

Planetary health and its relevance in the modern era: A topical review

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Abstract

Planetary health is a relatively new concept that has gained traction in recent years due to the urgent need to address the health of our planet and its inhabitants. It refers to the interdependent health of both humans and the environment, recognizing that the two are inseparable and that the health of one is intricately linked to the health of the other. This article aims to advocate changes in how health care for both the environment and humans is envisaged, and aligned with sustainable development goals using ethically sound, solution-oriented, and practical approaches to education. Rapid industrialization, urbanization, and population growth led to environmental degradation and climate change in this era. These factors have profound implications for human health, with the World Health Organization estimating that 23% of global deaths are linked to environmental factors. Climate change and extreme weather events are exacerbating existing health problems. Air pollution, water pollution, and toxic chemicals are additional environmental factors that add to it and lead to health issues, including non-communicable diseases and death. A collaborative and interdisciplinary approach is needed to address planetary health challenges, including working across sectors and investing in research to understand better the complex interactions between human health and the environment. By promoting sustainable development and protecting the planet's health and inhabitants, we can ensure a healthy future for generations.

Keywords

Environment, health care, outcome, planetary health

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Introduction

Humans are progressing every second, with the world moving from 3G to 5G and the latest advances in artificial intelligence and robotics. As humanity marches forward at a great pace, environmentalists have sounded an alarm over the breach of planetary boundaries (a set of biophysical interdependent parameters akin to the vital signs of Earth's health) caused by the Great Acceleration (the unprecedented growth of human-driven trends since the 1950s such as population, energy use, pollution) and approaching climate tipping points such as melting ice sheets, changing ocean currents, thawing permafrost.^{1–3} The increasing impact of human interventions is threatening our long-term survival and can irreversibly impact the planet's ability to sustain modern life.⁴

In recent years, there has been a growing recognition of the intricate interplay between human health and the health of our planet. Planetary health was first defined in 2015 as the “health of human civilization and the state of the natural

systems on which it depends.”⁵ It is an interdisciplinary field that explores the consequences of human-induced disruptions on the environment and the subsequent repercussions on human health.⁵ Recognizing the interdependence between earth's natural ecosystems and human health, The World Health Organization (WHO) introduced planetary health as one of the core terms in its “Health Promotion Glossary of Terms 2021.”⁶

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Continuous environmental destruction for human gain has mortgaged the health of future generations. One of the greatest impacts of climate change is the rampant spread of infectious diseases.⁷ The Intergovernmental Panel on Climate Change (IPCC) 2022 report warned of an escalation of infectious diseases if climate change continues to worsen.⁸ Furthermore, environmental factors such as climate and air pollution have been found to influence the susceptibility, transmission, and severity of the coronavirus disease 2019 (COVID-19).⁹ Hence, it is crucial to recognize and address the role of human activities in the emergence and spread of infectious diseases. By adopting sustainable practices and preserving natural habitats, we can better protect planetary health and mitigate our negative impact on the environment and our collective well-being.¹⁰

Human activities cannot completely undo the damage done to the earth, but we can certainly slow it down by embracing new development goals based on environmentally sustainable health care, such as adopting a carbon-neutral healthcare policy, reducing greenhouse gas emissions, engaging healthcare personnel as agents of sustainability, and increasing community resilience.¹¹ Such practices can simultaneously provide both environmental and health benefits such as health protection, health promotion, and efficient energy usage leading to financial savings in health systems.¹² To adequately address this issue, we must change our focus to planetary health, which requires appreciating the value of natural systems and grasping the potential harm that may result from human exploitation of these systems. To effectively promote planetary health, raising awareness of the connections between environmental, social, and health challenges is vital. By recognizing and addressing these shared issues, we may pursue answers that benefit the globe.

This topical review presents the increasing need for planetary health against the backdrop of the impacts of climate change on health. We discuss the challenges faced due to the absence of planetary health-specific instruction in academic curricula, especially affecting the youth, and recommend solutions for overcoming it. This review aims to advocate for changes in how health care for both the environment and humans is envisaged, and aligned with the SDGs using ethically sound, solution-oriented, and practical approaches to education and research.

Methods and materials

For compiling this narrative review, we performed a comprehensive literature search using the keyword “planetary health” and gathered input from recent publications in PubMed, Scopus, EMBASE, and Cochrane library. In addition, we included relevant information from gray literature on Google Scholar, websites of the United Nations (UN), and their specialized agencies.

