Trends in Health Sciences

Article

https://doi.org/10.47626/ths-2025-0001

Advancing evidence on climate- and health-centred solutions: the role of research in sustainable and climate-resilient development in Latin America

Avançando as evidências sobre soluções centradas no clima e na saúde: o papel da pesquisa no desenvolvimento sustentável e resiliente ao clima na América Latina

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ABSTRACT | Latin American countries are witnessing concerning and increasing health and well-being risks due to climate change impacts, which are exacerbated by social vulnerabilities. In this article, we emphasise the need for climate- and health-centred integral solutions to safeguard both people and the planet as well as three key roles of research for healthier, sustainable, and climate-resilient development in Latin America. Anthropogenic climate change threatens social progress in public health, sanitation, and housing, but also offers opportunities to build more equitable and resilient societies. The choice of fossil fuel-based energy sources, such as coal and gas, impacts both planetary and human health. Transitioning to clean and renewable sources of energy not only mitigates climate change but also reduces air pollution and improves population health. Additionally, given the intrinsic links between agricultural practices, food systems, and ecosystems, holistic approaches are vital. Policies must promote sustainable agriculture and equal access to nutritious food. As climate change challenges human health, integral approaches can optimise resources and provide health benefits. Research has a critical role to play in highlighting the links between health and climate change, generating actionable evidence, and advancing transdisciplinary efforts.

Keywords | Climate change; health; adaptation; mitigation; research; transdisciplinary.

RESUMO | Os países latino-americanos estão enfrentando riscos crescentes e preocupantes para a saúde e o bem-estar devido aos impactos das mudanças climáticas, os quais são agravados por vulnerabilidades sociais. Neste artigo, enfatizamos a necessidade de soluções integradas e centradas no clima e na saúde para proteger tanto as pessoas quanto o planeta. Além disso, destacamos três papéis fundamentais da pesquisa para um desenvolvimento mais saudável, sustentável e resiliente ao clima na América Latina. As mudanças climáticas antropogênicas ameaçam os avanços sociais em saúde pública, saneamento e habitação, mas também apresentam oportunidades para a construção de sociedades mais equitativas e resilientes. A escolha por fontes de energia baseadas em combustíveis fósseis, como carvão e gás, impacta tanto a saúde do planeta quanto a saúde humana. A transição para fontes limpas e renováveis de energia não apenas mitiga as mudanças climáticas, mas também reduz a poluição do ar, melhorando a saúde da população. Além disso, considerando os vínculos intrínsecos entre práticas agrícolas, sistemas alimentares e ecossistemas, abordagens holísticas são essenciais. As políticas devem promover uma agricultura sustentável e garantir acesso equitativo a alimentos nutritivos. Diante dos desafios impostos pelas mudanças climáticas à saúde humana, abordagens integrais podem otimizar recursos e proporcionar benefícios à saúde. A pesquisa desempenha um papel crucial ao evidenciar as conexões entre saúde e mudanças climáticas, gerar evidências para ação e impulsionar esforços transdisciplinares.

Palavras-chave | Mudanças climáticas; saúde; adaptação; mitigação; pesquisa; transdisciplinaridade.

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Submitted Jul 22 2024. Accepted Sep 19 2024.

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How to cite this article: Palmeiro-Silva Y, Llerena C, Risso A, Blanco L, Saliva S, Hartinger SM. Advancing evidence on climate- and health-centred solutions: the role of research in sustainable and climate-resilient development in Latin America. Trends Health Sci. 2025;67(1):e20250001.

Introduction

Anthropogenic climate change challenges all human systems (1). Ongoing changes in the diverse elements of the natural world create new challenges to human systems that were built and established under a climate that does not exist anymore. As efforts to mitigate the root causes of the problem and to adapt to a changing climate are slow to progress, populations and communities are becoming increasingly vulnerable and face heightened risks to their health and well-being.

