The 2023 Latin America report of the *Lancet* Countdown on health and climate change: the imperative for health-centred climate-resilient development

Stella M. Hartinger,[a,*] Yasna K. Palmeiro-Silva,[b,c] Camila Llerena-Cayo,[a] Luciana Blanco-Villafuerte,[a] Luis E. Escobar,[d] Avriel Diaz,[e] Juliana Helo Sarmiento,[f] Andres G. Lescano,[a] Oscar Melo,[g] David Rojas-Rueda,[h,ae] Bruno Takahashi,[i] Max Callaghan,[j] Francisco Chesini,[k] Shouro Dasgupta,[l,m] Carolina Gil Posse,[n] Nelson Gouveia,[o] Aline Martins de Carvalho,[p] Zaray Miranda-Chacón,[q] Nahid Mohajeri,[r] Chrissie Pantoja,[s,t] Elizabeth J. Z. Robinson,[m] Maria Fernanda Salas,[u] Raquel Santiago,[v] Enzo Sauma,[w] Mauricio Santos-Vega,[x,y] Daniel Scamman,[z] Milena Sergeeva,[aa] Tatiana Souza de Camargo,[ab] Cecilia Sorensen,[ac] Juan D. Umaña,[x] Marisol Yglesias-González,[a] Maria Walawender,[b] Daniel Buss,[ad] and Marina Romanello[b]

[a]Centro Latino Americano de Excelencia en Cambio Climático y Salud, Universidad Peruana Cayetano Heredia, Lima, Peru
[b]Institute for Global Health, University College London, London, UK
[c]Centro de Políticas Públicas UC, Pontificia Universidad Católica de Chile, Santiago, Chile
[d]Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA, USA
[e]Columbia University, International Research Institute for Climate and Society New York, USA
[f]Facultad de Economía, Universidad de los Andes, Bogotá, Colombia
[g]Centro Interdisciplinario de Cambio Global, Pontificia Universidad Católica de Chile, Santiago, Chile
[h]Environmental and Radiological Health Sciences, Colorado State University, CO, USA
[i]Departament of Communication, Michigan State University, MI, USA
[j]Mercator Research Institute on Global Commons and Climate Change, Berlin, Germany
[k]Departamento de Salud Pública, Facultad de Medicina, Universidad de Buenos Aires, Buenos Aires, Argentina
[l]Centro Euro-Mediterraneo sui Cambiamenti Climatici (CMCC), Venice, Italy
[m]Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science (LSE), London, UK
[n]Facultad de Ciencias Sociales, Universidad de Buenos Aires, Buenos Aires, Argentina
[o]Departamento de Medicina Preventiva, Faculdade de Medicina, Universidade de São Paulo, São Paulo, Brazil
[p]Departamento de Nutrição, Faculdade de Saúde Pública, Universidade de São Paulo, São Paulo, Brazil
[q]Medicine School, Universidad de Costa Rica, San Pedro, Costa Rica
[r]Institute of Environmental Design and Engineering, Bartlett School of Environment, Energy and Resources, University College London, London, UK
[s]Nicholas School of the Environment and Sanford School of Policy Policy, Duke University, Durham, NC, USA
[t]Departamento Académico de Economía, Universidad del Pacífico, Lima, Peru
[u]Universidad de Costa Rica, San Pedro, Costa Rica
[v]Faculdade de Nutrição, Universidade Federal de Goiás, Goiânia, Goiás, Brazil
[w]Engineering Faculty, Pontificia Universidad Católica de Chile, Santiago, Chile
[x]Grupo de Biología y Matemática Computacional (BIOMAC), Universidad de los Andes, Bogotá, Colombia
[y]Departamento Ciencias Biológicas, Universidad de Los Andes, Bogotá, Colombia
[z]Institute for Sustainable Resources, University College London, London, UK
[aa]Global Climate and Health Alliance, Berkeley, CA, USA
[ab]Faculdade de Educação, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
[ac]Department of Environmental Health Sciences, Mailman School of Public Health, Columbia University, Department of Emergency Medicine, Columbia Irving Medical Center, NY, USA
[ad]Pan American Health Organization, Washington, DC, USA
[ae]Colorado School of Public Health, Colorado State University, CO, USA

Summary

In 2023, a series of climatological and political events unfolded, partly driving forward the global climate and health agenda while simultaneously exposing important disparities and vulnerabilities to climate-related events. On the policy front, a significant step forward was marked by the inaugural Health Day at COP28, acknowledging the profound impacts of climate change on health. However, the first-ever Global Stocktake showed an important gap between the current progress and the targets outlined in the Paris Agreement, underscoring the urgent need for further and decisive action. From a Latin American perspective, some questions arise: How do we achieve the change that is needed? How to address the vulnerabilities to climate change in a region with long-

*Corresponding author. Av. Honorio Delgado 430, San Martín de Porres, 15102, Lima, Peru.
E-mail address: stella.hartinger.p@upch.pe (S.M. Hartinger).

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standing social inequities? How do we promote intersectoral collaboration to face a complex problem such as climate change? The debate is still ongoing, and in many instances, it is just starting.

The renamed regional centre *Lancet* Countdown Latin America (previously named *Lancet* Countdown South America) expanded its geographical scope adding Mexico and five Central American countries: Costa Rica, El Salvador, Guatemala, Honduras, and Panama, as a response to the need for stronger collaboration in a region with significant social disparities, including research capacities and funding. The centre is an independent and multidisciplinary collaboration that tracks the links between health and climate change in Latin America, following the global Lancet Countdown's methodologies and five domains. The *Lancet* Countdown Latin America work hinges on the commitment of 23 regional academic institutions, United Nations agencies, and 34 researchers who generously contribute their time and expertise.

Building from the first report, the 2023 report of the *Lancet* Countdown Latin America, presents 34 indicators that track the relationship between health and climate change up to 2022, aiming at providing evidence to public decision-making with the purpose of improving the health and wellbeing of Latin American populations and reducing social inequities through climate actions focusing on health.

This report shows that Latin American populations continue to observe a growing exposure to changing climatic conditions. A warming trend has been observed across all countries in Latin America, with severe direct impacts. In 2022, people were exposed to ambient temperatures, on average, 0.38 °C higher than in 1986–2005, with Paraguay experiencing the highest anomaly (+1.9 °C), followed by Argentina (+1.2 °C) and Uruguay (+0.9 °C) (indicator 1.1.1). In 2013–2022, infants were exposed to 248% more heatwave days and people over 65 years old were exposed to 271% more heatwave days than in 1986–2005 (indicator 1.1.2). Also, compared to 1991–2000, in 2013–2022, there were 256 and 189 additional annual hours per person, during which ambient heat posed at least moderate and high risk of heat stress during light outdoor physical activity in Latin America, respectively (indicator 1.1.3). Finally, the region had a 140% increase in heat-related mortality from 2000–2009 to 2013–2022 (indicator 1.1.4).

Changes in ecosystems have led to an increased risk of wildfires, exposing individuals to very or extremely high fire danger for more extended periods (indicator 1.2.1). Additionally, the transmission potential for dengue by *Aedes aegypti* mosquitoes has risen by 54% from 1951–1960 to 2013–2022 (indicator 1.3), which aligns with the recent outbreaks and increasing dengue cases observed across Latin America in recent months.

Based on the 2023 report of the *Lancet* Countdown Latin America, there are three key messages that Latin America needs to further explore and advance for a health-centred climate-resilient development.

Latin American countries require intersectoral public policies that simultaneously increase climate resilience, reduce social inequities, improve population health, and reduce greenhouse gas (GHG) emissions.

The findings show that adaptation policies in Latin America remain weak, with a pressing need for robust vulnerability and adaptation (V&A) assessments to address climate risks effectively. Unfortunately, such assessments are scarce. Up to 2021, Brazil is the only country that has completed and officially reported a V&A to the 2021 Global Survey conducted by the World Health Organization (WHO). Argentina, Guatemala, and Panama have also conducted them, but they have not been reported (indicator 2.1.1). Similarly, efforts in developing and implementing Health National Adaptation Plans (HNAPs) are varied and limited in scope. Brazil, Chile, and Uruguay are the only countries that have an HNAP (indicator 2.1.2). Moreover, self-reported city-level climate change risk assessments are very limited in the region (indicator 2.1.3).

The collaboration between meteorological and health sectors remains insufficient, with only Argentina, Brazil, Colombia, and Guatemala self-reporting some level of integration (indicator 2.2.1), hindering comprehensive responses to climate-related health risks in the region. Additionally, despite the urgent need for action, there has been minimal progress in increasing urban greenspaces across the region since 2015, with only Colombia, Nicaragua, and Venezuela showing slight improvements (indicator 2.2.2). Compounding these challenges is the decrease in funding for climate change adaptation projects in Latin America, as evidenced by the 16% drop in funds allocated by the Green Climate Fund (GCF) in 2022 compared to 2021. Alarmingly, none of the funds approved in 2022 were directed toward climate change and health projects, highlighting a critical gap in addressing health-related climate risks (indicator 2.2.3).

From a vulnerability perspective, the Mosquito Risk Index (MoRI) indicates an overall decrease in severe mosquito-borne disease risk in the region due to improvements in water, sanitation, and hygiene (WASH) (indicator 2.3.1). Brazil and Paraguay were the only countries that showed an increase in this indicator. It is worth noting that significant temporal variation within and between countries still persists, suggesting inadequate preparedness for climate-related changes.

Overall, population health is not solely determined by the health sector, nor are climate policies a sole responsibility of the environmental sector. More and stronger intersectoral collaboration is needed to pave development pathways that consider solid adaptation to climate change, greater reductions of GHG emissions, and that increase social equity and population health. These policies involve sectors such as finance, transport, energy, housing, health, and agriculture, requiring institutional structures and policy instruments that allow long-term intersectoral collaboration.

Latin American countries need to accelerate an energy transition that prioritises people's health and wellbeing, reduces energy poverty and air pollution, and maximises health and economic gains.

In Latin America, there is a notable disparity in energy transition, with electricity generation from coal increasing by an average of 2.6% from 1991–2000 to 2011–2020, posing a challenge to efforts aimed at phasing out coal (indicator 3.1.1). However, this percentage increase is conservative as it may not include all the fossil fuels for thermoelectric electricity generation, especially during climate-related events and when hydropower is affected (Panel 4). Yet, renewable energy sources have been growing, increasing by an average of 5.7% during the same period. Access to clean fuels for cooking remains a concern, with 46.3% of the rural population in Central America and 23.3% in South America lacking access to clean fuels in 2022 (indicator 3.1.2). It is crucial to highlight the concerning overreliance on fossil fuels, particularly liquefied petroleum gas (LPG), as a primary cooking fuel. A significant majority of Latin American populations, approximately 74.6%, rely on LPG for cooking. Transitioning to cleaner heating and cooking alternatives could also have a health benefit by reducing household air pollution-related mortality. Fossil fuels continue to dominate road transport energy in Latin America, accounting for 96%, although some South American countries are increasing the use of biofuels (indicator 3.1.3). Premature mortality attributable to fossil-fuel-derived $PM_{2.5}$ has shown varied trends across countries, increasing by 3.9% from 2005 to 2020 across Latin America, which corresponds to 123.5 premature deaths per million people (indicator 3.2.1). The Latin American countries with the highest premature mortality rate attributable to $PM_{2.5}$ in 2020 were Chile, Peru, Brazil, Colombia, Mexico, and Paraguay. Of the total premature deaths attributable to $PM_{2.5}$ in 2020, 19.1% was from transport, 12.3% from households, 11.6% from industry, and 11% from agriculture.

From emission and capture of GHG perspective, commodity-driven deforestation and expansion of agricultural land remain major contributors to tree cover loss in the region, accounting for around 80% of the total loss (indicator 3.3). Additionally, animal-based food production in Latin America contributes 85% to agricultural CO_2 equivalent emissions, with Argentina, Brazil, Panama, Paraguay, and Uruguay ranking highest in per capita emissions (indicator 3.4.1). From a health perspective, in 2020, approximately 870,000 deaths were associated with imbalanced diets, of which 155,000 (18%) were linked to high intake of red and processed meat and dairy products (indicator 3.4.2).

Energy transition in Latin America is still in its infancy, and as a result, millions of people are currently exposed to dangerous levels of air pollution and energy poverty (i.e., lack of access to essential energy sources or services). As shown in this report, the levels of air pollution, outdoors and indoors, are a significant problem in the whole region, with marked disparities between urban and rural areas. In 2022, Peru, Chile, Mexico, Guatemala, Colombia, El Salvador, Brazil, Uruguay, Honduras, Panama, and Nicaragua were in the top 100 most polluted countries globally. Transitioning to cleaner sources of energy, phasing out fossil fuels, and promoting better energy efficiency in the industrial and housing sectors are not only climate mitigation measures but also huge health and economic opportunities for more prosperous and healthy societies.

Latin American countries need to increase climate finance through permanent fiscal commitments and multilateral development banks to pave climate-resilient development pathways.

Climate change poses significant economic costs, with investments in mitigation and adaptation measures progressing slowly. In 2022, economic losses due to weather-related extreme events in Latin America were US$15.6 billion –an amount mainly driven by floods and landslides in Brazil–representing 0.28% of Latin America's Gross Domestic Product (GDP) (indicator 4.1.1). In contrast to high-income countries, most of these

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losses lack insurance coverage, imposing a substantial financial strain on affected families and governments. Heat-related mortality among individuals aged 65 and older in Latin America reached alarming levels, with losses exceeding the equivalent of the average income of 451,000 people annually (indicator 4.1.2). Moreover, the total potential income loss due to heat-related labour capacity reduction amounted to 1.34% of regional GDP, disproportionately affecting the agriculture and construction sectors (indicator 4.1.3). Additionally, the economic toll of premature mortality from air pollution was substantial, equivalent to a significant portion of regional GDP (0.61%) (indicator 4.1.4).

On a positive note, clean energy investments in the region increased in 2022, surpassing fossil fuel investments. However, in 2020, all countries reviewed continued to offer net-negative carbon prices, revealing fossil fuel subsidies totalling US$23 billion. Venezuela had the highest net subsidies relative to current health expenditure (123%), followed by Argentina (10.5%), Bolivia (10.3%), Ecuador (8.3%), and Chile (5.6%) (indicator 4.2.1).

Fossil fuel-based energy is today more expensive than renewable energy. Fossil fuel burning drives climate change and damages the environment on which people depend, and air pollution derived from the burning of fossil fuels causes seven million premature deaths each year worldwide, along with a substantial burden of disease. Transitioning to sustainable, zero-emission energy sources, fostering healthier food systems, and expediting adaptation efforts promise not only environmental benefits but also significant economic gains. However, to implement mitigation and adaptation policies that also improve social wellbeing and prosperity, stronger and solid financial systems are needed. Climate finance in Latin American countries is scarce and strongly depends on political cycles, which threatens adequate responses to the current and future challenges.

Progress on the climate agenda is lagging behind the urgent pace required. While engagement with the intersection of health and climate change is increasing, government involvement remains inadequate. Newspaper coverage of health and climate change has been on the rise, peaking in 2022, yet the proportion of climate change articles discussing health has declined over time (indicator 5.1). Although there has been significant growth in the number of scientific papers focusing on Latin America, it still represents less than 4% of global publications on the subject (indicator 5.3). And, while health was mentioned by most Latin American countries at the UN General Debate in 2022, only a few addressed the intersection of health and climate change, indicating a lack of awareness at the governmental level (indicator 5.4).

The 2023 *Lancet* Countdown Latin America report underscores the cascading and compounding health impacts of anthropogenic climate change, marked by increased exposure to heatwaves, wildfires, and vector-borne diseases. Specifically, for Latin America, the report emphasises three critical messages: the urgent action to implement intersectoral public policies that enhance climate resilience across the region; the pressing need to prioritise an energy transition that focuses on health co-benefits and wellbeing, and lastly, that need for increasing climate finance by committing to sustained fiscal efforts and engaging with multilateral development banks. By understanding the problems, addressing the gaps, and taking decisive action, Latin America can navigate the challenges of climate change, fostering a more sustainable and resilient future for its population.

Spanish and Portuguese translated versions of this Summary can be found in Appendix B and C, respectively.

The full translated report in Spanish is available in Appendix D.

Introduction

In 2023, a series of climatological and political events unfolded, contributing to advance the global climate and health agenda while heightening population's vulnerabilities to them. The transition from La Niña to El Niño[1] and the continuous intensification of human-induced climate change[2] potentially resulted in an increased severe El Niño Southern Oscillation (ENSO) linked weather events.[3] Latin America experienced unprecedented events, including flash floods in Brazil and Chile,[4,5] intense winter heatwaves in South America, severe droughts in Brazil, Central America, and

Uruguay,[6,7] and powerful winds and hurricanes in Mexico.[8] These combined climatic phenomena impacted Latin American ecosystems, populations, infrastructure, and other human systems, leading to economic losses and posing substantial risks to the region's social progress achieved in recent decades.

On the policy front, the first *Health Day* occurred at a Conference of Parties (COP) under the United Nations Framework Convention on Climate Change (UNFCCC). The COP28 Presidency, along with the World Health Organization (WHO) and the UAE Ministry of Health and Prevention, introduced the COP28 UAE Declaration on Climate and Health, endorsed by over 140 countries. This ground-breaking declaration recognises the health impacts of climate change and advocates for resilient, sustainable, and equitable health systems. It also emphasises the health co-benefits of robust climate action and signifies a paradigm shift in climate policy, prioritising social implications.[9]

This declaration coincided with the inaugural Global Stocktake, which assessed progress toward the targets outlined in the Paris Agreement. The assessment revealed that the world is currently off-course in achieving these goals despite legally binding international actions outlined in the agreement,[10] even with some countries reducing their initial commitments made in 2015.[11] Despite ongoing negotiations to recalibrate climate-related initiatives and establish new targets, the current Paris Agreement still allows for the continued use of "transitional fuels" and a "phase-down" of unabated coal rather than the necessary "phase-out" of oil, coal, and gas. This tolerance to fossil fuels deviates from the urgent actions to be taken and concerns many countries and climate groups, particularly in Latin America.

