small business development strategies, and acquire necessary permits, they and offer classes in fiscal and organizational management (Bateman et al., 2011).

The PUIs were accompanied by Mejoramiento Integral de Barrios (MIB), which were comprehensive and integrated strategies that coordinated the management and delivery of projects and services required by different government agencies in one place, thereby pairing spatial interventions with services and employment opportunities for long-marginalized communities (Restrepo-Mieth et al., 2020). By combining PUIs and MIBs, complementing social public policies in the most marginalized communities, Medellín has also managed to enroll local community members as partners, not just recipients, and maintain continuity of physical and social development projects that have taken a decade or more to complete (Dutch et al., 2019). This integrated approach has ensured that even in the informal poor areas of the city, close to 97 percent of homes are connected to the official water system and 95 percent to sewers.

Basic service delivery for all remains an urban management challenge, even in Medellín. For instance, the Pan American Health Organization Report ***2030 Agenda for Drinking Water, Sanitation and Hygiene in Latin America and the Caribbean: A Look from the Human Rights Perspective*** noted that only 65 percent of the population in the region has formal access to safe drinking water and 22 percent to sanitation. To address this issue, Medellín has approached service delivery in an integrated way, launching a project called ***Unidos por el Agua*** in 2019. This project aims to connect the last mile of those home still not accessing municipal water by hiring local residents to help with the construction and management of the projects. This also helps build trust with government and is working to stabilize dangerous hillsides, improve pedestrian paths in the areas, and link service delivery to food security and other related health issues facing city residents living on the periphery.

Figure 46 **An example of the integrated community projects in Comuna 1, Popular, Medellín**

Source: Urbam, EAFIT University, 2014. Map: proyecto urbano integral PUI comuna nororiental.

Medellín also institutionaliz participatory bBudgeting (PB) during the alcaldía of Juan Gómez and the planning director Zoraida Gaviria (1998–2000). This is now a component of the Sistema Municipal de Planeación. Many PUI projects were envisioned and partially resourced through collective PB process. In Medellín's PB process, 5 percent of the city's annual budget is reserved for comuna councils to determine its allocation.[20] From 2005 to 2015, the annual participatory budget increased from roughly 60 million to 151 million Colombian pesos. The allocation of the participatory funds for community driven projects is managed by a group of popularly elected neighborhood planning representatives called Juntas Administradoras Locales (JALs) (Guerrero, 2011).

In 2012, the Development Plan of Medellin, Un Hogar para la Vida 2012–2014, from mayor Aníbal Gaviria promoted the Jardín Circunvalar de Medellín (Circumvent Garden and green belt), a master plan for the formalization of the rural urban edge, in conjunction with the metropolitan area of the Aburrá valley. One community project included during this time was in Comuna 8, ***Villa Hermosa***, on the urban hillside fringe of the city. This community's residents demanded a pathway where people could ride bikes and walk, connecting once isolated neighborhoods. The path used to be known as the ***Camino de la Muerte*** — the "path of death"—because it was where gangs would hang the bodies of their enemies. The new path, co-designed by residents and city planners, was named ***El Camino de la Vida***, which is now a 12-kilometer trail connecting formerly disconnected neighborhoods along the mountainside. It was more than symbolic. The life-promoting project included stabilizing the steep mountainside slopes to prevent landslides. It includes hundreds of acres of community gardens where residents not only grow their own food but also distribute it at markets across the city. The project has planted over 40,000 native trees on the hillsides, developed new community waste management plans, and built this pedestrian and cycle pathway as part of the boundary for the greenbelt (Alcaldía de Medellín, 2015). Local community organizations such as the Displaced Persons Board and the Commune Housing Board 8, ensured that any environmental and greening projects also included strategies to prevent displacement, integrated local agricultural and cultural practices, and included local people in defining what they needed for dignified housing (Oliveros Ossa and Eslava, 2016). Medellín's Department for Social Inclusion and Family (Secretaría de Inclusión Social y Familia de la Alcaldía de Medellín, or SISF) was also active in the project and supports food security and coordinates school food programs through which all students in the city receive fortified milk and lunch every day. This is just one example of how Medellín used participatory processes to respond to urgent community needs for safety and security, link multiple environmental and economic development objectives, and include social programs along with built environment improvements to ensure ongoing management and benefits to local people.