The World Meteorological Organization (WMO) State of the Climate in Latin America and the Caribbean 2023 report highlighted that the 2023 was the warmest year on record, with a mean ambient temperature of 1.39 °C above the 1961-1990 period. Heavy rains, followed by flash floods and landslides, occurred throughout the whole region, with the most severe events in Brazil. Severe droughts were also recorded, particularly in Argentina, Brazil, Chile, Mexico, Nicaragua, and Panama, with significant impacts on agricultural production and commercial activities. Extreme heat was felt across the whole region, with some areas in Brazil exceeding 41 °C and almost 52 °C in Mexico in August. The conditions of drought and high temperatures were associated with high risks and actual wildfires in many countries (2,3).

These changes in climate and meteorological extremes, coupled with slow political and social progress in mitigating and adapting to climate change, are having a significant impact on the health and well-being of people across the region. The 2023 Latin America report of the Lancet Countdown on health and climate change highlighted multiple exposures and impacts that threaten health because of a changing climate. Between 1986-2005 and 2013-2022, infants and adults over 65 years old were exposed to 248% and 271% more heatwave days, respectively. Also, during 2013-2022, individuals were exposed to an additional 256 and 189 annual hours per person in which ambient heat posed at least a moderate and high risk of heat stress, respectively, during light outdoor physical activity (compared to 1991-2000). Considering a severe health outcome, the region experienced a 140% increase in heat-related mortality from 2000-2009 to 2013-2022. Additionally, the transmission potential for dengue by *Aedes aegypti* mosquitoes increased by 54% between 1951-1960 and 2013-2022, in line with outbreaks and increasing numbers of dengue cases in several countries (3).

The evidence shows that Latin American countries are witnessing severe and concerning risks to health and well-being, driven by a rapidly changing climate and vulnerable populations exposed to its effects. These health risks are not a matter for the future but are already affecting us in the present; therefore, urgent action is needed to protect both people's health and the environment that sustains us.

In this article, we focus not on the problems, but on the solutions. We discuss why integrated climate- and health-centred solutions are essential to safeguard both human and planetary health, and outline three key roles of research in advancing healthier, sustainable, and climate-resilient progress in Latin America.

The need for climate- and health-centred integral solutions

Anthropogenic climate change is a serious threat to the social progress made until now in Latin America (1,4,5), including progress on public health, sanitation, poverty, and housing,

among other areas. Nonetheless, it also poses significant opportunities to strengthen many of our already unequal systems and build better, fairer, healthier, sustainable, and climate-resilient societies for current and future generations.

Because climate change is a complex problem and its effects on human systems are multiple, compounded, and cascading, integral and multisectoral solutions are required (6). In this section, we elaborate on two examples of climate- and health-centred solutions that might contribute to take advantage of the opportunities presented by anthropogenic climate change.

Clean and renewable energy for the climate and health

Briefly, anthropogenic climate change is mainly caused by the burning of fossil fuels such as coal, crude oil, natural gas. These fuels are burned for electricity generation, cooking, heating, among other activities. This process releases large quantities of greenhouse gases (GHG) into the atmosphere, trapping more heat than needed and causing global warming (as well as changes in the composition of the ocean and other effects not covered here) (7). And although Latin American countries are not large emitters of GHGs compared to the United States or China, the use of fossil fuels has a significant local impact by polluting the air we breathe.

Latin American cities are among the most polluted cities in the world, with Ciudad de Mexico, Santiago, and Lima leading the list (8). The fuels and sectors responsible for this pollution vary, but include biomass, carbon, coal, diesel, and gas (natural or liquified petroleum) in energy, industry, transport, and household sectors. This air pollution is associated with increased mortality and incidence of respiratory and cardiovascular diseases and some cancers (3,9,10).

Because the fuels and sources of energy and electricity we use determine the health of the planet and ourselves, the choice to protect the health of both is in our hands. Clean and renewable energy is not only a climate measure to mitigate anthropogenic climate change, it can also reduce local air pollution, which has important positive impacts on public health.

Latin America has a significant potential for renewable energy, particularly solar and wind power. These sources increased by an average of 5.7 percentage points from 1991-2000 (2.7%) to 2011-2020 (8.4%). The highest increases are seen in Uruguay, Nicaragua, El Salvador, Honduras, Costa Rica, Chile, and Brazil (3).