Overall, Latin American countries have made significant social and health progress despite the profound disparities between and within countries, which partially originate from their colonial times and fragmented development policies.[12,13] This legacy, along with current social inequities and a changing climate significantly increases the health risks of some communities to climate change. Indigenous populations throughout Latin America often face significant societal and economic barriers, hindering their capacities to deal with climate change effects on their territories and their livelihoods. Nevertheless, by addressing these systemic issues on par with solid responses to climate change, Latin America can create positive change and work towards a more equitable and prosperous future for all, ensuring that no one is left behind.

The renamed regional centre *Lancet* Countdown Latin America expanded its geographical scope, adding Mexico and five Central American countries: Costa Rica, El Salvador, Guatemala, Honduras, and Panama, a response to the need for stronger collaboration in a region with significant social disparities, including

research and funding capacities. The final report covers 17 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela. It is an independent and multidisciplinary collaboration that tracks the links between health and climate change in Latin America, following the global Lancet Countdown's methodologies and five domains. The *Lancet* Countdown Latin America work hinges on the commitment of 23 regional academic institutions, United Nations agencies, and 34 researchers who generously contribute their time and expertise. This report is primarily a document for Latin Americans and was designed and developed by Latin American researchers and others around the world.

Building from the first report,[14] the 2023 report of the *Lancet* Countdown Latin America includes 34 indicators that track the relationships between health and climate change (Panel 1). All indicators were chosen and developed based on their importance to Latin America and research gaps guided by a previous scoping review series on climate change and health.[15–20] As the centre expands its research capabilities in the region, new opportunities of including relevant indicators appear, resulting in a more comprehensive *Lancet* Countdown Latin America report. For this current report, the methodology of one indicator was improved (i.e., indicator 2.3.1), two new indicators were developed by the Latin American centre (i.e., indicators 3.3; and 5.2), and seven additional indicators were added from the global centre (i.e., indicators 1.1.1; 1.1.3; 2.2.4; 3.1.1; 3.4.1; 4.1.1; 4.2.1).

The aim of this report is to provide evidence to public decision-making with the purpose of improving the health and wellbeing of Latin American populations and reducing social inequities through climate actions focusing on health.

Section 1: hazards, exposures, and impacts

Latin America is exposed to multiple climate-related hazards. Monitoring and understanding the dynamics of these hazards and the population exposure over time is critical to inform climate policies that minimise the associated health impacts, increase climate resilience, and improve population health and wellbeing (Panel 2).[15] Section 1 analyses indicators related to changes in heat exposure and impacts, and climatological suitability for wildfires and diseases. In the 2023 report, seven indicators have been assessed, including exposure to warming (indicator 1.1.1); exposure of vulnerable populations to heatwaves (indicator 1.1.2); heat and physical activity (indicator 1.1.3); heat-related mortality (indicator 1.1.4); wildfires (indicator 1.2.1); climate suitability for infectious disease (indicator 1.3); and food insecurity and undernutrition (indicator 1.4). Details on the methods and additional analyses are presented in the Appendix.

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1.1: Health and heat

Indicator 1.1.1: exposure to warming–headline finding: in 2022, Latin American populations were exposed to an average increase in summer temperature of 0.38 °C compared to 1986–2005 baseline

The average ambient temperature in Latin America has continuously increased over the years, as indicated here and elsewhere.[21,22] This indicator draws on the 2023 global *Lancet* Countdown report and presents the population-weighted change in temperatures, as a proxy for population exposure to heat.[22]

A warming trend has persisted at least since the 1986–2005 baseline and despite the cooling effect of La Niña that occurred between 2020 and 2023.[23] Average summer mean temperatures, relative to that baseline period, increased an average of 0.03 °C per year from 2000 to 2022 in Latin America. In 2022, average population-weighted temperatures (i.e., temperatures averaged by giving more weight to places where most population lives) across Latin America were 0.38 °C higher than in the 1986–2005 period, with Paraguay showing the highest anomaly (+1.9 °C),
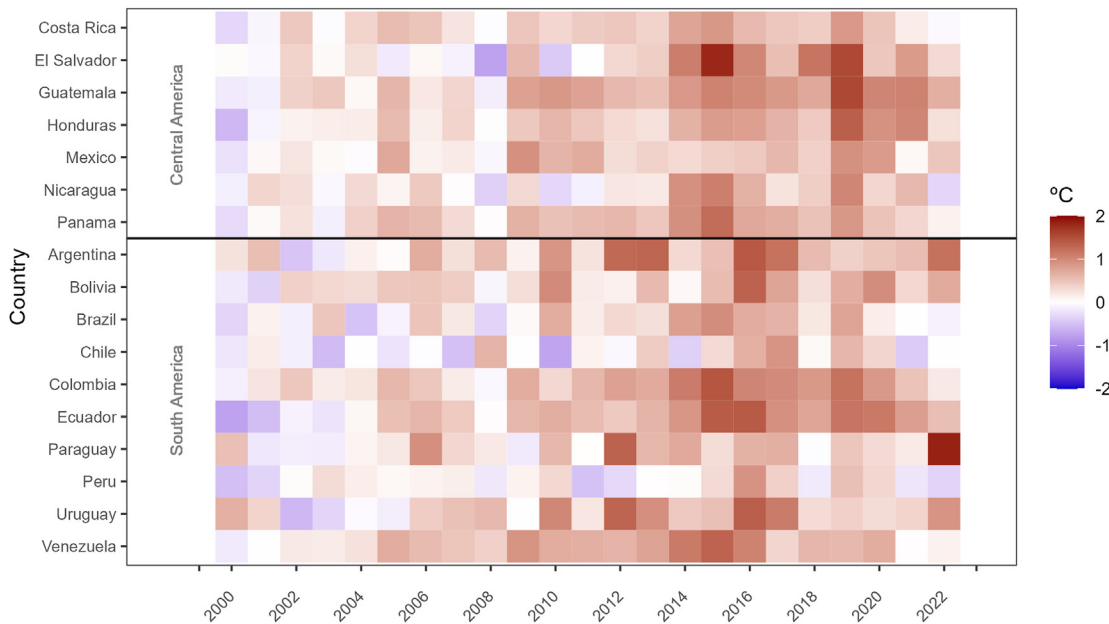
Fig. 1: Population-weighted change (anomaly) in summer mean temperatures relative to 1986–2005 baseline by country in Latin America. The horizontal black line separates the plot in Central and South America.

followed by Argentina (+1.2 °C), and Uruguay (+0.9 °C) (Fig. 1).

Indicator 1.1.2: exposure of vulnerable populations to heatwaves–headline finding: in the 2013–2022 period, infants and people older than 65 years experienced, on average, 248% and 271% more days of heatwave per year than in 1986–2005, respectively
Population exposure to extreme heat is associated with multiple negative health outcomes, ranging from general discomfort and headaches to heat stroke and death.[24] Overall, high ambient temperatures challenge the human body by affecting the physiological responses, resulting in a high risk of heat stress. This situation is even worse in some people with physiological alterations, such as people with co-morbidities, people under certain treatments, and older people.[24] Additionally, the risk of heat stress also increases due to inadequate behavioural and social responses, which are mostly linked to social factors that allow appropriate behaviour to reduce the risk of heat stress (i.e., access to adequate housing insulation and ventilation, cooling centres, and urban green spaces). Heatwaves are an important risk factor to population health and wellbeing as they represent a sustained period (two or more days) with unusually high ambient temperatures during the day or night.

This indicator tracks population exposure to heatwaves in Latin American countries based on data from the 2023 global *Lancet* Countdown report.[22]

In 2013–2022 in Latin America, infants (i.e., children younger than 1 year) experienced 2.2 million more

person-days of heatwaves annually (i.e., 2.2 million persons in one day per year), and adults older than 65 years experienced 13.3 million more person-days of heatwaves, both compared to the average in 1986–2005. From another perspective, each infant was exposed, on average, to 248% more days of heatwave in 2013–2022 compared to 1986–2005, and each person older than 65 years old to 271% more. Guatemala, Ecuador, and Venezuela have experienced the highest increases in heatwave exposure in children younger than 1 year. Ecuador, Colombia, and Guatemala experienced the highest increases in heatwave exposure in adults older than 65 years (Figure A1 in the Appendix).

Indicator 1.1.3: heat and physical activity–headline finding: compared to 1991–2000, in 2013–2022, there were 256 and 189 additional annual hours per person during which ambient heat posed at least moderate and high risk of heat stress during light outdoor physical activity in Latin America, respectively
Physical exercise contributes to good physical and mental health.[25] Nevertheless, exercising during high ambient temperatures may increase the likelihood of developing heat-related illnesses.[26] This is a new indicator in the Latin America report that draws on the 2023 global *Lancet* Countdown report. It estimates the risk of heat stress during physical activity based on daily ambient temperature and relative humidity together with the intensity of the physical activity and clothing worn. Results include heat stress risk for "light intensity" (e.g., walking) and "moderate intensity" (e.g., jogging, cycling) outdoor physical activity.[22]

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Compared to the baseline average (1991–2000), the number of at least moderate (moderate, high, and extreme) risk of heat stress for light and moderate outdoor physical activity has increased in Latin America by 256 and 246 h per person per year during 2013–2022 (Table A1 and Figures A2 and A3 in Appendix). The greatest rise occurred in El Salvador, Venezuela, Ecuador, and Panama for light outdoor physical activity (Fig. 2). This evidence demonstrates that even people engaging in light physical activity are at greater risk of heat stress under a warming climate.

Indicator 1.1.4: heat-related mortality–headline finding: the estimated annual average number of heat-related deaths increased by 140% from 2000–2009 period to 2013–2022 period
Heat stress threatens the health of vulnerable individuals, resulting in negative health outcomes, including death.[27] This indicator draws on data from the 2023 global *Lancet* Countdown report and estimates heat-related deaths of people older than 65 years.[22]

In Latin America, the estimated heat-related mortality has overall followed an upward trend between 2000 and 2022. In the 2013–2022 period, all Latin American countries, on average, have shown a 140% increase in heat-related deaths compared to 2000–2009. The countries with the highest relative change are Ecuador (+339%), El Salvador (+230%), Honduras (+204%), and Guatemala (+202%), while the countries with the lowest

increase are Mexico (+67%), Argentina (+59%), and Uruguay (+27%). Although there are interannual fluctuations, a clear, sustained upward trend was observed in Argentina, Bolivia, Mexico, Paraguay, and Uruguay (Figure A4 in the Appendix).

1.2: Health and extreme weather-related events
Indicator 1.2.1: wildfires–headline finding: the number of days in which people were exposed to very or extremely high fire danger increased in 11 of 17 Latin American countries between 2001–2010 and 2013–2022. Nevertheless, population exposure to wildfires decreased in all countries, except for Venezuela, in the same period
Wildfires pose several risks to population health and wellbeing, including direct physical harm, acute and chronic health outcomes due to smoke exposure, mental health impacts, and even death.[28] Understanding how meteorological conditions (i.e., rising temperatures and droughts) represent a potential risk to fire (i.e., fire danger) is key to evaluating potential population exposure to wildfires and better preparing risk management plans.

This indicator draws on data from the 2023 global *Lancet* Countdown report and presents two subindicators: i) number of days people were exposed to very high or extremely high fire danger and ii) number of days people were exposed to active wildfires.[22]

Eleven countries showed an increase in the number of days during which people were exposed to very or
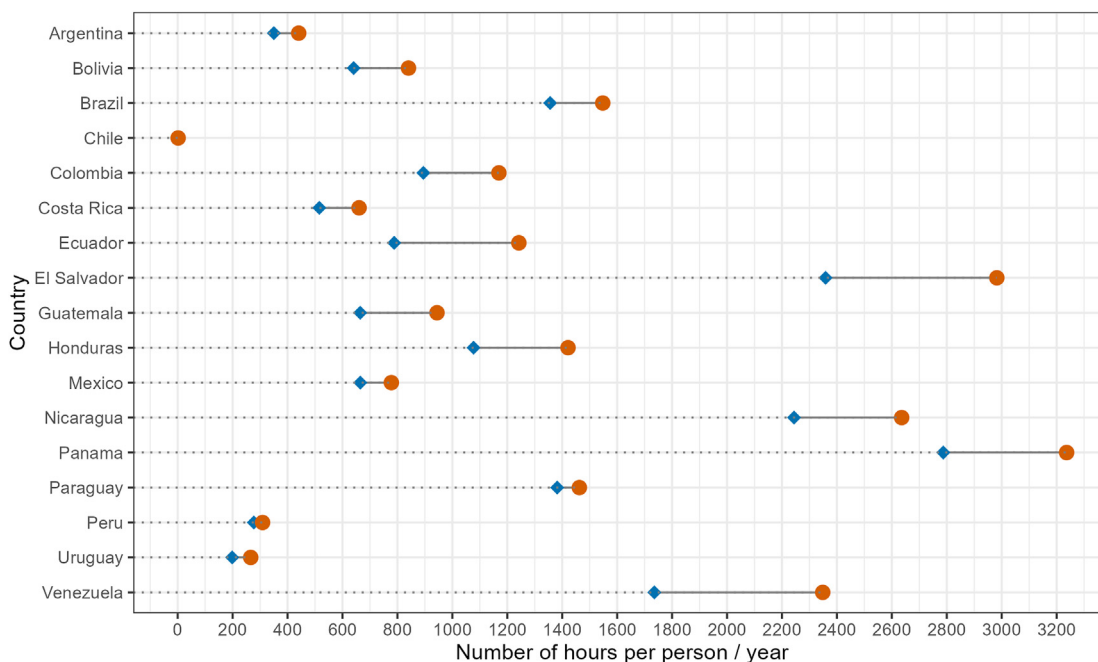

Fig. 2: Average annual hours per person that light physical activity entailed at least a moderate heat stress risk in 1991–2000 (blue diamond) and in 2013–2022 (orange circle) in Latin American countries.

extremely high fire danger in the 2013–2022 period compared to 2001–2010 (Figure A5 in the Appendix), with an average of one additional day of exposure per person. The highest increases were seen in Chile (13 more days), Venezuela (four more days), Argentina (four more days), Colombia (three more days), and Brazil (three more days). On the other hand, Panama, Uruguay, Honduras, El Salvador, Mexico, and Nicaragua recorded small reductions in the days of exposure (Fig. 3). Nonetheless, despite the overall increase in the population exposure to very or extremely high fire danger days, the annual average number of days that people were exposed to active wildfires has decreased in all Latin American countries in the same period, except for Venezuela. This could be a result of adaptation policies and social behaviour adaptation, or deforestation, or changes in the availability of material to be burnt because of previous wildfires.

Indicator 1.3: climate suitability for infectious disease transmission–headline finding: the transmission potential for dengue by *Aedes aegypti* increased by 54% from 1951–1960 to 2013–2022. Similarly, the coastline suitable for Vibrio spp. transmission has steadily increased over the last four decades in Latin America

Climate change influences the transmission potential of vector- and water-borne diseases, including dengue fever and vibriosis. This is particularly important for regions where the vector and microorganisms are endemic, such as Latin America. Therefore, monitoring the climatic suitability for disease transmission is highly relevant for public health.

This indicator presents two sub-indicators, both drawn from the 2023 global *Lancet* Countdown report. The first track the climate suitability for transmission potential for dengue by *Ae. aegypti*, the primary vector of dengue in the Americas, estimated by the basic reproduction number (R_0). The second sub-indicator estimates the length (km) of the coast with suitable conditions for the transmission of *Vibrio* spp. bacteria (excluding *V. cholerae*).[22]

All Latin American countries have experienced an increase in the estimated R_0 for dengue transmission by *Ae. aegypti* between 1951–1960 and 2013–2022, averaging an increase of 54%. The greatest increases were found in Bolivia (145%), Peru (95%), Brazil (94.5%), Guatemala (70.4%), Colombia (65.8%), Ecuador (59.5%), and Paraguay (59.3%) (Figure A6 in the Appendix). These results align with the increase in the total number of cases of dengue fever over the last years (Figure A7 in the Appendix), especially in Bolivia, Brazil, Colombia, Ecuador, Guatemala, Mexico, Nicaragua, Panama, and Peru.[29,30] The association between the estimated increase in climatic suitability for vectors and the observed increase in dengue cases supports a link between climatic conditions and dengue fever in the population.