20. Municipal Resolution 43 of 2007 created and institutionalized participatory planning within the municipal planning system.

9.5.7 Education and healthy public space

Investing in education, culture, and inclusive programing, such as employment training, was also a key aspect of Medellín's healthy transformation. In 2004, a program called "Medellín, la más educada" ("Medellín, the most educated"), began guaranteeing early childhood and primary education to all residents. The city began training and hiring over 20,000 new teachers. Every child was guaranteed after-school programs, so learning continued outside the classroom. The program also needed to build new community schools for the new teachers and programs. The education programs in the city evolved as a complete system, which included the Buen Comienzo program (promoted by Mayor Alonso Salazar, 2008–9 and supported until 2015) and technical and university education with the agency for education, SAPIENCIA. Subsequently, with the Medellín Ciudad para la Vida Fund (2014), it was proposed to build three new university campuses.

One school that symbolized the integration of employment, education, and cultural memory that was built near the San Javier neighborhood is called Colegio Maestro Lusitania Paz de Colombia. It is a modern, beautiful glass facility with the latest technologies for student learning and creativity. The school includes preschool, primary, and secondary school classrooms for 1,400 students. Its circular design invites collaboration and sharing, with the glass walls giving students and faculty soothing views of the surrounding parks and natural preserve. The architectural significance also reflected the city's commitment to memory and peace since the round playground of the school was a former plaza de toros or bullring. Thus, a former place of death had been turned into a place of opportunity and life for youth and adults.

The same commitment to life-supporting community projects built in the most impoverished and formerly violent areas is also reflected in the Articulated Life Units, or Unidades de Vida Articulada (UVAs). The UVAs are hillside water storage tanks that were formerly behind a fence or wall and were opened up and turned into public spaces through participatory, community-driven design processes (Restrepo-Mieth et al., 2020) (**Figure 47**). UVAs include two concepts and typologies of the buildings, the first developed by EPM to transform aqueduct tanks into social facilities and the second implemented by the Institute of Sports and Recreation and the Urban Development Company (EDU) with an emphasis on the creation of new sports and recreation facilities (Figure 49).

Figure 47 ***A water tank converted into an Articulated Life Units, or* Unidades de Vida Articulada (UVA)**

Source: Jorge Perez Jaramillo.

Through a partnership with Medellín's utility company, EPM, local residents were able to co-design each UVA in a unique way to reflect local needs and culture. Some UVAs have water features and performance spaces while others are more passive green spaces. Each UVA offers public gathering and recreation space in neighborhoods that mostly lack these amenities, but also train and employ local people to be social workers, childcare specialists, art and sport instructors and a host of other well-paying jobs. The UVAs are often adjacent to library parks, which also act as cultural, performance, and public places for lifelong learning.

Between 2002 and 2017, communities with library parks in Medellín saw their employment rate increase 17 percent more than neighborhoods without the parks (Alcaldia de Medellín, 2021). The San Javier Library Park and neighborhood UVAs have helped create a stronger sense of community cohesion among residents in a place that was severely traumatized by Operation Orion and related gang violence (Nichols, 2017). By literally removing walls that separated poor, hillside communities and state/government owned facilities, the UVAs are acting to remove barriers physically and socially between government and the most vulnerable places (**Figure 48**).

Figure 48 ***Two types of UVAs: (first) a social gathering space and (second) UVA El Paraíso San Antonio de Prado INDER-EDU, a place of learning and sports***

Source: Pepe Navarro.

To link what happens in UVAs, schools, and library parks to university resources, the city created the ***Parque de la Vida,*** a community center supported by the University of Antioquia. The programs and services at the Parque de la Vida truly aim to promote life and peace, since they include training for residents in conflict resolution, healthy diets and lifestyles, and racial and cultural inclusion. The Park of Life has been recognized by the WHO and the Latin American Network for Social Innovation as one of the most innovative and health promoting initiatives in Latin America (Ramirez, 2018). One program called Recreado para la paz y la convivencia (Recreated for peace and coexistence), works with children and adolescents to develop nonviolent communication, tolerance, and conflict resolution skills. Another program trains community residents to mobilize and meaningfully engage in Medellín's participatory budgeting process. The Parque de la Vida has also created over 1,000 jobs, some at the center but many in the neighborhoods.