Need for planetary health

With the current technological advancements, we are facing a setback with a deteriorating environment. A lot of damage to biodiversity has been done. Incidents of deforestation, ocean acidification, wildlife loss, and forest fires reflect the damage humans have done to the environment. This is directly linked to the degrading effect on people’s lives.¹³ The increase in environmental degradation is directly related to the rise in non-communicable diseases in the human population.¹³ The vision of improved future global health using sustainable development goals is at risk if the current human interventions are not controlled and balanced appropriately.¹⁴ According to the IPCC, the world could be 1.5°C warmer in the coming years.¹⁵ The IPCC Sixth Assessment Report warns of increasing frequencies of extreme climate events in the coming years if global greenhouse gas emissions are not brought under control.¹² While some impacts of climate change have been deemed “irreversible” (such as rising sea levels and ocean temperatures and melting of ice sheets and glaciers), global warming can be halted and even reversed by aggressive interventions.¹² Planetary health helps us understand that human growth does not have to come at the cost of environmental damage; humans can develop by keeping peace with ecosystems.

We can positively impact the environment and human well-being by introducing sustainable healthcare practices and planetary health education.^{11,16} Taking proactive steps toward sustainable development may significantly delay future degradation and contribute to our planet’s long-term health and resilience. By building a foundation for understanding the interconnections between environmental, social, and health crises and searching for solutions to the shared challenges that the globe faces today, planetary health has become more important than ever.¹⁷

Various aspects need to be addressed to solve global health difficulties, with funding and resource allocation being critical.^{18,19} What matters is not only the quantity of money spent but also the manner in which those resources are allocated and utilized.¹⁹ There is a need to encourage smart public spending via priority setting in health care, directing funds toward cost-effective interventions, which result in saving more lives and advancing health equity.²⁰ Key aspects of planetary health, a modern approach, and strategies for action are enumerated in Table 1.

Challenges in planetary health and lack of proper curriculum

Climate change is not a new issue but has been discussed for a long time. The upcoming 2024 UN Climate Change Conference is another step toward addressing the urgent issue of climate change and fostering international collaboration to develop impactful solutions. On the contrary, a significant gap exists between policy making and actual

Table 1. Key aspects of planetary health and its relevance in the modern era.

Aspect	Description
Definition	Planetary health refers to the interdependent health of human civilization and the natural systems on which it depends
Key drivers	<ul style="list-style-type: none"> - Climate change - Biodiversity loss - Land degradation - Pollution - Unsustainable resource use - Population growth and urbanization
Impacts	<ul style="list-style-type: none"> - Increased incidence of infectious diseases - Declining air quality and respiratory diseases - Loss of biodiversity and ecosystem services - Food and water insecurity - Mental health issues related to environmental degradation - Social and economic inequalities
Planetary health approach	<ul style="list-style-type: none"> - Holistic perspective integrating human health and environmental health - Emphasis on prevention and proactive measures to protect and restore the health of both human and natural systems - Collaboration across sectors and disciplines to address the complex and interconnected challenges of planetary health - Promotion of sustainable development and sustainable consumption and production patterns
Strategies for action	<ul style="list-style-type: none"> - Mitigating climate change through reducing greenhouse gas emissions and transitioning to clean energy sources - Conserving and restoring ecosystems to safeguard biodiversity and enhance ecosystem services - Implementing sustainable agriculture practices to ensure food security and reduce environmental impacts - Promoting public health measures, such as access to clean water and sanitation, to improve human well-being - Enhancing environmental governance and policy frameworks to promote sustainable development and protect planetary health - Raising awareness and education on the importance of planetary health and individual actions to contribute to its preservation

implementation on the ground, thereby failing to achieve the required targets and not having the desired impact.²¹

Educating children about deforestation and greenhouse gases is not enough, providing them with the tools and opportunities to turn their ideas into action is vital. To empower the future generation and effect real change, the school curriculum must include planetary health education which concentrates on understanding the environmental crises and the negative impacts they have on health.^{5,16} Learners may acquire the skills necessary to initiate transdisciplinary and mutually reinforcing activities by introducing planetary health competencies into education at all levels and disciplines. This technique will enable students to contribute to protecting and restoring planetary health while also working toward achieving the SDG targets.²² Young people have to advocate for change since they are the future. By instilling in the next generation a culture of creativity and entrepreneurship, we can empower them to think beyond the restrictions of a blank sheet of paper and actively contribute to discovering long-term solutions to environmental challenges.^{23,24}

Youth participation in global events, such as the recent 28th Climate Change Conference of the Parties (COP 28) in Dubai,²⁵ highlights the need to incorporate the younger generation in addressing global health concerns. We can harness the power of youth to drive change and shape the future of

health care using their excitement, innovation, and fresh perspectives. Through mentorship programs, youth-led organizations, and technology-driven platforms, we can amplify their voices and turn their ideas into real-world activities that contribute to positive change. It is critical to provide opportunities for young people to engage with legislators, scientists, and business leaders, enabling them to adopt policies and practices that prioritize the well-being of our planet and future generations.