The total coastal area suitable for *Vibrio* spp. bacteria in Latin America increased by 42 km annually since 1982. In 2022, the coastline suitable for *Vibrio* spp. bacteria was 670 km higher (9.5%) than in the
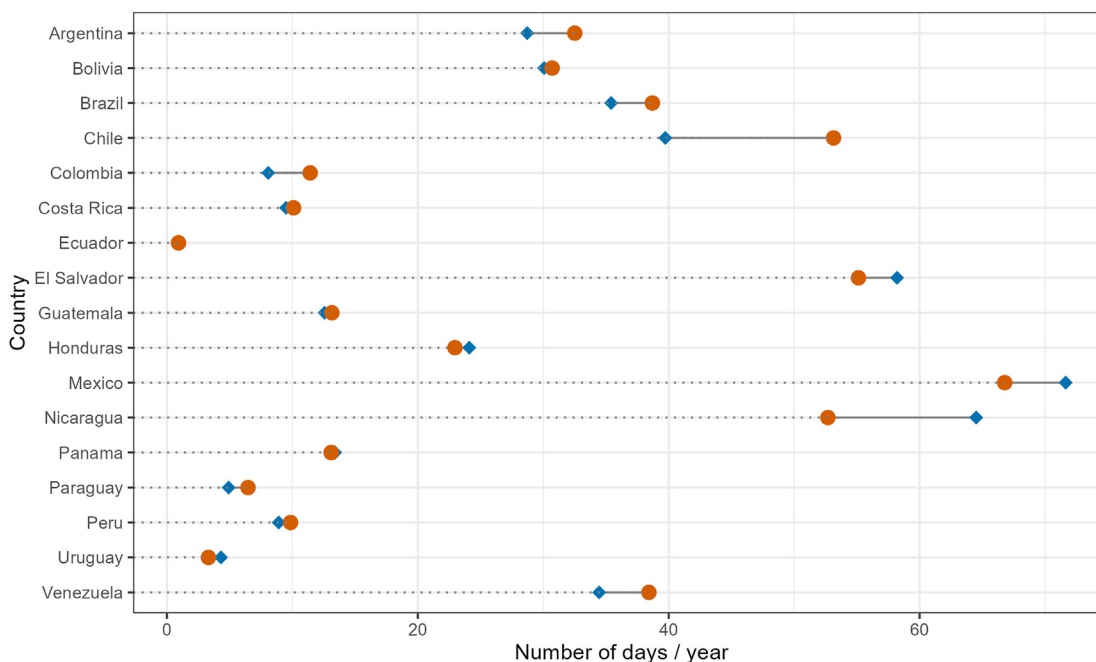

Fig. 3: Average annual days where people were exposed to very or extremely high fire danger days in the 2001–2010 period (blue diamond) compared to 2013–2022 period (orange circle) Latin American countries.

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1982–2010 period. This increase also correlates with an increase in human cases of vibriosis in the region.[31]

Indicator 1.4: food security and undernutrition–headline finding: the higher frequency of heatwave days and drought months in 2021 compared to 1981–2010, was associated with 9.9 million additional people experiencing moderate or severe food insecurity across Latin America

Food security is affected by climatic (i.e. heatwaves and droughts) and non-climatic factors (i.e., poverty, COVID-19), affecting the quality, availability, access, and affordability of food. Evidence shows that temperature increases contributed to food insecurity globally over the past years.[32,33]

This indicator combines data from the Food and Agriculture Organization (FAO) Food Insecurity Experience Scale (FIES)[34] with the frequency of heatwaves days and drought months (SPEI-12) using a time-varying panel regression.[22] The FAO FIES tracks eight dimensions of access to food, from not being able to eat a sufficient variety of food to not eating for a whole day.[34]

In 2021, 42.2% of Latin American respondents to the FIES survey reported eating only a few kinds of food, 37.2% reported being unable to eat healthy and nutritious food, and 33.2% reported eating less than they thought they should. A total of 9.9 million additional people is estimated to have experienced moderate or severe food insecurity due to a higher number of heatwaves and droughts, compared with the 1981–2010 average. A higher number of heatwave days was associated with 4.29% of higher, moderate, or severe food insecurity in 2021 while increasing frequency of droughts resulted in food insecurity being 1.93% higher (Figure A8 in the Appendix). Low-income respondents have a significantly higher risk of suffering from food insecurity.

Conclusion

It is a fact that the climate in Latin America is changing, and this report shows that these climatic changes are already affecting the health and wellbeing of people in this region. Increasing ambient temperatures and extreme heat events are leading to higher exposure of vulnerable populations to heatwaves and to increased mortality (indicators 1.1.1, 1.1.2, 1.1.4). Additionally, heat stress risk is increasing among people who engage in even light physical activity outdoor (indicator 1.1.3), undermining healthy and physically active lifestyles, and triggering important questions related to safety and planning of outdoor events during summer. Climatic variations are also increasing the risk of food insecurity (indicator 1.4) in a region that is already impacted by food insecurity of social origin.

Changes in climatological conditions result in more days of higher fire danger (indicator 1.2.1) and higher disease transmission risk by *Ae. aegypti* mosquitoes, which correlates with higher transmission of dengue and other mosquito-borne diseases (indicator 1.3). The transmission potential for dengue in places where populations have not previously been exposed to it poses high risk of increased morbidity and mortality. This situation emphasises the need for health systems and public health surveillance systems to be proactive and responsive, which requires support from adequate adaptation plans and financial schemes (refer to Sections 2 and 4). A changing climate coupled with natural climatic phenomena represent extremely dangerous conditions that affect population health and the prosperity of Latin American societies.

Section 2: adaptation, planning, and resilience for health

The impacts of climate-related hazards on people's lives depend on the capacity of the human systems to prepare for, minimise, and proactively respond to these hazards. Section 1 showed that a changing climate is negatively impacting population health in Latin America, underscoring the urgency of accelerating adaptation efforts in the region. Climate adaptation strategies and measures play a pivotal role in building resilience against multiple climate hazards, making it essential to prioritise and invest in these measures, as well as to adopt a whole-of-government and multilevel approach.

Additionally, Latin America not only faces significant climate hazards, but also grapples with important social inequities, disparities in access and quality of healthcare, and underfunded healthcare systems.[40,41] Systems that are already struggling to deal with current social and environmental challenges,[42] are hardly equipped for the additional burden of climate-sensitive health outcomes. In this sense, health equity must be a cornerstone of all climate adaptation measures, which is not merely about creating more resilient health systems but weaving climate and environmental justice into the core of health planning.

This section reports on eight indicators related to climate change adaptation, including assessment and planning for health adaptation (indicators 2.1.1, 2.1.2, and 2.1.3); climate information for health (indicator 2.2.1); urban greenspace (indicator 2.2.2); global multilateral funding for health adaptation programmes (indicator 2.2.3); detection, preparedness, and response to health emergencies (indicator 2.2.4); and vulnerability to mosquito-borne diseases (indicator 2.3.1). Details on the methods and analyses are found in the Appendix.

2.1: Assessment and planning of health adaptation

Indicator 2.1.1: national assessments of climate change impacts, vulnerability, and adaptation for health–headline finding: Brazil and Guatemala were the only Latin American countries that reported having completed a climate change and health vulnerability and adaptation assessment in 2021 Assessing the effects of climate change on health is complex due to the multiple interwoven factors. Nevertheless, climate change and health vulnerability and

adaptation assessments (V&A) serve to enhance comprehension of climate-related health risks, identify system weaknesses, and suggest priority interventions. These assessments provide decision-makers with current and reliable data for effective health-protective climate policy implementation.

This indicator relies on self-reported data from 11 participating countries in the 2021 World Health Organization (WHO) Health and Climate Change Global Survey.[43] A search on Google was also performed in July 2023 to update the data with any new V&As.

Among the Latin American countries with commitments through the COP26 Health Programme[44] (Table A2 in the Appendix) to develop climate-resilient and low-carbon health systems up to 2022 (i.e., Argentina, Brazil, Colombia, Costa Rica, Ecuador, Panama, and Peru), Brazil was the only one that reported having conducted a climate change and health V&A assessment in 2021. Although not reported in the WHO survey, Argentina,[45] Guatemala,[46] and Panama[47] published V&A assessments between 2019 and 2021 (Figure A9 in the Appendix). However, these assessments resulted in limited allocation of resources to address climate change and health. An exception was Argentina, where the V&A assessment and an action plan was crucial for the approval of the Green Climate Fund Readiness and Preparatory Support Programme[48] that aimed, as its title suggests, at "*Increasing health sector's capacities and strengthening coordination on climate action in Argentina at national and subnational levels*".[49]

Indicator 2.1.2: national adaptation plans for health–headline finding: Brazil, Chile, and Uruguay continue to be the only countries in Latin America with a national health and climate change strategy or plan in place

It is essential to establish Health National Adaptation Plans (HNAPs) aimed at reducing the vulnerability to climate change. To achieve this aim, these plans should focus on enhancing adaptive capabilities and resilience while ensuring the coherent integration of climate change adaptation into pertinent policies, programs, and initiatives. This integration should be carried out systematically, encompassing various sectors and levels, especially in the context of development planning processes and strategies, as deemed appropriate.

This indicator tracks the development of national health and climate change strategies and plans, and the barriers to implementation. The data come from the 2021 WHO Health and Climate Change Global Survey,[43] which provides self-reported data on health sector responses to climate change, and data from the World Bank/OECD report Health at a Glance: Latin America and the Caribbean 2023.[50]

As of 2021, Brazil was the only country that self-reported having developed a HNAP. Brazil's level of implementation was, however, moderate, with action reported for some of the plan/strategy priorities. Argentina,

Colombia, Costa Rica, El Salvador, Nicaragua, and Peru reported having plans under development. Bolivia and Guatemala do not have a HNAP in place. Nevertheless, other countries have developed or are developing health strategies that include climate and health perspective (e.g., Argentina, Colombia, Costa Rica, El Salvador, Nicaragua, and Peru).[50] For example, Argentina approved a National Health and Climate Change Strategy in 2023,[51] and Nicaragua approved a National Policy of Climate Change in 2022.[52]

In a recent publication, 38 national climate change planning documents, including National Adaptation Plans (NAPs), sectoral NAPs, National Determined Contributions (NDCs), and National Communications (NCs) from 12 South American countries were analysed.[17] Across all of the countries, the majority of these plans include information on the impact of climate change on population health and health systems based on international or global literature, revealing the need for enhanced local-level evidence to provide clarity and specificity in the planning and implementing of adaptation measures to reduce vulnerability. Additionally, they reveal the persistent need for strengthening the measurement of the policy impacts on society as well as basal funding schemes for the adaptation measures.

Indicator 2.1.3: city-level climate change risk assessments– headline finding: in 2022, 55.6% of all municipalities that completed the CDP survey reported they had completed a city-level climate change risk assessment. However, the participants only represent 1.7% of all municipalities in Latin America

It is estimated that 80% of the population in Latin America resides in urban areas,[53] where a significant proportion is exposed to multiple climatic and non-climatic hazards that affect people's health and well-being. Compounding climate change-related hazards and environmental pollution, unplanned urbanisation and inadequate climate preparedness may amplify impacts and social inequalities. Thorough climate risk and vulnerability assessments, especially at the municipal level, can serve as a solid foundation for making informed decisions, adapting to the adverse effects of climate change locally, building more resilient communities, and improving the quality of life more broadly.

This indicator tracks the development of climate risk assessments at the municipal level. The data come from the 2022 Carbon Disclosure Project (CDP) Annual Cities Survey,[54] which provides self-reported data for risk assessments from 268 jurisdictions of 14 countries in Latin America. For specific details, please refer to the Appendix (Table A3).

In 2022, 268 municipalities voluntarily participated in this survey, representing 1.7% of the total 16,050 municipalities of the analysed countries. Of the

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responding municipalities, 149 (55.6%) have completed their jurisdiction's climate risk and vulnerability assessments; 94 (35.1%) municipalities plan to conduct these assessments in the next two to three years; 21 (7.8%) municipalities –of which 15 are from Brazil– have opted against future assessments, arguing resource constraints and other pressing priorities.

Of the 208 municipalities in South America that responded to the survey, infectious diseases were identified as the main problem by 19.7% (n = 41), followed by floods by 17.8% (n = 37) and extreme heat and urban flooding by 15.4% (n = 32). In Central America, out of 66 responding municipalities, 27.3% (n = 18) indicated that extreme heat and extreme precipitation are major challenges, followed by floods at 25.8% (n = 17) and infectious diseases at 21.2% (n = 14).

2.2: Enabling conditions, adaptation delivery, and implementation

Indicator 2.2.1: climate information for health - headline finding: in 2022, 13 WMO member countries in Latin America reported working with the health sector for the provision of climate services

Enhancing climate services for health is vital to effectively prepare for and respond to climate change challenges. Climate services strengthen decision-making by providing timely and accurate climate information, which in turn contributes to a better allocation of resources within resource-constrained health sectors. Some benefits include better pinpointing high-risk communities, tracking environmental factors, and notifying communities and healthcare providers of potential climate hazards. As climate information enhances the overall efficiency and effectiveness of healthcare services, cooperation and collaborative work between meteorological, climate, and health services can substantially increase effectiveness and efficiency in protecting populations from climate-related hazards.

This indicator monitors the extent to which climate and health services cooperate in Latin American countries. Data come from the 2021 WHO Health and Climate Change Global Survey[43] and the World Meteorological Organisation (WMO).

Of the 11 participant countries in the WHO survey, only Argentina, Brazil, Colombia, and Guatemala indicated an integration of meteorological information into their health services, particularly health surveillance systems. The predominant areas that include meteorological information are respiratory diseases (Argentina, Colombia, and Guatemala), injuries (Argentina and Brazil), and vector-borne diseases (Argentina and Guatemala). Only Argentina has declared having integrated meteorological services for heat-related diseases, and Guatemala has integrated meteorological services for water-borne diseases. Integration of meteorological information for food-borne diseases, infectious diseases, mental health, noncommunicable diseases, and zoonoses is unclear and limited.

Complementarily, 13 of the 17 WMO member countries in Latin America have self-reported that their meteorological and hydrological offices provide climate services for health services, mainly focusing on data services, climate monitoring, climate analysis and diagnostics, and climate predictions.

Indicator 2.2.2: urban greenspace–headline finding: none of the 109 urban centres examined in Latin America has levels of greenspace classified as high or above, and only 12 centres (11%) have moderate levels of urban greenness

Expanding and preserving urban green spaces is a vital climate strategy that numerous cities around the world adopt. This involves transforming underutilised areas like parking lots, vacant lots, roofs, and abandoned buildings into parks and green infrastructure. This expansion can yield significant health benefits and climate resilience, improving physical and mental well-being while reducing mortality and morbidity.[55] These positive impacts stem from the reduction of air and noise pollution, cooling effects, and spaces for exercise and social interaction that greenspaces offer. However, evidence suggests that there are significant disparities in greenspace quantity, accessibility, and quality, which disproportionately affect vulnerable populations across Latin America.[56]

This indicator examines the 109 urban areas larger than 500,000 inhabitants in Latin America. The vegetation coverage was estimated using the satellite-based normalised difference vegetation index (NDVI). Population-weighted NDVI was calculated as an estimate of exposure to green space. The level of greenness was defined as "exceptionally low", "very low", "low", "moderate", "high", "very high", and "exceptionally high". Cities were also classified according to the Köppen-Geiger climate classification.[57]

Overall, there has been no substantial change in levels of greenspace in the region since 2015. Colombia, Nicaragua, and Venezuela were the only countries where levels of greenspace in cities slightly increased since 2015 (refer to Figures A10–A26 in Appendix). None of the 109 urban centres examined had high, very high or exceptionally high levels of urban green space in 2022, and only 12 cities (11%) had moderate levels of urban green, with five of them located in Venezuela. All the remaining cities have low, very low, or exceptionally low levels of greenness (Fig. 4). In relation to climate zones, the mean population-weighted peak-season NDVI is higher in tropical cities, followed by temperate cities. As expected, arid and polar cities have lower mean values. However, on average, the mean population-weighted peak-season NDVI for cities in Latin America is below the global average in each corresponding climatic zone (Table A4 in the Appendix).
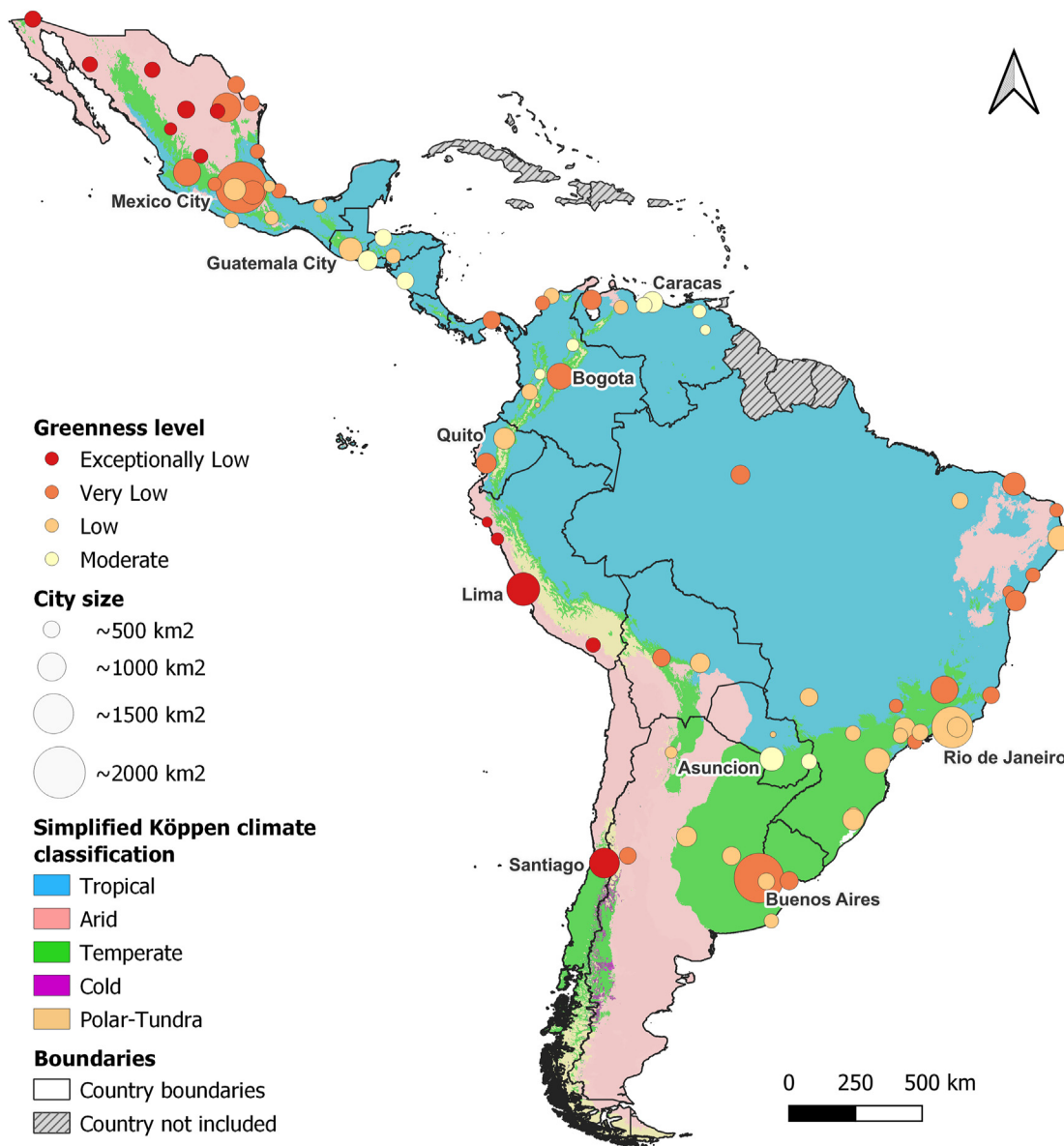
Fig. 4: Greenness level (population-weighted peak-season NDVI) in Latin American cities.