Many of the projects and initiatives mentioned here were financed through Medellín's public utility company, EPM. Voters decided in the 1990s to require that 30 percent of the utilities' profits go back into public use projects, and this created about $450 million per year, or about 20 percent of the annual budget of the municipality (Bateman, 2011). The private sector also plays a significant role, providing financing for some of Medellín's transformational projects (Dutch et al., 2019).

9.5.8 Inclusive parks, green space, and Health

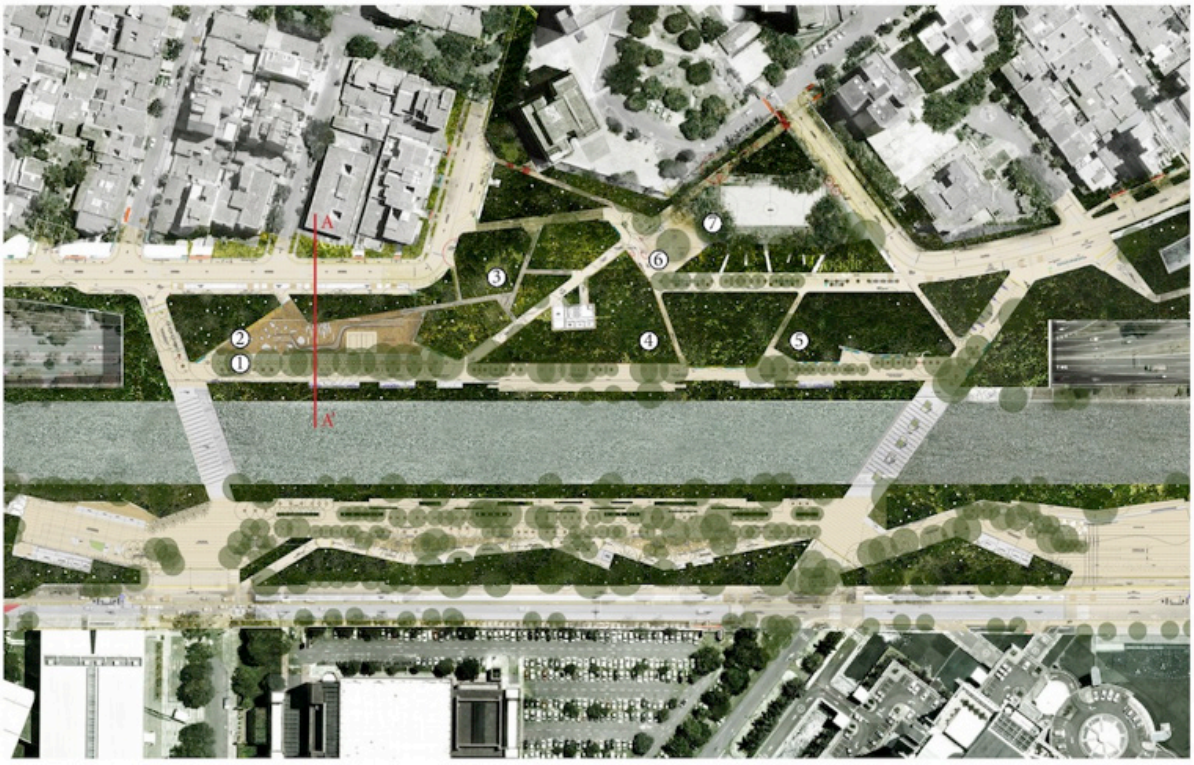
While we have described only some of the transformative processes and projects that have helped change living conditions in Medellín, it is important to note that the transformation is an ongoing project, constantly aiming to improve living conditions and reduce inequities. For example, the social urbanism approach means that many new projects and investments went to the impoverished hillside communities, but very little development happened in the center of the city. The ***Parques del Río*** project got its start in the 1990s, through the sanitation program by EPM and then under the orientation of ***Instituto Mi Río***, created to lead regeneration programs for the river basin and the creek system throughout the city. Today, the Parques del Río project is a planning and climate change resilience strategy that seeks to create a more compact land use with several concepts: integrating the city and its river, creating new public green space, enhancing ecosystems, linking pedestrian and bicycle infrastructure to the metropolitan transport system, and improving the water quality in the river (**Figure 49**).The river was once the city's sewer, collecting runoff from the surrounding hills that included human and industrial waste (Kugel, 2019).