Chile has emerged as a leader in decarbonisation and renewable energy, establishing ambitious plans for closing coal plants by 2025 and investing in renewable energy infrastructure (11), also supporting a green economy transition. Nonetheless, Chile continues to struggle with energy poverty (12) and high levels of air pollution. Therefore, multisectoral and integral policies are needed to multiply social and health wins and translate the benefits of a cleaner electric matrix and green economy to the daily life of people (13). For example, solutions and perspectives on renewable energy sources, energy efficiency at the industrial and household levels, electric public transport systems, and strict legal regulations should be discussed and planned altogether rather than in silos. Of course, this demands a high level of coordination, collaboration, and understanding that is sometimes are difficult to find and achieve.

Sustainable and climate-resilient agriculture for the climate and health

The second cause of anthropogenic climate change is the loss of carbon sinks due to deforestation, and important causes

of deforestation are commodity-driven deforestation and land-use change for agricultural purposes, which together account for around 80% of the total loss in Latin America (3).

Agriculture is a key economic and social activity in Latin America, accounting for a significant share of regional and national gross domestic product (14). However, modern agricultural practices and food systems have significant impacts on the planet (e.g., climate change, biodiversity loss, and soil degradation) (15). All these consequences are also threatening back food security and human health, creating a vicious circle.

Agricultural practices in Latin America account for 40% of the region's total CO_2e (carbon dioxide equivalent) emissions, nearly twice the global average (16). In 2020, the production and consumption of animal-based food products (i.e., cow and buffalo meat, dairy products, pig meat, poultry, and sheep and goat meat) accounted for 87% and 85%, respectively, of the region's agricultural CO_2e emissions (3).

At the same time, the food we produce, process, access, and eat has profound implications on our health. Nowadays, the region is facing a dual challenge in terms of human health: while some populations struggle with undernutrition, others face overnutrition, both of which have negative health consequences (17). In 2022, 247.8 million people in the region experienced moderate or severe food insecurity (i.e., forced to reduce the quality/quantity of the food or even went without food/eating for days) (18), with 24% of population not able to afford a healthy diet (19). This is linked to that stunting (i.e., impaired growth) in children under 5 years of age reached 11.5%, while the prevalence of overweight reached 9.7% in South America and 6.7% in Mesoamerica (18).

Because agricultural practices, food systems and ecosystems, and human health are inextricably linked, holistic approaches are needed. Integral policies must enable and promote sustainable (and local) agricultural practices, while promoting equal access to healthy food.

In 2021, Brazil announced the second cycle of the Brazilian Agricultural Policy for Climate Adaptation and Low Carbon Emission (ABC+), which runs from 2020 to 2030. This plan aims to promote more sustainable and resilient Brazilian agriculture by i) adopting an integrated landscape approach; ii) looking for synergies of adaptation and mitigation actions that limit the GHG emissions and reduce vulnerability of farming systems; and iii) fostering adoption and maintenance of sustainable systems, practices, products, and production processes (20). Although this plan is relevant to an agricultural country, it does not explicitly mention the relevance of it to human health and wellbeing.

There appear to be several policy gaps regarding the interconnections between agriculture, food systems, and human health. Based on the literature and policy documents, there are challenges related to silos and lack of cross-sectoral approaches (21), which may undermine the effectiveness of these policies in addressing complex problems. From a health perspective, it is also quite common to see recommendations for individual behaviour change (e.g., "eat healthier meals" or "cut your food waste") (22); however, these recommendations are far from effective when structural barriers impede people accessing healthy and nutritious food. This situation obliges us to think holistically about building sustainable and climate-resilient agriculture.

One promising approach is the food systems approach, which views agriculture, health and environmental sustainability as

interconnected (23). By focusing on the entire chain, policies can encourage sustainable agricultural practices while ensuring access to healthy and nutritious food. For example, policies could promote agricultural practices that protect and restore and soils and reduce GHS emissions while simultaneously improving infrastructure and markets for local nutritious food.