Indicator 2.2.3: global multilateral funding for health adaptation programmes—headline finding: in 2022, the green climate fund (GCF) budget for projects aimed at climate change adaptation in Latin America decreased 16% compared to 2021. An 11.6% of the total approved funding goes towards projects with potential health benefits

Strong and financial commitments to develop, expand, and improve climate adaptation and resilience projects are imperative to protect the health of populations, especially in the face of present and potential future impacts of climate change. The Green Climate Fund (GCF), which is one of the largest multilateral funding mechanisms under the UNFCCC, along with the Clean

Technology Fund and the Amazon Fund support climate mitigation and adaptation projects in developing countries.[58]

This indicator tracks overall and health-specific funding in adaptation and cross-cutting (i.e., adaptation and mitigation) projects provided by the GCF. It monitors the allocation of approved funds for adaptation projects within the GFC by analysing and reviewing the Project Approval Documents from the Project Portfolio.[59]

In 2022, the GCF approved approximately US$486 million for projects on climate change adaptation in Latin America. This amount represents a 16% decrease

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compared to the US$583 million approved for the same region in 2021. Importantly, none of the funds approved in 2022 were allocated to climate change and health projects. The 2022 funds were allocated to six projects, benefiting Argentina, Brazil Chile, Colombia, Costa Rica, Ecuador, Mexico, and Panama. Three of the six projects self-declared to have destined a fraction for potentially improving health adaptation, totalling US$56 million and representing a 56% increase compared to the US$36 million in 2021. Nevertheless, it is worth noting that, even with this increase, this fraction remains at 11.6% of the total approved funding.

Future iterations of this indicator will include other sources of funding, such as new finance commitments made at COP28, including a US$300 million commitment by the Global Fund to prepare health systems, and US$100 million by the Rockefeller Foundation to scale up climate and health solutions.[60]

Indicator 2.2.4: detection, preparedness, and response to health emergencies–headline finding: 14 of 17 Latin American countries self-reported high or very high implementation status for health emergency management in 2022

Being able to detect, assess, notify, and report events and to respond to public health risks and emergencies of national and international concern is a critical function of health services, especially under a changing climate.

This indicator, new to the Latin America report of the *Lancet* Countdown, tracks the implementation of the core capacity 7 (i.e., health emergency management) under the legally binding International Health Regulations (IHR). Data were retrieved in September 2023 from the electronic IHR State Parties Self-Assessment Annual Reporting Tool (e-SPAR).[61]

In 2022, 14 countries in Latin America self-reported having high or very high level of implementation of the IHR health emergency management capacity. El Salvador, Nicaragua, Brazil, Chile, Mexico, and Panama self-reported having very high level of implementation (81–100%), while Bolivia, Uruguay, Venezuela, Colombia, Ecuador, Guatemala, Paraguay, and Peru self-reported having high level of implementation (61–80%). Figure A27 in the Appendix shows the level of reported implementation of this capacity for each Latin American country in 2022.

2.3: Vulnerabilities, health risk, and resilience to climate change

Indicator 2.3.1: vulnerability to severe mosquito-borne diseases–headline finding: risk to mosquito-borne disease has decreased in Latin America, on average, by 54% from 2000–2009 to 2013–2022, mostly due to improvements in water, sanitation, and hygiene (WASH)

Vulnerability to mosquito-borne diseases, including dengue, is influenced by biophysical, environmental, social, and economic factors, including local coping and adaptive capacities.[62] Reductions in healthcare access and quality, high rates of urbanisation, high population density, and low socioeconomic status are societal factors that can potentially increase population vulnerability to severe outcomes from dengue fever. In a region with a changing climatic suitability for the transmission of *Aedes*-borne diseases (indicator 1.3), information on vulnerability to dengue, combined with changes in the climatic suitability for its transmission, can assist countries in understanding the risk and investing in resilience and adaptation actions.

This improved indicator presents the Mosquito Risk Index (MoRI), which estimates the risk of mosquito-transmitted diseases by combining hazard (i.e., a normalized mosquito-borne viral suitability index P, sensitive to temperature, humidity, and precipitation),[63] vulnerability (i.e., proportion of the urban population without basic drinking water management),[64] exposure (i.e., proportion of the population living below 2000 m above sea level),[65] and resilience (i.e., healthcare access and quality index).[66] For more details, please refer to the Appendix.

The MoRI shows an overall decrease in the risk of mosquito-borne diseases of 54% in the region from 2000–2009 to 2013–2022. However, there is considerable temporal variation in the indicator within and between countries. Considering the same time periods, the countries with the highest reduction in this risk were Paraguay, Mexico, Ecuador, and El Salvador. On the other hand, Venezuela and Panama saw an increase in vulnerability.

In 2022, Brazil, Peru, Guatemala, Panama, and Venezuela were in the upper quartile of the MoRI (i.e., highest risk of mosquito-borne diseases). The 2022 MoRI, compared to the average MoRI during the last five years (i.e., 2018–2022), increased in Brazil and Paraguay and decreased in the other Latin American countries (Table A5 in the Appendix). These results are mainly explained by the high vulnerability, determined by the high proportion of the urban population without basic drinking water management. Venezuela is the only country with a deterioration in the coverage of basic drinking water services, exposing it to a higher MoRI in most of the years compared to the region.

Although the risk of mosquito-borne diseases has decreased over the years, climatic changes (indicator 1.3) coupled with poor sanitary preparation systems have an important impact on dengue cases. As was seen in 2022–2023, dengue outbreaks occurred in different countries in Latin America,[29] mainly in those affected by specific climate conditions and high mosquito-borne risk.

Conclusion

Adaptation and planning to climate change is a critical step to adequately prepare for and respond to multiple climate hazards (indicator 2.2.4), contributing to better

climate-resilient development for health. However, climatic adaptation policies, economic resources, and intersectoral collaboration are still limited in the region. To adequately respond to a changing climate and limit adverse consequences to people's health, baseline assessments of national and city-level vulnerability and adaptation are urgently required. Nevertheless, very few countries have conducted a V&A (indicator 2.1.1) and very few cities have conducted city-level climate change risk assessments (indicator 2.1.3). These assessments are important because allow decision-makers to understand the potential impacts of climate change on the population, identify social vulnerabilities that mediate the impacts (indicator 2.2.2 and indicator 2.3.1), and strengthen the capacities needed to adequately respond. The information generated contributes to better climatic policies and national adaptation plans, which as of now, have only been developed by three countries (indicator 2.1.2).

For sustained and long-term planning, these policies and processes must have permanent funding sources that go beyond national political cycles. However, there has been a decrease in the international funding coming from the GCF to the region (indicator 2.2.3). Given the potential future pathways of climate change, governments need to consider appropriate national budget allocations to climate-facing actions that protect people's health and wellbeing now and in the future.

Overall, addressing the complex challenges of climate change in Latin America requires well-funded institutional structures that facilitate and promote intersectoral collaboration (Panel 3), following a transdisciplinary approach and placing health equity and environmental justice at their core. However, there is still limited collaboration between meteorological and health sectors in the region (indicator 2.2.1). The results from these eight indicators inform the path forward for developing more resilient systems in the face of climate change.

Section 3: mitigation actions and health co-benefits

Latin America plays a pivotal yet underappreciated role in global climate change mitigation. As a region experiencing rapid urbanisation,[53] countries across Latin America face increasing climate-related health risks while also contributing to GHG emissions. The region, therefore, faces a two-fold challenge: growing risks to health from climate change (refer to Section 1) and mitigating GHG emissions while continuing to develop and grow. Targeted interventions hold promise for addressing this dual challenge. Thoughtful climate policies and initiatives in Latin America can substantially curb GHG emissions while also conferring important near-term health co-benefits to local populations.

This section aims to describe the current context around emissions mitigation and health co-benefits in Latin America. It analyses mitigation gaps across the

Panel 3: Multilevel and intersectoral adaptation and resilience planning in Latin America.

Although most of the climatic policies in Latin America are still weak, siloed, and lack strong financial schemes, important progress on health and climate change at regional[67] and subregional levels has been made: the Caribbean Action Plan on Health and Climate Change,[68] the Andean Health and Climate Change Plan,[69] and the recent approved Mercosur Climate Change and Health Strategy[70] are examples of that.

Additionally, despite the unequal development of HNAPs in the region (indicator 2.1.2), a significant number of countries have included *health* in their climate change policies, strategies or plans, or are in the process of doing so.[50] Nonetheless, greater challenges appear when planning and implementing these policies, strategies, or plans at subnational levels, particularly in countries with federal political organisation, such as Argentina, Brazil, Mexico, or Venezuela.

Argentina has made important progress in this regard, where three provinces: Misiones,[71] Neuquén,[72] and Tucumán[73] have developed their action plans on health and climate change. This significant step was possible in the context of a Readiness proposal financed by the Green Climate Fund and implemented by the National Ministry of Health and PAHO/WHO.[49] Each provincial plan was developed by inter-programmatic working groups, created within the provincial Ministries of Health and supported by public consultations, where different groups, sectors, and governmental areas also participated.

The experience from Argentina demonstrates that further progress on health and climate is possible if basic conditions are met, including political will and financial schemes. Intersectoral and multilevel collaboration and participation also appear as key enablers of progress, allowing different perspectives to be included and maximising societal benefits, including health benefits.

region's major emitters and identifies high-impact levers for capturing health co-benefits. Eight indicators are presented in this section: energy systems and health (indicator 3.1.1); household energy use (indicator 3.1.2); sustainable and healthy road transport (indicator 3.1.3); premature mortality from ambient air pollution (indicator 3.2.1); and exposure to household air pollution (indicator 3.2.2). A new indicator of tree cover loss and health was developed for Latin America (indicator 3.3), which is partly linked to emissions from agricultural production and consumption (indicator 3.4.1) and diet and health co-benefits (indicator 3.4.2). For specific details on the methods and additional analyses, please refer to Section 3 in the Appendix.

3.1: Energy use, energy generation, and health

Indicator 3.1.1: energy systems and health–headline finding: In Latin America, electricity generation from coal has increased, on average, by 2.6 percentage points from 1991–2000 (2.6%) to 2011–2020 (5.2%), threatening efforts of coal phasing-out. Nevertheless, renewable sources appear as an opportunity as they increased, on average, 5.7 percentage points from 1991–2000 (2.7%) to 2011–2020 (8.4%)

Decarbonising energy systems is critical to meet global efforts to address climate change and its associated health impacts. As the largest single source of GHG emissions and a major contributor to air pollution, the energy sector

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plays a key role in shaping the environmental and public health landscape. The urgency of transitioning from fossil fuels to renewable energy extends beyond climate change mitigation; it encompasses achieving broader social advantages like providing universal access to affordable and clean energy, reducing air pollution, decreasing dependence on international markets and foreign policies, and bringing health co-benefits.[22] Latin America, endowed with substantial renewable energy potential, holds the promise of becoming a significant player in this transformative journey.[74]

This new indicator to the Latin America *Lancet* Countdown report draws on data from the International Energy Agency (IEA)[75] to analyse the critical relationship between energy system transition and its implications for health outcomes. This indicator examines the share of energy sources (i.e., coal, low-carbon fuels, and renewables) used for electricity generation. For more details, refer to the Appendix.

Overall, the share of electricity generation from coal has increased, on average, by 2.6 percentage points from 1991–2000 (2.6%) to 2011–2020 (5.2%) in Latin America (Fig. 5). Only Argentina and Colombia have slightly reduced the use of coal for electricity generation, while Honduras, Mexico, Brazil, Peru, Panama, Chile, and Guatemala have increased or maintained their use. Coal has the highest greenhouse gas emissions and air pollution intensity of all fossil fuels. As such, strong calls have been made for its phase-out by the health and climate change communities.

Electricity generation from low-carbon energy sources (i.e., nuclear, hydro, geothermal, solar, tide, wave, and marine current, and wind) has decreased across all Latin American countries, except for Nicaragua, Costa

Rica, and Paraguay. However, these sources still account for 56% of the electricity generation in 2011–2020 in Latin America, on average.

On a positive note, renewable energy sources, mainly wind and solar power, have emerged as pivotal contributors to electricity generation in all Latin American countries. These sources increased, on average, by 5.7 percentage points from 1991–2000 (2.7%) to 2011–2020 (8.4%) in Latin America. The highest increases are seen in Uruguay, Nicaragua, El Salvador, Honduras, Costa Rica, Chile, and Brazil. These numbers represent important progress, efforts, and opportunities for Latin American countries to continue advancing in energy transition, phasing out fossil fuels, and delivering health-centred energy policies.

Indicator 3.1.2: household energy use–headline finding: 46.3% of the rural population in Central America and 23.3% in South America did not have access to clean fuels for cooking in 2022

The health consequences of exposure to household air pollution (HAP) are intricately linked to the fuel and cooking technology used in people's homes. The use of fossil fuels for cooking presents significant health risks indoors. Recent research underscores an association between exposure to NO_2, which is released when burning fossil fuels, and childhood asthma. Also, particulate matter of 2.5 μm of diameter ($PM_{2.5}$) from biomass combustion is associated with child pneumonia and chronic respiratory conditions.[76]

To assess progress in this regard, this indicator relies on data from the WHO Sustainable Development Goal 7 (SDG7) database, which tracks the percentage of the population using clean fuels or non-polluting fuels at
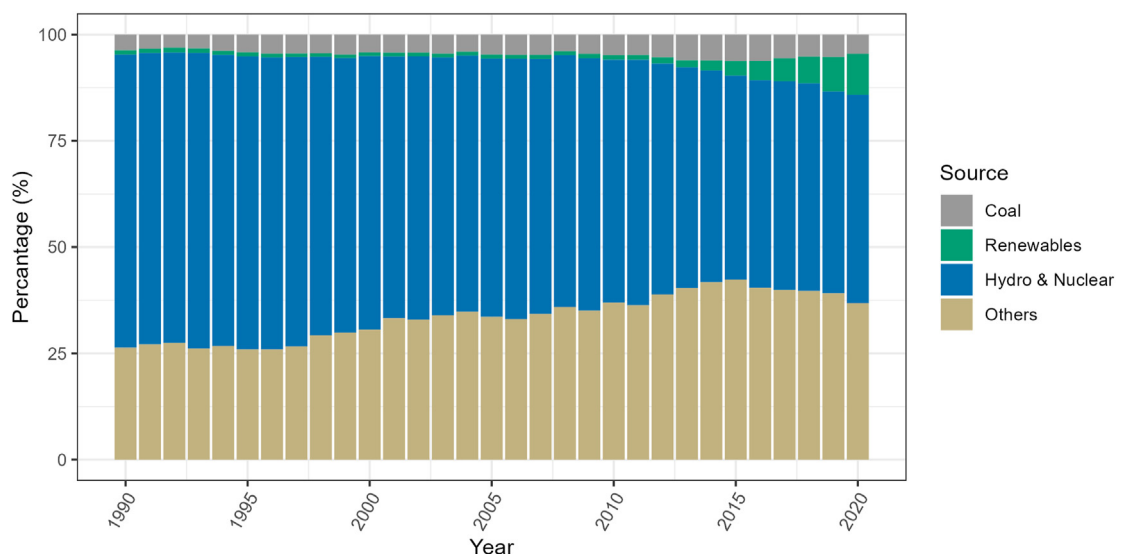

Fig. 5: Share (%) of electricity generation provided by different energy sources from 1990 to 2020.

point of use (i.e., electricity, natural gas, liquefied petroleum gas, biogas, ethanol, and solar) for cooking,[77] while meeting WHO air quality guidelines.[78]

In 2021, 19.5% of the Latin American population lacked access to clean cooking fuels and technologies, revealing pronounced regional disparities. This lack of access was higher in Central America (28.9%) than in South America (12.8%). Furthermore, an urban-rural divide persisted, with rural areas facing a staggering 32.8% of people lacking clean fuels compared to 6.2% in urban areas. These disparities extended within each region as well: in rural and urban South America, 23.3% and 2.3% of population lack access to clean fuels, respectively. In rural and urban Central America, 46.3% and 11.7% populations lack access to clean fuels, respectively (Figure A28 in the Appendix).