The valley floor area of Medellín also has a deficit of public parks, with less than four square meters per capita. The project is aiming to achieve park, housing, and climate change objectives by putting the main motorway of the city underground, and building a 20-kilometer linear park and housing above, simultaneously connecting two previously disconnected sides of the city through pedestrian and bicycle bridges.

Areas adjacent to the River Parks projects are targeted for more dense housing, including a plan for 120,000 new homes, 20 percent of which will be social housing. The development rights to new land created by the park will help offset the costs and the aim is to create a more dense, walkable urban core and limit sprawl along the city's steep hillsides (Ortega, 2015).

Figure 49 **Parques Del Río Plan (first) and built section (second)**

Source: Jorge Perez Jaramillo.



The western side built has a residential and community character, linked to the consolidated neighborhood of Conquistadores. Its intention is to respond with activities to its environment and surrounding public, with areas of stay and passive activity.

① River walk
② Sand area
③ Elevated Trail / Undergrowth
④ River pavilion
⑤ Forest clearing
⑥ Citizen service module
⑦ Colseguros court

A new Green Corridors complements the River Parks project. It is planting thousands of trees along roads, creeks, and ecologically sensitive riparian areas across the metropolitan region to stabilize hillsides, improve water quality, and cool the city. This is part of an Eco-City Medellín initiative that was launched in 2020 as part of the Medellín Future Development Plan, which will build on previous territorial, mobility, and environmental quality plans (Mercado, 2020). The Plan has a series of strategic projects that include (1) improving urban densification, (2) completing the "last mile" of municipal services to those households still not connected, (3) ensuring a newly proposed underground metro line delivers ecologic and health benefits, (4) enhancing electric bus and bicycle mobility and safety, and (e) expanding the Parques del Río project toward the North of the city.

9.5.9 A concrete peace

With all the different projects and programs in Medellín, there is clearly no one way to measure health, equity, or well-being. Conventional public health indicators can give us some clues about the likely impacts of the above-mentioned changes. For example, life expectancy in Medellín has increased from 65 years in 1993 to 75.2 years in 2006 to 78.2 in 2019, with women living on average three years longer than men. The infant mortality rate for Medellín decreased from 14.3 per 1,000 in 2004, to 10.1 in 2011 to 8.3 in 2015 to 7.3 in 2019. The mortality rate for children under five due to respiratory infections declined from 24.5 per 1,000 in 2006 to 6.8 in 2016. The prevalence of chronic malnutrition for children under six has declined from 10.8 per 1,000 in 2011 to 7.4 in 2019. Violence as a cause of death in Medellín has declined since 2012, but respiratory diseases and hypertension-related deaths have increased (Medellín Como Vamos, 2020) (**Table 11**).

Another way to measure impact is using Medellín's Multidimensional Index of Living Conditions (IMCV). This index combines data from measures of household economic status, education attainment, housing quality, use of the social security system, number and type of connected utility services, feelings of security in one's neighborhood, perceptions of environmental pollution, ratings of public transport, levels of civic participation/voting, access to health services, participation in recreation, and overall perception of the quality of life. These data are gathered by the Departamento Administrativo de Planeación at the household level, so analyses by community are possible. The IMCV data from Alcaldía de Medellín suggests that there have been some important improvements in the Popular (1) and San Javier (13) comunas. Life expectancy in Popular has increased from 71 years in 2005 to 76 years in 2016. The responses of good or excellent self-rated health (the answer to the question "how would you rate your health?"), increased by six percentage points from 2011 to 2018 in Comunas 1, 8 and 13 (some of the poorest areas) (Medellín Como Vamos, 2020).

Table 11 **Medellín: Leading cause of death, 2012–2019 (% of total)**

Source: Medellín Como Vamos, 2020

	2012	2014	2016	2018	2019
Primary Cause	Heart disease (15.5)	Heart disease (15.1)	Heart disease (14.4)	Heart disease (14)	Heart disease (13.4)
2nd cause	Violence (8.6)	Lower respiratory disease (7.9)	Lower respiratory disease (7.3)	Lower respiratory disease (7.5)	Lower respiratory disease (8.2)
3rd cause	Lower respiratory disease (6.9)	Cerebrovascular diseases (6.5)	Cerebrovascular diseases (6)	Cerebrovascular diseases (6.4)	Hypertensive diseases (5.9)
4th cause	Cerebrovascular diseases (6.8)	Violence (5)	Pneumonia (5.1)	Hypertensive diseases (5.2)	Cerebrovascular diseases (5.7)