Role of research for healthier, sustainable, and climate-resilient progress in Latin America

Having presented examples of climate- and health-centred solutions, one question remains: what is the role of research in all this? Research and scientific evidence (both referred to hereafter as research) are critical stones in which many of the solutions and policies are built. In this section we highlight three key roles of research for healthier, sustainable, and climate-resilient progress in Latin America.

Making visible the interrelationships between health and climate change

Research and its appropriate communication have been key to making the link between health and climate change visible, which in turn has been critical to raising awareness of the problem, seeking solutions, and advocating and advancing climate action (24).

An example of this is the work of The Lancet Countdown on Health and Climate Change (www.lancetcountdown.org). Launched in 2009 and then formally launched in 2015, it is the first global academic-led group to track more than 40 indicators on diverse perspectives on health and climate change, including population exposure to climate change-related hazards, vulnerabilities to these hazards, the co-benefits of climate change mitigation, the economic and financial aspects, and public engagement with the topic. This group has been pivotal in informing international organizations, the media, and decision-makers on the latest scientific evidence on the relationship between health and climate change.

The visibility of this link has also shaped the way certain climate-related hazards are communicated and the public's perception of risk (25). As a general example, not so many years ago, heatwaves were usually portrayed as synonymous with "ice cream and the beach"; now they are more likely to be communicated as a time for vigilance and preparedness, potentially saving many lives (26).

Generation of evidence for action on health and climate change

For decades, research has been generating evidence to inform decision making and climate action. A key example is the scenario-based analysis of shared socio-economic pathways (SSP). SSPs are narratives of future potential societal and economic development pathways that have been used as inputs to climate models. These models were integrated into the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (7).

These projections (not predictions) represent alternatives of how the world might evolve in the presence (or absence) of different climate policies. Depending on the choices we make today, there are a number of plausible futures: "taking the green road," in which the world gradually shift towards a more sustainable path; "middle of the road," in which the development follows similar historical patterns; "regional rivalry," in which national and regional competitiveness and

security issues grow; "inequality," in which inequalities increase; and "fossil-fuelled development," in which fossil fuels are largely exploited with investment increases in health and education (27).

These science-driven SSPs are not only the latest scientific evidence for better climate modelling but also an important opportunity to support and aid decision making. Based on them, decision-makers at different levels are not left without evidence on potential future development pathways; on the contrary, the evidence is there, and the choice is ours.

Advancing transdisciplinary research and action in health and climate change

Through questioning, discussion and discovery, research has the power to convene and potentially address complex problems. As climate change is a complex problem, it has been suggested that transdisciplinary research and action may provide relevant elements for advancing climate- and health-centred solutions (28).

Transdisciplinary research is generally understood as a research process that integrates knowledge across academic disciplines and with non-academic stakeholders, with the purpose of solving societal problems (29). Constructive discussion and dialogues that integrate different people from different areas, disciplines, and sectors have the advantage of providing comprehensive analyses that potentially result in long-lasting and more integral solutions (29). Additionally, integrating the community voice and perspective into research has several advantages, including a better understanding of the problems and implementation of potential solutions.

An example of the need for transdisciplinary research can be found in Peru. Although important progress has been made, health care systems are still not equipped to provide researchers with the necessary information outside the main metropolitan areas, limiting the ability to analyse high-quality data for decision-making in regions such as the Andes or the Amazon. The development of interoperable health information systems is a crucial area that could significantly improve data collection, integration, and analysis. In this case, transdisciplinary research and action could provide relevant opportunities to further strengthen holistic and integral dialogues and solutions.

Conclusion

As anthropogenic climate change is imposing diverse challenges to human health and wellbeing, holistic and integral approaches have the potential to optimise resources and time, presenting significant opportunities to mitigate climate change and exploit health co-benefits. Research has several roles to play, including making the interrelationships between health and climate change visible, generating evidence for action, and advancing in transdisciplinary research and action.

DISCLOSURE: The authors report no conflicts of interest.

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