Despite overall progress over the past three decades, disparities exist between the two regions. South America has seen faster access to and adoption of clean fuels, but challenges persist in rural areas in countries like Peru (with 54.6% of rural populations relying on unclean fuels) and Paraguay (with 58.4% of rural populations relying on unclean fuels). In Central America, Nicaragua and Guatemala stand out, with the vast majority of the rural population lacking access to clean fuels for cooking (87.9% and 90.3%, respectively). Furthermore, Mexico stands as the only country in Latin America where access to clean fuels in urban areas has decreased in the last decade, with 99% of the urban population having access to clean fuels in 1990 to 91% in 2021 (Figure A29 in the Appendix).

Although liquefied petroleum gas (LPG) is considered a "clean" fuel at the point of use within the SDG7, it may have some negative health effects due to exposure to NO_2.[79] Nonetheless, a substantial proportion of the Latin American population employs LPG for cooking (74.6%), with notable disparities between urban (82.8%) and rural (56%) usage rates. This reliance on fossil fuels for cooking underscores the urgent need for transition to even cleaner alternatives. Subsequent iterations of this report will continue to monitor the access to clean cooking fuels and LPG, emphasising the critical nature of transitioning to cleaner and more sustainable cooking practices and environmentally friendly fuel sources within the region.

Indicator 3.1.3: sustainable and healthy road transport–headline finding: fossil fuels still dominate Latin America's road transport energy (96%), while biofuels are increasing their use in some South American countries
The importance of sustainable and healthy road transport in Latin America cannot be overstated, as almost 20% of premature mortality attributable to $PM_{2.5}$ comes from the transport sector (indicator 3.2.1). This region has experienced significant growth in road transport energy use over the years, leading to environmental and

health implications. As Latin American countries grapple with rapid urbanisation, frail public transport systems, and increased car ownership, addressing the sustainability and health aspects of road transport becomes a paramount concern.

This indicator follows the 2023 global *Lancet* Countdown report[22] and takes data from the IEA in the World Extended Energy Balances.[75]

Overall, there is a significant increase in per capita energy use for road transport across Latin America. Several countries, including Bolivia, Brazil, Chile, Ecuador, Guatemala, Panama, Paraguay, Peru, and Uruguay have experienced a remarkable increase in per capita energy use in road transport since the 1990s. This surge might be linked to rapid urbanisation and a surge in car sales throughout the region. Fossil fuels have maintained their dominance as the primary energy source for road transport in Latin America, accounting for 96% of total energy, followed by biofuels which only accounted for 3.5% of total energy in 2020. Surprisingly, electricity usage for road travel remains extremely low, representing a mere fraction of the total energy utilised in this sector (0.05%). Interestingly, fossil fuel consumption has seen a slight reduction since 2010, with biofuels experiencing substantial growth. Biofuels have been particularly favoured by countries like Argentina, Brazil, Colombia, Paraguay, Peru, and Uruguay. However, while biofuels are sometimes considered more sustainable than fossil fuels, their production drives land use change, and they can entail overall positive GHG emissions, contributing to exacerbating climate change.[80] In addition, their combustion contributes to high levels of pollution, which poses health risks.[81] In contrast, countries like Chile and Ecuador are leading the way in electrifying road transport (Figure A30 in the Appendix). This highlights the pressing need for accelerated efforts in transitioning to cleaner and more sustainable energy sources in the region.

3.2: Air pollution and health co-benefits
Indicator 3.2.1: premature mortality from ambient air pollution–headline finding: premature mortality rate attributable to fossil-fuel-derived-$PM_{2.5}$ increased by 3.9% from 2005 to 2020
Air pollution is a major global health threat, causing seven million premature deaths annually and leading to a range of diseases, including cardiovascular and respiratory diseases, and cancer.[82] In Latin America, no urban centres meet the WHO air quality guidelines,[78] meaning that millions of people are exposed to dangerous and health-threatening air pollution levels.

This indicator draws on data from the 2023 global *Lancet* Countdown report and estimates the mortality attributable to ambient $PM_{2.5}$ by economic sector and source. It uses the Greenhouse Gas–Air Pollution Interactions and Synergies (GAINS) model, which combines bottom-up emission calculations with

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atmospheric chemistry and dispersion coefficients.[22] Data are presented for each South American country, Mexico, and Central America.

In 2020, 123.5 premature deaths per million people were attributable to ambient $PM_{2.5}$ in Latin America, representing an increase of 3.9% from 2005 (118.9 premature deaths per million people). However, there are important differences between countries. Premature mortality attributable to $PM_{2.5}$ has decreased in Argentina, Brazil, Ecuador, Mexico, Uruguay, and Venezuela, and notably increased in Central America, Chile and Colombia since 2005 (Fig. 6). The Latin American countries with the highest premature mortality rate attributable to $PM_{2.5}$ (more than 100 deaths per million people) in 2020 were Chile, Peru, Brazil, Colombia, Mexico, and Paraguay. Of the total premature deaths attributable to $PM_{2.5}$ in 2020, 19.1% was from transport, 12.3% from household, 11.6% from industry, and 11% from agriculture (Figure A31 in the Appendix). These sectors are also responsible for the bulk of greenhouse gas emissions in Latin America, and where health-centred climate change mitigation actions carry the potential to reduce their contribution to air pollution-related mortality. Accounting for the potential delivery of these health co-benefits through climate action is, therefore, crucial in the planning of a response to climate change that delivers a thriving future to local populations.

Indicator 3.2.2: household air pollution–headline finding: transitioning to cleaner alternatives for heating and cooking can reduce national-level annual HAP-$PM_{2.5}$ personal exposure by 61%, leading to a 27% reduction in related mortality

Approximately 2.4 billion individuals, nearly one-third of the global population, rely on polluting fuels and inefficient stove technologies for their household cooking needs, leading to the generation of harmful HAP and GHG emissions.[82] This number in Latin America reaches 60.1 million people, with Guatemala and Honduras having more than 50% of their population relying on polluting fuels for cooking.[83]

This indicator draws on data from the 2023 global *Lancet* Countdown report and estimates annual average HAP-$PM_{2.5}$ personal exposure levels associated with various fuel types (biomass, charcoal, coal, gas, electricity) and stove technologies (traditional, improved) in both rural and urban settings. It is based on a Bayesian hierarchical model, created using sample data on indoor air quality from 282 peer-reviewed publications. It then estimates the exposure-attributable death rate (per 100,000 population) using a comparative risk assessment.[84]

Significant exposure disparities exist between polluting solid fuels and cleaner alternatives, such as electricity and gas, in both urban and rural settings across Latin American countries. In 2020, the use of polluting solid fuels for cooking and heating resulted in
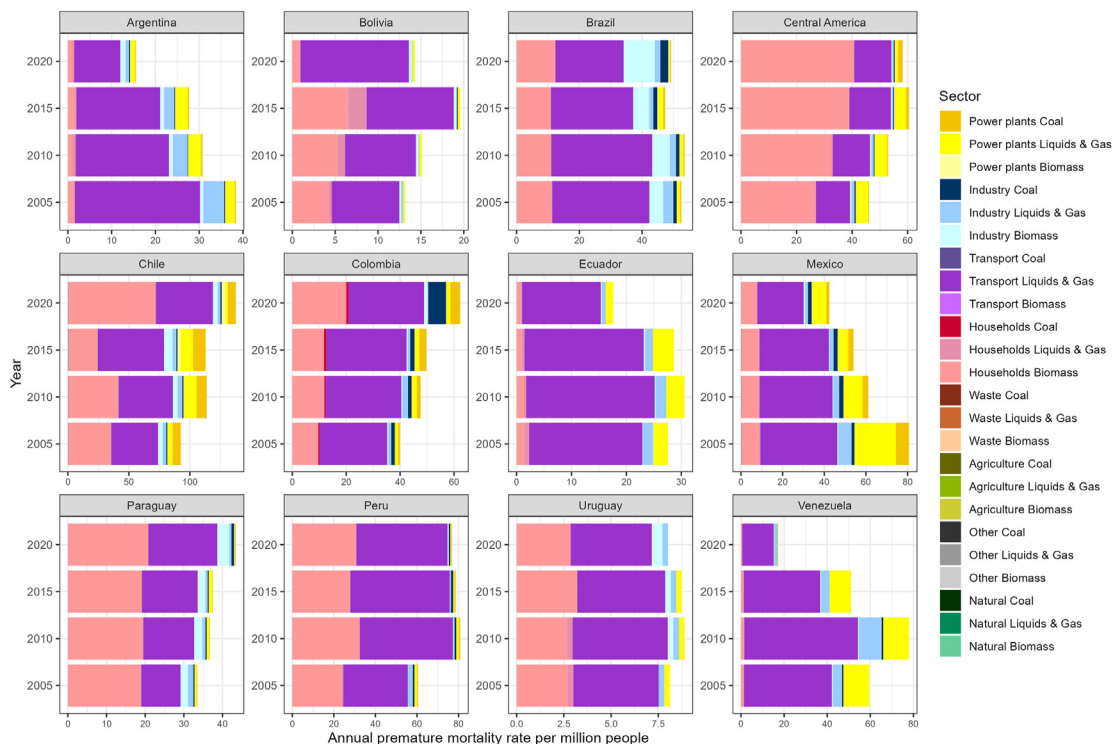

Fig. 6: Estimated premature mortality attributable to PM2.5 from 2005 to 2020 in Latin American countries. The estimates are divided according to sector and fuel type.

an average national-level personal exposure level of 145 μg/m^3, exceeding the WHO annual average threshold of 5 μg/m^3.[78] However, intra-national disparities exist, with rural inhabitants experiencing an average HAP exposure of 163 μg/m^3, while urban inhabitants face a lower average of 108 μg/m^3. Conversely, the adoption of cleaner fuels results in a national-level annual average exposure of 55 μg/m^3, with rural inhabitants encountering an average of 68 μg/m^3 and urban inhabitants facing an average of 45 μg/m^3 (Table A6 in the Appendix).

Exposure to household air pollution stemming from polluting solid fuels like biomass, charcoal, and coal has a profound impact on public health. At the national level, the death rate associated with exposure to PM$_{2.5}$ from the use of these fuels in Latin America averages 71 (95% CI 57–84) per 100,000 inhabitants, with rural areas experiencing an average of 73 (95% CI 60–86) and urban regions recording an average of 60 (95% CI 52–67) per 100,000 inhabitants. In comparison, the average death rate attributable to the use of so-called clean fuels (which include natural gas) stands at 52 (95% CI 40–64) per 100,000 inhabitants at the national level, with rural and urban averages of 58 (95% CI 45–71) and 47 (95% CI 35–60) per 100,000 inhabitants, respectively.

Transitioning from polluting fuels to cleaner alternatives for heating and cooking in Latin America holds the potential to reduce national-level annual HAP-PM$_{2.5}$ personal exposure by approximately 61%. Consequently, this transition could lead to a 27% reduction in the rate of mortality attributable to exposure to HAP-PM$_{2.5}$ at the national level (Figure A32 in Appendix).

Indicator 3.3: tree cover loss and health–headline finding: commodity-driven deforestation and the elimination of tree coverage in favour of expansion of agricultural land are the main drivers of tree cover loss in Latin America, accounting for around 80% of total loss

The rapid loss of tree cover in Latin America is a pressing concern with profound implications for climate change, biodiversity, and human health. Forests play an integral role in stabilising the climate, preserving unique ecosystems, and supporting human livelihoods. Their decline augments carbon emissions and limits carbon sinks, intensifies global warming, and disrupts the habitat of countless species, which may lead to increased disease transmission.[85,86]

This new indicator for the *Lancet* Countdown Latin America uses high-resolution Google Earth imagery to detect tree cover loss, and estimates the most likely cause of forest disturbance at any 10 km × 10 km grid cell globally from 2001 to 2022, including i) commodity-driven deforestation, ii) shifting agriculture, iii) forestry, iv) wildfire, and v) urbanisation (for definitions refer to the Appendix).[87,88] It is essential to note the distinction between temporary loss and permanent deforestation.

Only commodity-driven deforestation and urbanisation result in permanent loss. While this dataset offers valuable insights at the global and regional scale, care must be taken when interpreting results for smaller areas due to potential inaccuracies.

From 2001 to 2022, Latin America experienced a concerning decline in tree cover. The main culprits behind this decline are commodity-driven deforestation and the shift from tree cover to the use of land for agricultural purposes, accounting together for around 80% of the total loss (Fig. 7). The countries with the most land area losing tree cover were Brazil, Bolivia, Paraguay, Argentina, and Colombia. Increased tree cover loss during those years was seen, including in the top five countries of Brazil, Colombia, Peru, Mexico and Honduras (Figure A33 in the Appendix). Furthermore, while wildfires have led to temporary tree cover loss, the distinction between natural and anthropogenic wildfires remains challenging, and so does the extent of their impacts on permanent tree cover loss. Shifting agriculture, representing both temporary loss and permanent deforestation due to small and medium-scale agriculture, further complicates the landscape of tree cover reduction.

The escalating tree cover loss in Latin America underscores the urgent need for comprehensive conservation strategies, sustainable agricultural practices, and robust urban planning. Agriculture practices have not only severe impacts on the planet due to significant GHG emissions (e.g., ruminants and manure) and loss of carbon sink (i.e., tree cover loss) but also on human health. The overconsumption of animal-derived products is a key driver of increased livestock rearing, and the associated tree cover loss, while also being responsible for a substantial burden of disease from unhealthy diets in Latin America (indicator 3.6). This underlines the potential for delivering synergistic health and climate interventions, which promote healthier diets, reduce the burden of non-communicable diseases, and reduce deforestation.

As the planet grapples with climate change, preserving forests is not only essential for the environment but also pivotal for human health and survival.

3.4: Food, agriculture, and health co-benefits
Indicator 3.4.1: emissions from agricultural production and consumption–headline finding: most Latin American countries have decreased CO$_2$e emissions per capita from the production and consumption of animal-based foods; however, these foods account for more than 85% of CO$_2$e emissions from the agricultural sector in Latin America

Demographic growth, coupled with associated economic expansion, has driven a surge in global food demand and triggered shifts in dietary patterns. Agricultural practices in Latin America, which include land–intensive activities, are responsible for 40% of the region's total CO$_2$e (Carbon dioxide equivalent) emissions. This figure is nearly twice the global average,
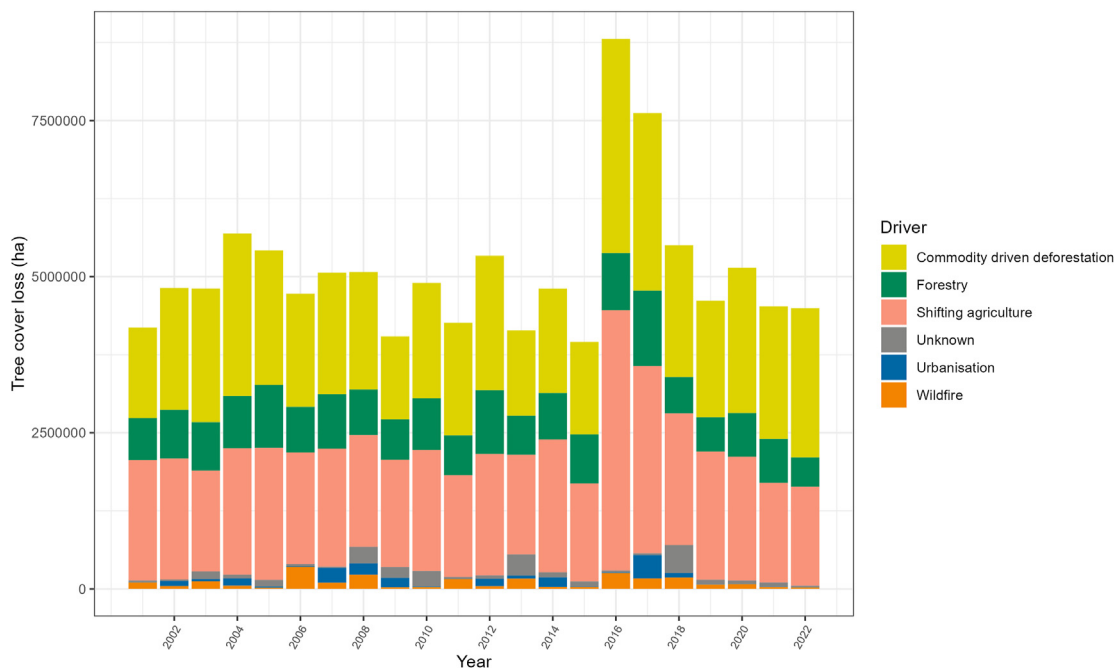
Countdown

Fig. 7: Annual tree cover loss (in hectares) in Latin America by main driver between 2001 and 2022.

highlighting the significant environmental impact of agriculture in the region.[89]

To evaluate the sources of agricultural CO_2e emissions, this indicator draws from the 2023 global *Lancet Countdown* report.[22] It analyses the CO_2e emissions from local consumption and production of different food products, including animal-based food products (i.e., cow and buffalo meat, dairy products, pig meat, poultry. and sheep and goat meat) and plant-based food products (i.e., cereals, fruits and vegetables, palm oil, rice, and other crops).