Interventions like the UVAs, libraries, and Metrocable and some others, though not specifically framed as violence

reduction interventions, have contributed to safer and more accessible public space throughout the city. In a longitudinal study conducted between 2003 and 2008, researchers found that the decline in homicide rates was 66 percent greater in neighborhoods that received a Metrocable line compared to those that did not. Neighborhoods with Metrocables also saw a 75 percent greater decrease in reported violence between the two time periods (Cerdá et al., 2012).

Before the COVID-19 pandemic, social indicators suggested that the resources for health and healing were improving in Medellín. The Gini Index—a measure of income inequality—had declined in Medellín since 2010 (with a brief uptick in 2014). The lower the Gini, the less inequality, and in Medellín it was 0.56 in 2003 but fell to 0.46 in 2017, according to data from DANE, the Colombian statistics agency (for comparison, the Gini in the United States is about 0.41 and in South Africa it is 0.65). Other indicators of population and place changes over time in Medellín include the following:

- Poverty rates dropped from 36.5 percent of the population in 2002 to less than 14 percent in 2018.
- The percent of households receiving municipal services of water, sewer connection, and energy increased from 94 percent in 2010 to 97.5 percent in 2018.
- High school dropout rates declined from 9 percent in 2015 to 2.9 percent in 2019, the lowest rate in 14 years.
- About 60 percent of 18- to 24-year-olds were enrolled in higher education in 2017.
- The number of homes destroyed by natural disasters decreased from 1,322 in 2012 to 790 in 2015.
- Urban Greening programs since 2012 have decreased the heat island effect about 2°C, doubled the biodiversity of flora species, and reduced the risk of landslides across the city (ACI, 2019).
- The city has created the ***Medellín Innovation District MID*** leaded by Ruta-n in Carabobo Norte and the ***Perpetuo Socorro*** Creative District in Comuna 10, to promote innovation and grow the "orange economy," where the arts, culture, music, design, gastronomy, film, and other human expressions are fostered through labs, business supports, tax breaks, subsidies, and innovation spaces.
- Data from the National Statistics Office (DANE) revealed that from 2002 to 2018, the percentage of informal workers in Medellín went from about 60 percent of the population to 41 percent, meaning about 500,000 people were able to acquire more formal employment with benefits, while there was a 33 percent reduction over this time in housing informality, meaning about 200,000 households improved their access to municipal services and avoided living in high-risk areas (DANE, 2020).

9.5.10 Toward a more inclusive Medellín

The transformation of Medellín has more to do with its on-going commitment to social justice and inclusive planning than just built environment and technologic innovations. Importantly, the transformation is incomplete, and the city has emphasized learning and adaptation as key aspects of the ongoing project. Some projects like acknowledging and addressing the traumatic legacy of local violence, such as through a program called Peace and Reconciliation: Return to Legality (Paz y Reconciliacion: Regreso a la Legalidad), are hard to measure but signify a commitment to government transparency, social healing, and collective memory—all concepts known to address the trauma of structural violence (Corburn, 2021; PHO, 2019; Rueda, 2017). In addition, places like the Museo Casa de la Memoria, or House of Memory Museum, opened in 2012, act as sites of "remembering and not repeating" the armed conflict, forced displacement, violation of human rights, and other tragedies Medellín's citizens experienced (Alvarado and Muggah, 2018).

As we have suggested here, the transformation of Medellín into a safer, more inclusive, and healthier city is due to its simultaneous commitment to working on six key aspects of urban planning and policy:

1. **Enhancing community control over decisions.** A key to the success of Medellín's transformation was that it was citizen led and inclusive of people with low incomes. The plans and programs reflected residents' urgent needs, and the municipality didn't rely only on outside institutions to design and implement changes. These participatory strategies were also institutionalized, such as through the participatory budgeting process.
2. **Targeted universalism.** Medellín has shown that policies that set universal goals, such as ecologic, transport, and public space improvements, can be best pursued using a targeted process. Whereas universal policies aspire to serve everyone without regard to group membership, poverty status, or location, and targeted approaches single out specific populations to the exclusion of others, a targeted universalism approach still sets policy goals for the entire city but differentiates implementation strategies depending on actual circumstances. In Medellín, this meant setting safety, transport, redevelopment, poverty alleviation, and education goals for the city but investing first on these issues in the poorest, most violent communities.