There is an urgent need to bring planetary health into the education system. Importantly, planetary health should feature prominently in the curricula of all healthcare disciplines since the health system is one of the major contributors to the global carbon footprint.²⁶ The healthcare sector contributes to approximately 4.4% of global net emissions, a value significant enough to hurt the environment.²⁶ To put things into perspective, if the entire health sector were a separate nation, it would be the fifth-largest emitter in the world.²⁶ As responsible healthcare providers, it is their duty to treat patients, keep the planet healthy, and let it heal. The fact that human well-being is tightly interlinked with the planet's ecosystems cannot be neglected. Healthcare professionals need to safeguard the environment by reducing healthcare interventions in the ecosystem and targeting disease prevention as the primary goal, as it is more cost-effective and rewarding for

human health in the long run while offering secondary prevention, which is disease treatment.⁵ Recent research among students of medicine, nursing, and allied professions revealed a significant knowledge gap on issues related to the environment such as climate change and global warming.^{27–29} This knowledge gap is a challenge to properly addressing declining ecosystems and their consequences for human health. Recognizing the critical need for action, including planetary health education within clinical education and healthcare systems, becomes a crucial first step.³⁰ Incorporating planetary health education into the health curricula and building peer education systems may equip healthcare practitioners with the knowledge and skills to understand the connections between the environment and human health.¹²

Therefore, bridging the knowledge gap via planetary health education for healthcare practitioners is critical to ensuring they have the abilities and awareness to deal with the complex and interconnected concerns confronting our ecosystems and human health. We can work toward a more sustainable and resilient future for the planet and its inhabitants by providing healthcare professionals with the information and skills to incorporate planetary health principles such as planetary consciousness, integration, and interdependence into their practice.^{26,31}

Role of healthcare professionals as agents of change

There needs to be more emphasis on the threats and challenges climate change presents to the clinical practice of modern-day professionals since the health curriculum rarely addresses this burgeoning issue.^{30,32} It is imperative to learn about diseases and the pathophysiology underpinning climate-related exposures and illnesses, and only then will health professionals be able to recognize and manage them. Climate change is impacting health directly and indirectly, leading to death and illness from increasingly frequent extreme weather events, such as heatwaves, storms, and floods; the burden of climate-related mental health trauma; malnutrition arising from food insecurity; an increase in zoonosis and foodborne (waterborne and vector) diseases; financial poverty; and the rise of emerging and re-emerging diseases.^{30,32} These climate-sensitive health risks are disproportionately felt by the most vulnerable people, including women, children, ethnic minorities, poor communities, migrants or displaced persons, older populations, and those with underlying health conditions.³²

In the healthcare profession, activities related to ensuring access to care, navigating the system, mobilizing resources, addressing health inequities, influencing health policy, and creating system change are known as health advocacy.³³ Addressing climate change and health requires financial, institutional, and human resources. Despite the local and short-term economic costs of, for instance, using cleaner energy technologies, the benefits of reducing climate change

and its impacts are dispersed globally over decades. Local accrual of health gains can generate a political commitment to cleaner investments.³⁴

Physicians, as well as other healthcare professionals, are active in various roles. They can be involved in the physician–patient relationship, but they can also act as consultants, experts in political institutions, or participants in public discussions. Due to the impact of this change on people’s health, balancing these roles is crucial for reducing the negative effects of climate change on individuals’ health.³⁵ Clinicians are generally regarded as sources of authentic information; therefore, they are well poised to address the pressing issue of planetary health.³⁶ There are numerous ways in which one can champion the cause of planetary health at home or in one’s personal capacity. Employing educational materials at work, incorporating climate change and health into patient education materials, and taking it them into consideration in disease management and care protocols are a few strategies for integrating planetary health in professional settings. Other strategies include addressing energy efficiency and procurement strategies for climate change mitigation and adaptation in the workplace. Setting a personal example by reducing one’s carbon footprint and advocating for planetary health within the local community through support and engagement in meetings and events is also impactful. While action at all levels is important (from home to advocacy), physicians have a crucial role in leading the community and policymakers, who make decisions with huge impacts.³⁷

Besides physicians, there are professionals of other domains who play a vital role in curative and preventive health. Community health workers (CHWs) are frontline functionaries who play important roles in preventive healthcare delivery, acting as a bridge between the health framework and the community.³⁸ They address social determinants of health such as livelihoods, equality, access to health care, and social support structures.³⁸ They respond to shared challenges by ensuring patient-centric, comprehensive primary health care.³⁸ CHWs are instrumental in creating awareness of some of the most pressing challenges facing humanity, including climate challenges leading to extreme weather, biodiversity collapse, reduced agricultural productivity, and environmental pollution, and initiating efforts to advocate for local actions to build community resilience.³⁹

Nursing and midwifery are other domains that can act as drivers of planetary health. Nurses and midwives have diverse roles and responsibilities, such as providing and coordinating personalized care and addressing preventive, acute, and chronic health issues in healthcare settings.^{40,41} They also collaborate with social services to address the personal and social requirements of individuals and contribute to the improvement of community health services by participating in public health initiatives and community-based programs.^{40,41} As the largest patient-centric component of the health system, nurses and midwives are well positioned to

Table 2. Recommendations for promoting planetary health in the modern era.