Overall, in 2020, the production and consumption of animal-based food products accounted for 87% and 85% of agricultural CO_2e emissions in Latin American countries, respectively. Cow and buffalo meat represent the highest proportion, followed by dairy products. The top five countries with the highest annual per capita CO_2e emissions from production and consumption are Argentina (2.0 and 1.6 tCO_2e per person), Brazil (1.7 and 1.4 tCO_2e per person), Panama (2.9 and 2.7 tCO_2e per person), Paraguay (1.8 and 0.7 tCO_2e per person), and Uruguay (4.4 and 1.7 tCO_2e per person).

Over the years, Bolivia, Guatemala, Nicaragua, and Paraguay have increased the CO_2e emissions per capita associated with the production of cow and buffalo meat. Additionally, there have been increases in emissions per capita associated with the production of i) sheep and goat meat in Bolivia, ii) poultry in all Latin American countries, except for Venezuela, and iii) dairy products

in Nicaragua. Complementary, Bolivia, Chile, and Guatemala have increased CO_2e emissions per capita associated with the production of cow and buffalo meat over the last years (Figures A34 and A35 in the Appendix).

In 2020, Argentina, Bolivia, Brazil, Colombia, Costa Rica, Honduras, Mexico, Nicaragua, Panama, Paraguay, and Uruguay had higher production-based CO_2e emissions per capita for cow and buffalo meat, compared to consumption-based emissions, noting the local environmental impact of products that are consumed in other countries. Meanwhile, in Chile, El Salvador, Guatemala, Peru, and Venezuela, these emissions were higher for consumption, noting the net import of carbon-intensive food products (Fig. 8).

Indicator 3.4.2: diet and health co-benefits–headline finding: in 2020, in Latin America, almost 870,000 deaths were associated with imbalanced diets, of which 155,000 (18%) were linked to high intake of red and processed meat and dairy products

Nutritious plant-based diets that are rich in whole grain cereals, legumes, vegetables, and fruits are associated with lower GHG emissions, less land use change due to livestock feeding, a reduced risk of non-communicable diseases, and an increase in life expectancy. On the other hand, excessive consumption of animal-based and processed meat and refined sugars is linked to higher GHG emissions and intensive agricultural practices, as well as higher rates of diseases and premature mortality
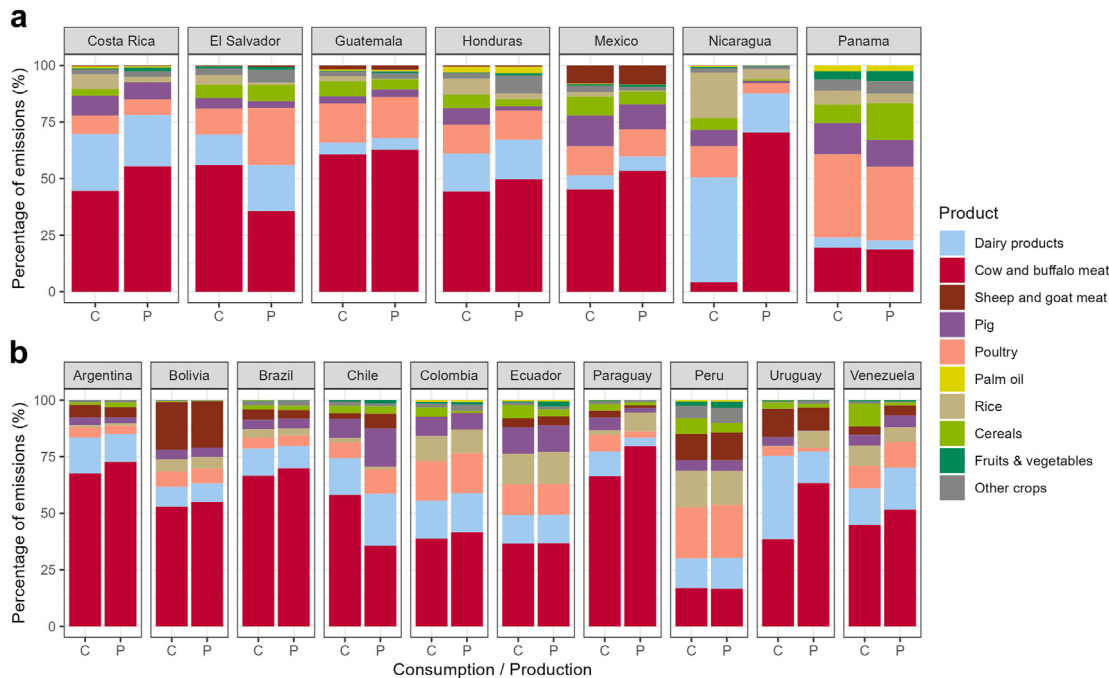
Fig. 8: Percentage of CO2e by product from consumption (C) and production (P) in 2020 in Central America (a) and South America (b).

in human populations.[90] In this sense, a shift from diets intense in animal-based and processed foods to nutritious plant-based diets, would have a double impact: on the planet and human health.

This indicator draws from the 2023 global *Lancet* Countdown report and examines attributable deaths to dietary risk factors based on food consumption figures from the FAO food balance sheets.[22,91]

In 2020, approximately 870,000 deaths were associated with imbalanced diets, either low consumption of nutritious plant-based food (i.e., fruits, legumes, nuts and seeds, oils, vegetables, and whole grains) and high consumption of animal-based and processed food (i.e., eggs, fish, milk, poultry, refined grains, processed meat, red meat, roots, and sugar), representing an increase of 2.6% from 2019 (Figure A36 in the Appendix). Of these, 155,000 (18%) were linked to a high intake of red and processed meat and dairy products.

Of these deaths, 19.7% were attributed to high consumption of refined grains, 18% to high consumption of red and processed meat and dairy products, 14.4% to low consumption of vegetables, and 13.8% to low consumption of whole grains. In Colombia, Costa Rica, Ecuador, Honduras, Nicaragua, Peru, El Salvador, and Venezuela a higher proportion of deaths were attributable to low consumption of plant-based food products, while in Argentina, Chile, Mexico, and Paraguay a higher proportion of deaths were attributable to high consumption of animal-based and processed food products. Overall, most of the attributable deaths are

related to the low consumption of whole grains and vegetables, especially in Venezuela, Nicaragua, Peru, Ecuador, Bolivia, Guatemala, Honduras, Mexico, and Paraguay; and high consumption of sugar (Figure A37 in the Appendix).

Conclusion

This section highlights the complex interplay between climate change mitigation and health in Latin America. Although low-carbon and renewable energy sources are gaining prominence in the region, fossil fuels still represent the highest proportion of energy consumed in the region (indicators 3.1.1 and 3.1.3) (Panel 4). This reliance on fossil fuels and other polluting sources of energy (e.g., biomass) has severe impacts on the climate and the health of people across Latin America (indicator 3.2.1), as exposure to air pollution has short- and long-term negative effects on health, including premature mortality.[82] Rural and urban areas are exposed to differential pollutants derived from these polluting sources. Rural areas have shocking limited access to clean sources of energy for cooking and heating, pushing them to rely on biomass and other polluting fuels, which in turn increase the exposure to harmful levels of houseful air pollution (indicator 3.1.2). Although people in urban areas have better access to clean fuels and technologies for cooking in their homes, are also exposed to other pollutants derived from transport and industrial processes (indicator 3.2.1 and indicator 3.2.2).

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A just transition of energy systems in Latin America holds the potential to strengthen the region's commitment to decarbonisation and address energy poverty, thereby improving living conditions, reducing inequalities, promoting inclusivity in the energy sector, and ultimately aiding in poverty alleviation.[92] Phasing out coal, expanding the production and access to renewable energy, ensuring access to clean energy inside people's homes, and increasing sustainable transport are critical actions in advancing environmental sustainability, public health goals, and Sustainable Development Goals in the region. A whole-of-government and whole-of-society approach is imperative to accelerate this transition and reap its myriad health and environmental benefits.

Additionally, diets with excessive consumption of animal-based and processed foods also have a two-fold impact. On one hand, they are carbon intensive and contribute to the degradation of carbon sinks through deforestation for pasture (indicator 3.3) and emit powerful GHGs (indicator 3.4.1), including nitrous oxide and methane (i.e., through manure and fertilisers), threatening health by exacerbating climate change. On the other hand, high consumption of animal-based and processed food and low consumption of nutritious plant-based foods have a direct effect on human nutrition, health status, and mortality (indicator 3.4.2). Shifting diets and agricultural practices towards more plant-based foods can lessen emissions and diet-related deaths. In summary, climate and health solutions are interconnected, and approaching them together offers an opportunity for multiple benefits of action. Citizens should demand the fulfilment of climate change mitigation commitments, not only for their contribution to combating climate change but also for all the local improvements in health and quality of life that they bring with them. Only a holistic transdisciplinary approach considering mitigation, adaptation, and health will enable Latin America to build a just, equitable and resilient future.

Section 4: economics and finance

The information presented in Sections 1, 2, and 3 demonstrates the need for better preparedness, adaptation, and mitigation policies to reduce climate-related health risks and strengthen climate-resilient and health-supporting development pathways. For planning and implementing these actions and policies, financing schemes that include long-term investments are critical.

Strong, stable, and just climate finance schemes are one of the core elements for successful energy transition and climate-resilient development in the short- and long-term. If these schemes are created and sustained to prioritise health and wellbeing, they can contribute not only to reducing the challenges imposed by climate change but also to create better and more prosperous societies. Every bit of funding that goes to protecting the health of people is not a cost so much as an investment in a more prosperous future for current generations and generations to come.

However, the health impacts of climate change also have profound economic impacts, including increasing healthcare costs, reducing labour capacity, or generating economic losses from damaged infrastructure and disrupted services and supply chains.

This section presents two groups of indicators: the first tracking the economic impacts of climate change and the second monitoring the economics of the transition to zero-carbon economies. The first group covers the economic losses due to weather-related extreme events (indicator 4.1.1); costs of heat-related mortality (indicator 4.1.2); loss of earnings from heat-related reduction in labour capacity (indicator 4.1.3); and the costs of the health impacts of air pollution (indicator 4.1.4). The second group includes clean energy investment (indicator 4.2.1) and the net value of fossil fuel subsidies and carbon prices (indicator 4.2.2). For specific details on the methods and additional analyses, please refer to Section 4 in the Appendix.

4.1: Economic impacts of climate change and its mitigation

Indicator 4.1.1: economic losses due to weather-related extreme events–headline finding: in 2022, economic losses due to weather-related extreme events in Latin America were US$15.6 billion, representing 0.28% of Latin America's Gross Domestic Product, and with 93% uninsured

Weather-related extreme events can be exacerbated by climate change and can damage infrastructure and undermine public service provision. They can also result in both direct economic losses (i.e., total or partial destruction of physical assets) and indirect losses (i.e., subsequent or secondary results of the initial impact), which could have additional health implications.

This indicator draws from the 2023 global *Lancet* Countdown report and tracks the total economic losses (insured and uninsured) resulting from weather-related extreme events (Tables A7 and A8 in the Appendix), using data provided by the Swiss Re Institute, the research arm of the Swiss Reinsurance Company.[98]

In 2022, economic losses due to weather-related extreme events in Latin America were US$15.6 billion, representing 0.28% of Latin America's Gross Domestic Product (GDP). Of those losses, 93% (USD$14.5 billion) were uninsured (Figures A38 and A39 in the Appendix). Total economic losses were nearly eight times higher than the USD$2 billion recorded in 2021 and were inflated by a series of floods and landslides in Brazil in 2022.[4] Despite this increase, the average annual losses in Latin America decreased 28.5%, from USD$7.3 billion during 2010–2014 to USD$5.2 billion during 2018–2022, though a reduction in GDP during this period meant the losses as a fraction of GDP remained roughly constant at around 0.1%. Furthermore, the proportion of losses that were uninsured increased slightly from 89.1% to 93.7% from 2010–2014 to 2018–2022, which contrasts with the global trend where uninsured losses decreased from 67.1% of total losses to 55.3% over the same period.

Indicator 4.1.2: costs of heat-related mortality - headline finding: in 2022, the monetised value of heat-related mortality of people aged 65 and older in Latin America is estimated to be equivalent to the average income of 451,000 people. The average annual monetised losses for 2018–2022 were 231% higher compared to the 2000–2004 period

Morbidity and mortality associated with extreme heat exposure have significant economic costs to society. This indicator draws from the 2023 global *Lancet* Countdown report and estimates the monetised value of heat-related deaths of people aged 65 and older.[22] It is reported in terms of an average person's annual income equivalent and as a proportion of GDP for comparison purposes.

On average, monetised losses increased 231% from 2000–2004 to 2018–2022 in Latin America, equivalent to

an increase in 163% of losses in GDP. Considering the same periods, and accounting for losses as a proportion of GDP, all Latin American countries saw losses, with Ecuador (826%), Honduras (269%), El Salvador (249%), Guatemala (213%), and Chile (152%) having the highest increases in annual average losses due to heat-mortality costs from 2000–2004 to 2018–2022. These monetised values, however, should be interpreted with caution as they only consider heat-related mortality of adults over 65 years of age, and not of other age groups.

Indicator 4.1.3: loss of earnings from heat-related labour capacity reduction–headline finding: the total potential loss of income from heat-related labour capacity reduction in Latin America was equal to 1.34% of GDP in 2022. The agriculture and construction sectors experienced the highest losses

Heat not only affects workers' health but also their labour productivity,[99] generating potential income losses that could affect the socioeconomic conditions which influence health outcomes. This also affects the overall productivity of a country and its development capacities.

This indicator, drawn from the 2023 global *Lancet* Countdown report, uses country-level heat-related labour capacity loss (expressed as potential work hours lost) across four sectors (services, manufacturing, construction, and agriculture), and estimates the potential loss of earnings by multiplying this labour capacity loss with the average earnings per hour for each country, sector, and year. This potential loss is presented in billions of real 2022 USD and as a percentage share of GDP.[22]

In 2022, the national potential income loss from heat-related labour capacity reduction represented USD$1.78 billion which is equivalent to 1.34% of national GDPs in Latin American countries, on average. Venezuela, Nicaragua, El Salvador, and Honduras had the highest total potential loss as a proportion of GDP: 6.9%, 4.7%, 1.94%, and 1.94%, respectively, while Chile had the lowest percentage loss (0.02%). The highest potential income losses are estimated in the agriculture (40.6% of total losses) and construction (32.5% of total losses) sectors (Fig. 9). Ecuador, Peru, Guatemala, Paraguay, Honduras, and Nicaragua lost more than 50% of their total losses in the agriculture sector, and Chile lost 56.3% of its total losses in the construction sector, followed by Argentina (46.1%), Bolivia (45.2%), and Panama (44.4%).

Indicator 4.1.4: costs of the health impacts of air pollution - headline finding: the monetised value of premature mortality due to air pollution in Latin America was, on average, equivalent to 0.61% of GDP, or to the average income of 6.6 million people in 2020

Air pollution is an important environmental threat to human health in Latin America (indicator 3.3). Premature mortality due to air pollution has significant societal and economic costs as people get ill and die during their
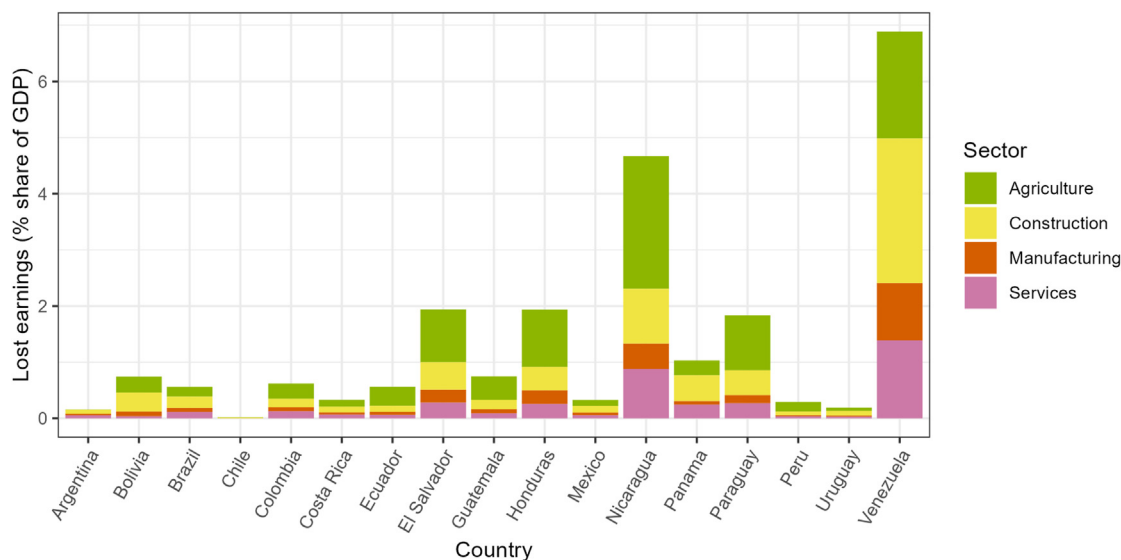
Countdown

Fig. 9: Loss of earnings from heat-related labour capacity reduction by sector in Latin America in 2022.

economically active lives. This situation impacts not only their family and potential familiar income, but also labour force productivity.[100]

This indicator draws from the 2023 global *Lancet Countdown* report and tracks the premature mortality cost from exposure to anthropogenic ambient $PM_{2.5}$ air pollution by providing a monetised valuation of the years of life lost (YYLs). Data for Mexico and South American countries were included, with other countries in Central America excluded due to the scarcity of national-level data on air pollution-related mortality.