3. **Putting health equity into all urban policies.** A health equity policy approach was used in Medellin to target the well-being of people with low incomes, which meant enrolling residents to identify the toxic stressors in their communities and co-creating solutions with government. In each proposed intervention, the well-being people with low incomes, Indigenous people, Afro-Colombia people, and other vulnerable groups was considered and made a priority. This is part of the HiAP Approach. According to PAHO and the WHO (PAHO/WHO, 2020), HiAP "considers the health implications of decisions across sectors, seeking synergies and avoiding harmful health effects of policies outside the health sector in order to improve both population health and health equity." HiAP is accomplished by bringing together the non-health policy (i.e., transport, economic development) and medical/public health sectors, nongovernmental organizations, and local residents to (a) assess and measure existing health inequities among different groups and communities; (b) conduct health impact assessments of existing and proposed policies; (c) ensure all impacted stakeholders participate in policymaking, implementation, and evaluation, and (e) institutionalize ongoing monitoring, evaluation, and reporting of interventions, with measures that report on population (different groups) and place-based (neighborhood) well-being.
4. **Integrating place-based investments with long-range plans.** Medellín**'**s success is that it didn't just plan but delivered short-term, community projects as incremental steps toward long-term planning goals. The long-term plans offered a vision and integrated policy direction, and the short-term projects delivered tangible outcomes to meet the needs of local residents. The place-based projects also helped reveal the broader institutional changes, such as reforming government processes, project financing, and democratic participation, needed to achieve the long-term visions. Through place-based projects Medellín eventually altered its urban development corporation and adopted more participatory strategies in planning and policymaking.
5. **Ongoing measurement and learning**. Medellín built a municipal culture of measuring progress and learning what was and was not working through policy and project implementation and reflection. This is rarely done, since measurement and evaluation come at the end of projects and there is no collective learning. These data also helped strengthen the legitimacy and eventually the budgets of municipal institutions, further enabling them to carry out projects and policies. Population and place-based data on the social determinants of health, self-rated perceptions of well-being, and other indicators can help track progress toward reducing the stressors that contribute to urban disease and premature death.
6. **Collective management and leadership.** Medellín combined increases in participatory democracy with a commitment to ongoing change across multiple mayors, lasting over 20 years. The citizen dialogues, creation of new nongovernmental organizations and the strengthening of municipal institutions to carry out projects over multiple administrations ensured a level of accountability for each mayor and an expectation by the public that projects would continue. Of course, fiscal resources were important, but more important was an ongoing political will. Collective management and leadership required innovations in resources, and the EPM revenue-sharing law remains a crucial aspect of providing resources for project continuity. As cities consider the 're-municipalization' of services to take back control of resource management, service delivery and management, Medellín offers one model for transparent, social investment of municipal resources (Gradus and Budding, 2020).

We believe all these approaches, rather than any one program, policy, plan, or project, should be considered by cities aiming to achieve a similar positive transformation as Medellín or develop in a more equitable and sustainable way.

We view Medellín as an ongoing project, much like a living laboratory. As COVID-19 continues its uncertain impact on the city, an important form of resilience will be the city's willingness to continue to meaningfully involve its residents in co-creating solutions and evaluating interventions (Molina-Betancur et al., 2021).

While the future is unknown, there is much to learn for cities everywhere from the continual transformation of Medellín.

KEY FINDINGS

Medellin's transformation from a violent, inequitable city to a more inclusive, healthy city was the result of citizen leadership, participation and institutional change. The city has become healthy by simultaneously focusing on the needs of vulnerable people and improving impoverished places.

Integrating Health in All Policies, from community development to transport to social programs, has promoted health equity in Medellín by avoiding a medical approach that focuses only on treatment, single diseases or one exposure at a time. The transformation of Medellín included a targeted strategy called urban acupuncture, in which catalytic and health-promoting public projects and services were created in the city's most violent, marginalized, and unhealthy neighborhoods.

Medellín's transformation is ongoing and incomplete since it demands constant civic oversight and participation, as well as transparency and accountability of local, regional, and national government.

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