In 2020, the total monetised costs of premature mortality due to air pollution in Mexico and South America were equivalent to the average income of 6.6 million people in the region. Chile, Peru, and Mexico registered the highest losses, equivalent to 1.63%, 0.91%, and 0.83% of their GDP (or the equivalent average income of 1,600, 900, and 800 thousand people, respectively). However, in addition to these direct effects, air pollution also has indirect economic effects that should be considered, including those related to healthcare costs due to a higher morbidity and a reduction in labour capacity due to illnesses. In this sense, these estimates may underestimate the impact of air pollution on people's health.

4.2: Economics of the transition to zero-carbon economies

Indicator 4.2.1: clean energy investment - headline finding: clean energy investment in Latin America grew to US$58.3 billion in 2022, a 6.8% increase compared to 2021, and exceeded investment in fossil fuels by 13%

Clean energy investment is essential for mitigating climate change and reducing air pollution. Using data

from the IEA,[101] this indicator monitors trends in energy investment in the IEA's Latin America region (Table A9 in the Appendix). In particular, it compares the investment in clean energy (including renewable energy, energy efficiency, electricity networks, nuclear, low-emission fuels, carbon capture, utilisation and storage and energy storage) with investment in fossil fuels.

Clean energy investment exceeded fossil fuel investment in Latin America by 13% in 2022 (USD$58.3 billion vs US$51.5 billion) (Figure A40 in the Appendix). Clean energy investment in 2022 was 6.8% higher than in 2021 but has mostly stagnated since 2015. Fossil fuel investment grew slightly in 2022 (by 2.8%) but has fallen by 44.5% from USD$92.8 million in 2015, with total energy investment (both clean energy and fossil fuels) falling 25.5% from USD$147 billion in 2015 to US$110 billion in 2022. Energy efficiency accounted for 7.1% (USD$7.9 billion) of all energy investment in Latin America in 2022, up slightly from 5.5% in 2021. To be on track for net-zero emissions by 2050, global clean energy investment must nearly triple by 2030 and fossil fuel investment must reduce to less than half its current value, and Latin America must play its role in helping to deliver this transition.

Indicator 4.2.2: net value of fossil fuels subsidies and carbon prices–headline finding: all countries reviewed in the region had a net-negative carbon price in 2020, reflecting an overall fossil fuels net subsidy of US$23 billion. The value of the resulting net subsidies represented, on average, 17% of national health budgets in Latin American countries

Subsidising fossil fuels means that public money is used to pay for health-harming emissions instead of

promoting good health. For a fast fossil fuel phase-out, governments need to stop promoting fossil fuel burning through subsidies, and redirect resources to enable a healthy, net-zero transition.

This indicator draws from the 2023 global *Lancet* Countdown report and compares fossil fuel consumption subsidies and carbon prices to estimate net-economy-wide average carbon prices and revenues.[22] In 2020, all Latin American countries analysed (n = 9) had net-negative carbon prices (i.e., provided a net subsidy to fossil fuels), accounting for a net total subsidy of US$23 billion. Brazil, Venezuela, and Argentina had the higher subsidies: 7.5, 5.6, and 4.6 billion US$, respectively. Overall, subsidies have fallen from 2010 to 2020 (except for Venezuela), but the net amount paid to fossil fuel subsidies has represented substantial proportions of the national health expenditures every year. In 2020, the highest net subsidies as a percentage of current health expenditure were seen in Venezuela (123%), Argentina (10.5%), Bolivia (10.3%), Ecuador (8.3%), and Chile (5.6%) (Figure A41 in the Appendix).

Conclusion

This section demonstrates that climate change not only directly affects the health of populations, but is also very costly to countries by affecting assets, lowering labour productivity, and increasing the costs of ill-health (indicator 4.1.2 and indicator 4.1.4). Additionally, these economic impacts then impact the social determinants of health, affecting the health of populations and creating a vicious circle of poverty, deeper inequalities and poor health.

The indicators about the economic impact of climate change and its mitigation suggest that costs to Latin America in 2022 were substantial. Economic losses due to weather-related extreme events were especially high in 2022, but the rate of uninsured losses remained close to 93% (indicator 4.1.1). This situation calls for more support in the use of insurance as an instrument to reduce vulnerability to extreme events, especially in countries with low incomes. The monetised value of heat-related mortality of people aged 65 and older in Latin America has increased in recent decades and is of particular concern in tropical countries (indicator 4.1.2), suggesting the need to implement programs that protect the most vulnerable population. Overall potential loss of earnings from heat-related labour capacity reduction in Latin America declined slightly from 2021 to 2022, but some sectors, like construction, presented an increase, thus requiring interventions that can address the effects (indicator 4.1.3).

To transition to a net zero-carbon economy, investing in clean energy is key. Such investments in Latin America were slightly higher in 2022 than in 2021, exceeding fossil fuel investment. However, there has been little growth in clean energy investment since 2015 (indicator 4.2.1). A much larger effort is required to make sure Latin American countries are not left behind in the transition to net-zero economies, which could exacerbate global inequities. Private investment and international cooperation could play a more important role in promoting this transition. Using sustainable and cost-effective energy sources (i.e., wind, solar, geothermal, hydropower, and biomass) would bring substantial benefits for climate, health, and economies in Latin America.[102]

Redirecting public spending from fossil fuel subsidies (indicator 4.2.2) to energy transition and energy equality is a way to promote good health and prosperous societies. Nonetheless, this redirection and transition should be carefully planned and implemented. Low-income populations are usually the most affected when removing these subsidies as the outcomes may include higher energy prices, inflation, and lower economic activity. However, it is still necessary to correctly balance these impacts with the costs of climate change inaction (Panel 5).

Section 5: public and political engagement

Engagement with health and climate change of key actors in society is essential to drive and enable health-promoting climate change action. Measuring public and political engagement across time can help identify current barriers and limitations in the understanding of the links, co-benefits, and trade-offs between health and climate change policy in Latin America, as well as monitor changes in such understanding as global conversations and actions evolve. Recognising the interconnectedness of health and climate change can foster effective collaboration among nations in addressing shared challenges.

This section tracks five indicators on the engagement with health and climate change. Information on news coverage of health and climate change in Latin America is analysed (indicator 5.1); social media engagement —a new indicator developed for Latin America— is tracked using posts and interactions on Facebook (indicator 5.2); scientific publications on the intersection are also analysed (indicator 5.3); governmental engagement is tracked by analysing the United Nations General Debate and NDCs (indicator 5.4); and engagement of the corporate sector is tracked by examining the mentions of health-related terms in United Nations' Global Compact Communication of Progress (GCCOP) reports (indicator 5.5). For specific details on the methods and additional analyses, please refer to Section 5 in the Appendix.

Indicator 5.1: media engagement with health and climate change–headline finding: newspaper coverage of health and climate change continued an upward trend and reached the highest level of 1260 articles in 2022. However, the proportion of climate change articles mentioning health has decreased over time

News media play a key role in placing key issues on the public and political agendas. Analysis of news coverage

Countdown

Panel 5: Potential economic costs associated with climate change inaction in Latin America.

The evidence clearly shows that the impacts of climate change on the health of populations, natural ecosystems, critical infrastructure, and other human systems bring cascading economic consequences and losses.[22] If mitigation and adaptation policies are not adequately and timely planned and implemented, then climate change inaction poses a significant threat to social development progress up to date and a huge obstacle for Latin American countries to continue progressing.

To understand the economic impacts of climate change inaction, some countries in the region have been performing such studies. For instance, it was estimated that the average annual health cost of mortality and morbidity due to temperature changes in Chile would be USD 564 million by mid-to-end of the century, which is approximately 10% of the Health Ministry's budget for the year 2020. However, there were other unquantified health effects in the study such as respiratory issues from wildfires, outbreaks due to contaminated food and water consumption, and injuries and fatalities due to extreme meteorological events.[103] Additionally, contemplating future scenarios with multiple impacts (Panel 2), raises strong concerns, as shifts in event frequency and severity could imply significant economic impacts.

Nonetheless, there are several limitations to studying the economic costs of inaction at the regional level. There is a high degree of uncertainty about the effects of climate change under different climate scenarios.[104] The quality of data in less developed areas, including Latin America, is of special concern. For example, Lieber and collaborators found that regional climate responses to El Niño and La Niña are more uncertain in poorer regions.[105]

In this sense, robust and detailed climate projects that reduce the uncertainty surrounding the health-related costs of inaction are imperative in Latin America. These projects would strengthen policymaking by facilitating the prioritisation and assignation of resources for better climate-resilient development pathways.

can provide significant information about how issues, such as health and climate change, are presented for public and political discussions.

This indicator draws on data from the 2023 global *Lancet* Countdown report and identifies how frequently news articles in leading newspapers from ten countries in Latin America included keywords related to "climate change" and "climate change and health", between 2007 and 2022.[22] For details, refer to the Appendix.

Since 2007, upward trends in news article coverage of "climate change" and "climate change and health" have been observed in Latin American outlets (Figure A42 in the Appendix). In 2022, news articles that included climate change and health-related keywords reached a record since 2007, totalling 1260 articles published across all sources. This represents an increase of 63% from 2021 to 101% from 2020. However, the proportion of news articles with climate change-related keywords that also include health-related terms has been decreasing in the past two years. While it represented 39.4% of all articles in 2020, in 2021 it only represented 28.1%, and 27.5% in 2022.

In 2022, *La Nación* in Argentina published the highest number of articles with a combination of health and climate-related keywords on record, representing 50.5% of the articles across 10 newspapers in Latin America. At the same time, the Argentine newspaper showed a significant increase throughout the year: from 41 articles in the first quarter to a peak of 400 articles in the fourth quarter of 2022 (155 only in November), which represents a unique record compared to any other quarter in any newspaper during the 16-year analysis period. Besides *La Nación*, four other newspapers — which represent 27% of all the articles with combined keywords in 2022— showed an upward trend compared to 2021: *El Comercio* in Ecuador (287%), *El Tiempo* in Colombia (32%), *La Nación* in Costa Rica (29%), and *O Globo* in Brazil (7%). *El Mercurio* in Chile, the newspaper with the highest number of articles with a combination of health and climate change keywords in the previous year (n = 184), showed a decrease of 16% in 2022 (n = 155) (Figure A43 in the Appendix).

This indicator will continue to evolve, with future iterations of the report aiming to add more relevant media outlets from Latin American countries. In addition to frequency analysis, a content analysis could provide more information to differentiate between news articles that mention the keywords but are not necessarily focused on health and climate change, and the number of articles that are entirely focused on the issue. This analysis could be useful to understand what qualities or characteristics make a health and climate change event or topic newsworthy, in order to explore strategies that would help to expand news coverage of this intersection.

Indicator 5.2: social media engagement with health and climate change–headline finding: social media posts related to health and climate change increased by 410% from 2017 to 2022

Social media platforms play an important role in the creation and dissemination of public discourses. The affordances of social media allow users to become informed —or misinformed— on a variety of issues in ways that traditional media cannot. The creation of echo chambers can lead to polarisation, but these platforms can also signal what issues users are paying attention to.

This new indicator tracks social media engagement in health and climate change in 17 Latin American countries. CrowdTangle, from Meta, was used to search for all Facebook posts (including individual and organisational accounts, and public groups) that contained pre-selected keywords on health and climate change from 2017 to 2022. The use of Facebook is justified, for it is the most popular and visited social media platform in Latin America with a penetration rate of 77.8%.[106,107]

The search yielded over 68,000 posts mentioning health and climate change. Posts related to health and climate change have risen consistently throughout the last six years: a 410% increase in the number of posts was observed from 2017 to 2022 and a 60% increase from 2020 to 2022. Additionally, interactions with the posts through reactions, such as likes, *hahas*, love, anger, and others, have also increased in the same

period; however, the progression is not linear and a spike in 2017 was driven by Brazil (Fig. 10).

In 2022, Costa Rica, Chile, Bolivia, Mexico, and Argentina were the top 5 countries with most posts per 100,000 inhabitants. The countries with the lowest rate of posts per 100,000 inhabitants were Guatemala, Honduras, Nicaragua, and Venezuela. Regarding interactions, Costa Rica, Chile, Brazil, Mexico, and Bolivia are now top five, while Honduras, Panama, and Venezuela have the lowest rates of interaction per 100,000 inhabitants.

Also in 2022, posts from accounts categorised as "media" (e.g., journalists, newspapers, radio stations) received the most engagement (28% of the total), closely followed by posts from accounts related to "politics" (e.g., politicians, political parties, embassies, governments), reaching 21% of the total engagement. In contrast, posts from accounts categorised as "education" (e.g., universities, education sites, colleges) or "science" account for only 2% and 3% of total engagement, respectively.

Indicator 5.3: scientific articles on health and climate change–headline finding: the number of scientific papers on health and climate change focusing on Latin America increased at a rapid pace between 2017 and 2021, decreasing in 2022. However, despite this increase, the number of papers is still less than 4% of the global scientific publications on the subject in 2022

Scientific evidence is vital for informing public, private, and political responses to health and climate change.

Collaboration among scientists, policymakers, and citizens is necessary to promote diverse knowledge and pathways towards a healthier and sustainable future.

This indicator draws on the 2023 global *Lancet* Countdown report and measures the scientific engagement in health and climate change by tracking the number of scientific publications that include topics related to health and climate change.[22]

In general, the number of scientific papers on health and climate change focusing on Latin America has followed an upward trend, with notable increases from 2007 to 2021. However, this number slightly decreased in 2022 falling to levels just above those in 2019. Overall, the number of scientific articles referring to Latin America increased by 306% from 2003–2012 to 2013–2022 (Fig. 11).

Looking at the entire series (1990–2022), climate and health research is dominated by studies on the impacts of climate change on health (93.5% of the total), followed by a small fraction of studies focusing on mitigation (4%) and adaptation (2.5%). The health-related topics most frequently mentioned in the scientific papers included "viral diseases" (n = 401), "dengue" (n = 375), "mosquito vector dynamics" (n = 346), "infectious diseases" (n = 341), and "air pollution" (n = 279). Publications with at least one author affiliated to an institution in Brazil account for most of the increase in publication since 2007 (44%).

Compared to other regions, Latin America had a higher frequency of the topics "Leptospirosis" (3.4 times),
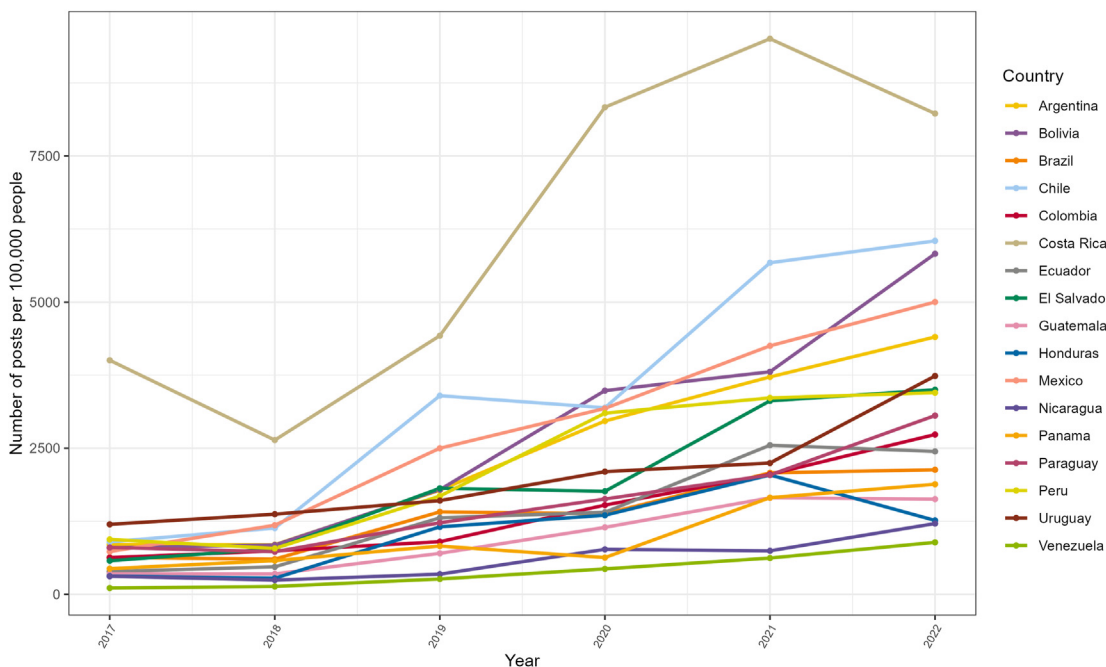

Fig. 10: Number of posts per 100,000 people on Facebook from 2017 to 2022 in each Latin American country.
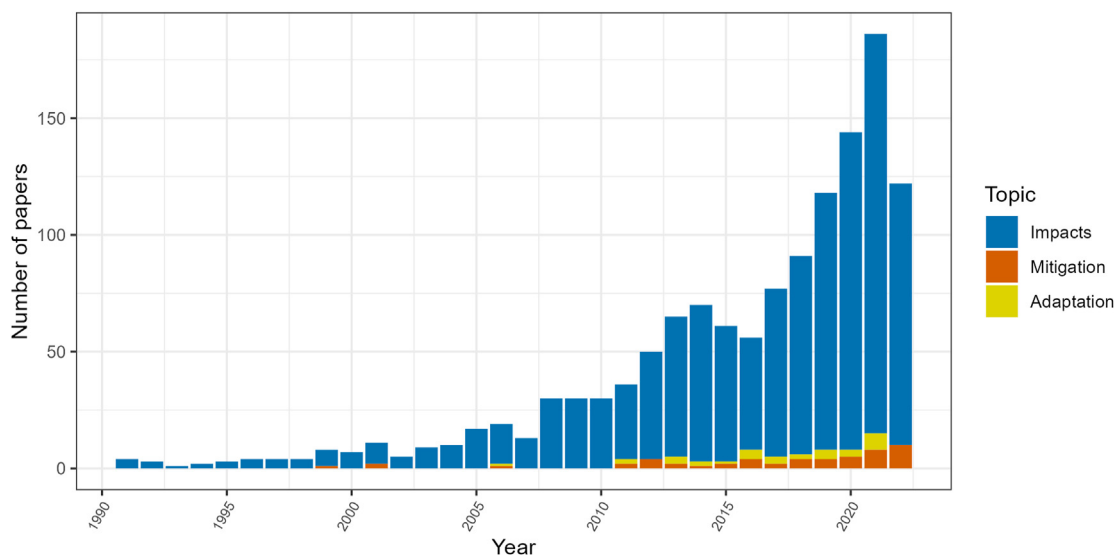
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Fig. 11: Number of publications on the nexus of health and climate change in Latin America (from 1990 to 2022).

"Mosquito, Mosquito vector dynamics" (2.7 times), and "Dengue" (2.7 times). Notably, the presence of topics such as "mental health" (0.43 times) and "adaptation" (0.53 times) lags in comparison to other regions.

Indicator 5.4: government engagement with health and climate change–headline finding: 16 of 17 Latin American countries mentioned "health" at the UN General Debate in 2022, but only four mentioned the intersection of health and climate change. *All NDC documents from Latin American countries make at least some reference to health.*

Monitoring government engagement on health and climate change is crucial as the success of the Paris Agreement hinges on collective national commitments. With the momentum building for the climate agenda in the Latin American region en route to COP30 in Brazil, integrating health considerations into climate policies in the upcoming NDC cycle holds immense opportunities. This could help achieve a comprehensive climate and health governance that could bring numerous benefits to populations and economies while promoting climate action. Policymakers and advocacy groups can leverage these data to encourage further engagement and increase climate ambition. Countries that recognise the interconnectedness of health and climate change might collaborate more effectively in addressing shared challenges.

This indicator draws from the 2023 global *Lancet* Countdown report and monitors governmental engagement on health and climate change by tracking i) the mentions of climate change-related and of health-related terms in statements made by national leaders at the UN General Debate (UNGD), and ii) the inclusion of health terms in NDCs submissions.[22]

Overall, Latin American governments increasingly recognise the topics of health, climate change, and their intersection. However, although 16 of 17 Latin American countries mentioned health in the UNGD, only four mentioned the intersection between health and climate change in 2022: Costa Rica, Guatemala, Mexico, and Venezuela. This represents a marked decrease compared to 2021, where 10 of 17 countries mentioned this intersection (Figure A44 in the Appendix).

Regarding NDCs, the 17 countries for which NDCs are available mention "health" in their NDCs (either first, second, or third versions), with most of the health-related mentions in newer versions. Considering the latest NDC versions of each country, the most common health-related topics are adaptation and mitigation. Additionally, the topics of "infectious diseases", "diseases", and "nutrition" appear as the most mentioned in a health-specific context. Increasing trends can be seen in mentions of "gender" and "knowledge" featuring in 80% and 100% of the 3rd NDC iteration of country commitments, respectively. However, the topics of injuries, co-benefits, and one-health are not frequently mentioned in the documents.

Indicator 5.5: corporate sector engagement with health and climate change - headline finding: in 2022, engagement among Latin American companies with health and climate change reached its second highest level since 2011, only behind 2021, with 29% of companies referring to the health dimensions of climate change in their 2022 UN Global Compact Communication of Progress reports

The corporate sector has a great capacity to exert significant influence in reducing global GHG emissions and other pollutants, contributing to the enhancement of overall population health. Transnational corporations hold

the potential to assume a pivotal position as guardians of the biosphere. Within this framework, numerous corporations have willingly joined the UN Global Compact, which, while voluntary and sometimes criticised for lacking accountability, promotes sustainability and commitment to social and environmental responsibility.

This indicator draws from the 2023 global *Lancet* Countdown report and tracks mentions of climate change and health terms in the Global Compact Communication of Progress (GCCOP) reports.[22]

The number of companies submitting GCCOP reports has increased from 391 in 2011 to 1081 in 2022, a 176% increase (Figure A45 in the Appendix). In 2022, the engagement of corporations with health was high across all Latin American countries (86%), followed by engagement with climate (72%). However, the engagement with the intersection of health and climate change is still low (39%), although a significant increment has been observed since 2011 (12%). Similarly, the proportion of GCCOP reports that refer to the intersection of health and climate change and gender has slightly increased over time, reaching a peak in 2019 (13.8% of reports) but decreasing to 3.8% in 2022.

Conclusion

Overall, this section demonstrates that public and political engagement in health and climate change has increased in Latin America over the years. However, important gaps still remain. According to the 2023 *Lancet* Countdown report, Central and South America have the lowest political engagement with health and climate globally,[22] demonstrating that considerable work has to be done in raising awareness of the scientific evidence linking health and climate change.

News media coverage has increased in almost all countries in the region (indicator 5.1), with important peaks of coverage around global events (e.g., UNFCCC Conferences of Parties). For ongoing engagement of media and the public, it is important that this coverage continues throughout the year, informing people about different aspects of climate change and contributing to correct communication (Panel 6). The increasing engagement of the public through social media shows that people want to be involved in the discussion (indicator 5.2); however, several challenges remain in understanding the quality and direction of this engagement. Also, scientific engagement is translated to an increasing number of scientific articles (indicator 5.3), with most of them covering impacts of climate change rather than adaptation and mitigation actions or policies, which scientific evidence is essential in informing. However, despite this increase, the number of papers is still less than 4% of the global scientific publications on the subject in 2022. To comprehensively understand the complexity and potential solutions at regional and local levels, a greater expansion of this perspective would be positive for evidence-informed

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Panel 6: Climate change in Latin America in danger of an infodemic.

Climate change communication in Latin America has not experienced the same scepticism, denialism, contrarianism, or obstructionism as in the United States, Europe, or Australia.[108,109] Conversely, misinformation and disinformation surrounding health crises, such as the COVID-19 pandemic, suggest that the communication of the intersection of climate change and public health could become a victim of an "infodemic".[110]

The WHO has defined "infodemic" as *"too much information including false or misleading information in digital and physical environments during a disease outbreak"*, which may cause more confusion among people and lead to mistrust, undermining the public health response during emergencies.[111]

As climate change worsens, along with extreme events and potential public health emergencies, several questions arise: how do news media, social media users, scientists, governments, and corporations understand and communicate the health impacts of climate change, scientific uncertainty about the intersection, or associated mitigation and adaptation costs beyond the frequency of such communication? To what extent are sceptical voices present in these social discursive arenas, and how is the issue framed?

Undoubtedly, these questions, and many others, are worth analysing. In this sense, some reflections may contribute to infodemic management and support social trust building, especially during public health emergencies.[112] Clear and trustable engagement and communication between authorities, influencers, media, corporations, scientists, and the public are key for climate-resilient development pathways and prosperous societies.

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climatic policies, including not only scientists but also health workers (Panel 7).

The engagement of governments and corporations with the health dimensions of climate change (indicator 5.4 and indicator 5.5) is paramount for climate action, yet ambition from these actors needs to level up to the urgency of the matter. The intersection of health and climate change is barely mentioned by governments in UNGA, and National Determined Contributions scarcely include health and climate change-related topics. Although the growing efforts of corporations in addressing the intersection of health and climate change is a positive development, it highlights the fact that only a minority of companies are actively engaging in this vital link. This underscores the imperative for greater engagement from this influential group of stakeholders in the future. Furthermore, there are apprehensions regarding the efficacy of the UN Global Compact and the genuine motives behind sustainability initiatives that might go beyond mere greenwashing claims. To make this commitment truly impactful, corporations must rise to the occasion by implementing substantial climate measures that contribute to adaptation and mitigation.

Conclusion of the 2023 Latin American report of the Lancet Countdown on health and climate change

The 34 indicators in this report demonstrated that Latin American populations are progressively being affected

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by a changing climate. Extreme heat is intensifying, leading to 248% and 271% more days of heatwave exposure in 2013–2022 among infants and people older than 65 years of age, respectively, compared to 1986–2005. Also, heat-related mortality among people above 65 years old has increased by 140% from 2000–2009 to 2013–2022, which translates to significant economic losses, equivalent to the average income of 451,000 people. Similarly, the transmission potential for dengue by *Aedes aegypti* increased by 54% from 1951 to 1960, which aligns with the outbreaks and increasing cases of dengue that have been happening lately in Latin America.[30] Economic losses in 2022 were nearly eight times the $2 billion in 2021, mainly due to floods and landslides in one country (Brazil). The interaction between anthropogenic climate change and natural phenomena is expected to further escalate these figures in the coming years,[21,33] jeopardising the social and health progress made up to date. Therefore, well-planned and integral public policies are needed to reduce the health impacts and subsequent economic costs of climate change.

Nonetheless, very few countries and cities have informed systematic assessments of their vulnerabilities and adaptive capacities to adequately face climate change challenges as climate risk. Vulnerability and adaptation assessments have also been scarcely conducted in the region (i.e., only Brazil and Guatemala). In terms of the enabling conditions for health adaptation, there has been a lack of change in urban greenspaces across the region since 2015, except for Colombia, Nicaragua, and Venezuela, highlighting the disparity between national and subnational capacities. Also, a lingering question persists of the necessity of including new budget allocations for health adaptation, which is crucial for driving significant change. All this situation limits the understanding of the severity of the problem and the actions needed to best protect populations from the growing hazards. If countries do not know their main vulnerabilities, capacities, potential impacts, and areas to be strengthened, it is likely that people's health and wellbeing will be impoverished, and economic resources will be misplaced and misused. Latin American populations do not have the luxury of wasting time and their limited economic resources due to weak climatic policies. It is expected that the recent climate and health pledges made at COP28 bolster funding for climate change and health adaptation projects in Latin America, leading to a transformation in climate action. However, several gaps remain: in 2022, the Green Climate Fund allocated approximately US$486 million, marking a 16% decrease from 2021, and none of the funds were allocated towards climate change and health initiatives.

Public policies in many countries in Latin America still allow and subsidise polluting energy sources. All countries reviewed in the region had a net-negative carbon price, reflecting an overall fossil fuel net subsidy of US$23 billion. While a 6.8% increase in clean energy investment in 2022 was estimated, signalling progress towards low-carbon and renewable sources, the pace and scale of this transition remain inadequate compared to the urgent need for action. This situation results in millions of people still lacking access to cleaner fuels for cooking, especially in rural areas (i.e., 46.3% in Central America and 23.3% in South America), exposing them to high indoor pollution and subsequent poor health. Latin America is, as a result, lagging in the capacity to transition to a zero-carbon future, being left behind in the transition to a sustainable economy, and still suffering from the health impacts of a persistent overdependence on polluting, expensive, and inaccessible fossil fuel-based energy.

Finally, although public engagement with the intersection between health and climate change has increased over the years, formal and continuous engagement is needed. From a political and corporative engagement perspective, qualitative analyses of the information are needed as sometimes discourses and reports include the topic, but an important gap remains between discourses and practical implementation.

As anthropogenic climate change worsens, Latin America is at risk of continuing to damage the health of ecosystems and reversing the social progress that it effortfully has gained during the last decades. This vulnerability arises from a lack of preparedness and the

inadequacy of existing climate-related public policies. Latin America must enhance its efforts in three key areas to establish pathways towards health-centred and climate-resilient development.

Latin American countries require intersectoral public policies that simultaneously increase climate resilience, reduce social inequities, improve population health, and reduce GHG emissions

Population health is not solely determined by the health sector, nor are climate policies a sole responsibility of the environmental sector. To pave development pathways that consider good adaptation to climate change, great reduction of GHG emissions, and better social equity and population health, then more and stronger intersectoral collaboration is needed. These policies involve sectors such as finance, transport, energy, housing, health, agriculture, among others, requiring institutional structures and policy instruments that allow long-term intersectoral collaboration. Taking population health as an example, public health interventions and policies should not only be focused on hospitals, but also on how cities are designed and how they promote better health and wellbeing while reducing air pollution and GHG emissions. Similarly, to improve the climate resilience of health systems, critical services outside the health sector are key, including water and electricity services. In this sense, the health sector should work together with urban, transport, energy, and sanitary sectors, at national, regional, and local levels. Given the complex environmental, societal, and health challenges that Latin American societies are facing, it is a legal and moral mandate for all governments to act accordingly and level up a strong leadership and commitment, especially from the health sector.

Latin American countries need to accelerate an energy transition that prioritises people's health and wellbeing, reduces energy poverty and air pollution, and maximises health and economic gains

Energy transition in Latin America is still in its infancy and as a result millions of people are currently exposed to dangerous levels of air pollution and energy poverty. As shown in this report, the levels of air pollution, outdoors and indoors, are a significant problem in the whole region, with marked disparities between urban and rural areas. In 2022, Peru, Chile, Mexico, Guatemala, Colombia, El Salvador, Brazil, Uruguay, Honduras, Panama, and Nicaragua were in the top 100 most polluted countries globally.[115] Transitioning to cleaner sources of energy, phasing out fossil fuels, and promoting better energy efficiency in the industrial and housing sectors are not only climate mitigation measures but also huge health and economic opportunities for more prosperous and healthy societies. The precariousness of housing conditions[116]; limited access to reliable and clean energy for cooking, heating, and lighting; and fossil fuel-based transportation systems in Latin America are exacerbating poverty and poor health and wellbeing, potentially increasing and perpetuating poverty traps. Such initiatives address climate change, alleviate poverty, and mitigate health hazards, thereby diminishing social disparities and freeing up resources for investment in other crucial domains. Intersectoral policies play a pivotal role in facilitating this transition.

Latin American countries need to increase climate finance through permanent fiscal commitments and multilateral development banks to pave climate-resilient development pathways

Burning fossil fuels is very costly: fossil fuel-based energy is more expensive than renewable energy; fossil fuel burning contributes to climate change and damages the environment on which people's depend; and fossil fuelled-derived air pollution causes seven million premature deaths each year and a substantial burden of disease.[117] The transition to healthy, zero-emission energy, the transition to healthy food systems, and the acceleration of adaptation efforts would be economically profitable. However, to implement mitigation and adaptation policies that also improve social wellbeing and prosperity, stronger and solid financial systems are needed. Climate finance in Latin American countries is scarce and strongly depends on political cycles, which threatens adequate responses to the current and future challenges. It is time to change that pathway and invest in prosperous and more productive societies. Eliminate all fossil fuel subsidies and start subsidising cleaner alternatives, including renewable energy sources. This will create new jobs that will add value to society and avoid deaths and illness. To ensure the transition truly protects people and their health, and resource use is optimised, this financial support, should also support increased research, knowledge generation, and innovation: current global and local challenges need new ways to think and do things. Science, knowledge, and technology have historically shaped people's lives and now it is not the exception. Generate knowledge through observatories, public-private initiatives, and citizen science. Latin America has shown an immense social progress when the financial resources are correctly assigned, and now public policies for climate-resilient development need to take advantage of that.

Latin American countries need to build equitable and sustainable development pathways that are low-carbon and resilient to climate change challenges. By fostering government's commitment to these endeavours, Latin Americans will be able to live more just, equitable, and healthy lives. Transcending mere climate considerations, it necessitates collective action across all sectors of society: governmental, civil, academic, and individual.

Countdown

The 2023 Latin America Report of The *Lancet* Countdown on health and climate change offers valuable insights for the region, drawing upon the best available global data at the national scale. Nevertheless, relying mostly on national-level information may not capture the full complexity of the region's diverse landscapes and social phenomena that shape unique impacts and vulnerabilities to climate change. Therefore, the *Lancet* Countdown Latin America will continue expanding the understanding of the intersection between climate change and health in the region. This year's report already expanded the geographical area covered to include Central American countries. In future iterations, indicators will be revisited, and new indicators will be added to continue to understanding the phenomena and supporting communities and decision-makers in Latin America. Efforts will focus on tackling remaining challenges associated with current methods and data availability, including increasing the understanding of the complex link between migration and climate change, the impacts of drought, the potential gender differential impacts of climate change due to social discrimination, and the contributions of Indigenous and local knowledge to climatic policies, among others. This report not only delineates the current progress and monitors main advancements –or lack thereof– on climate change and health, but also unveils research gaps, methodological challenges, and limited data resources. Moreover, it calls for further research into crucial areas where information is limited. The *Lancet* Countdown Latin America opens an invitation for broader discussion and collaboration to address these pressing issues collectively.

Contributors

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All authors contributed to the overall paper structure and concepts and provided input and expertise to their relevant sections. Authors contributing to Working Group 1: AGL, LEE, YKPS, TSC, RS, EJZR, SD. Working Group 2: AD, CLl, LBV, YKPS FC, NG, DB, MSV, JDU, MYG, ZMC, SH. Working Group 3: DRR, SH, RS, TSC, AMC, NM, ES. Working Group 4: OM, JH, CP, DS. Working Group 5: BT, CGP, MS, MFS, MC, CS. SH, YKPS, CLl, LBV, MW, MR provided coordination, strategic direction, and editorial support.

Data sharing statement

Data will be made available from the corresponding author upon reasonable request.

Editor's note

The Lancet Group takes a neutral position with respect to territorial claims in published maps and institutional affiliations.

Declaration of interests

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.lana.2024.100746.

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