Recommendations	Description
Promote sustainable lifestyles	Encourage individuals to adopt eco-friendly practices such as reducing waste, conserving energy, and using public transportation
Invest in renewable energy sources	Increase investment in renewable energy technologies like solar, wind, and hydroelectric power to reduce reliance on fossil fuels and mitigate climate change
Enhance environmental education	Implement comprehensive environmental education programs at all levels of education to increase awareness and understanding of planetary health issues
Strengthen environmental policies	Develop and enforce policies that prioritize environmental protection, including regulations on emissions, waste management, and land conservation
Foster interdisciplinary collaboration	Encourage collaboration among various sectors, including science, health care, policy, and business, to address planetary health challenges collectively
Support sustainable agriculture practices	Promote sustainable farming methods, such as organic farming, agroforestry, and regenerative agriculture, to ensure food security while minimizing environmental impact
Advocate for global cooperation	Engage in international efforts to address planetary health challenges, including agreements on climate action, biodiversity conservation, and sustainable development
Encourage research and innovation	Invest in research and development to advance technologies and solutions that promote planetary health, such as clean energy systems, sustainable materials, and eco-friendly practices

advocate the cause of planetary health via multiple modalities such as education, outreach services, and local and regional awareness drives, thus assuming a leadership role in addressing planetary health.^{41–43} They can also help in developing and strengthening climate-resilient health systems by partnering with local decision-makers and framing plans regarding sustainability in health care.^{41–43} Recommendations for promoting planetary health in the modern era, encompassing the job roles of all healthcare professionals, are shown in Table 2.

Addressing the emerging challenges of climate change would require greater knowledge and involvement of healthcare personnel of all disciplines who understand health's social and environmental determinants and not only treat but advocate for climate-positive community actions. Table 3 shows the role of artificial intelligence (AI) and machine learning (ML) in planetary health and the collaborative roles of healthcare professionals for sustainable impact.

Research into planetary health

Out of the 169 UN SDG targets, 48 have been identified as having a key role in understanding the causal relationship of the disease in an urban setting.⁴⁴ Also, the SDGs implicitly emphasize the connection between climate change and health. The 13th goal is to take urgent action to combat climate change and its impacts, and the third goal is about ensuring healthy lives and improving well-being for all ages. Climate and health are closely linked to these goals; action on one gets results on the other.⁴⁵ However, the SDG indicators of climate change currently need to include health; academic research is one way to fill this gap.³⁴

Research and sharing knowledge on the interconnection between climate change and health is a key strategy to achieve a global movement toward this issue.³⁴ So, education and research in this area are emphasized.

Holistic health care would require a greater understanding of climate-smart health care and supporting research to build early warning systems and develop preparedness and prevention strategies to ward off the impact of climate emissions.⁴⁶ Newer models are imminent to predict and prepare for future health risks, damage to health infrastructure, and the economic and social implications delineated under the Shared Socioeconomic Pathways.^{47,48}

Besides climate change's impact on economic and social well-being, research is needed to understand the varied characteristics, drivers, and effects of dietary preferences, modifications, and transitions across geographies and cultures.⁴⁹ Rapid urbanization and economic development have not only affected social and economic well-being but also had a significant impact on the food industry. Research is needed to study food preferences across geographies and cultures and aim for a climate-positive approach. This would require strong institutional support from the government to foster sustainable dietary transitions.⁴⁹

The COVID-19 pandemic has reiterated and proved that the implications of climate change run deep.⁵⁰ Biodiversity and the risks associated with its loss to the global economy and human health are profound; hence, there is an urgent need to foster research, invest in sustainable technologies, and build a curriculum that gives priority to planetary health and prioritizes climate change to achieve good health and well-being.^{51,52}

Balancing present management and future planning for a sustainable legacy in planetary health

In planetary health, competent management for today and planning for the future is critical to ensuring the planet's and its people's well-being. Addressing modern environmental

Table 3. Artificial intelligence (AI) and machine learning (ML) in planetary health: applications and collaborative roles of healthcare professionals for sustainable impact.

Aspect	AI/ML application	Role of healthcare professionals
Environmental monitoring	<ul style="list-style-type: none"> • Remote sensing using AI/ML algorithms to analyze satellite imagery and aerial data for monitoring deforestation, land use change, air quality, and ecosystem health • AI-powered drones for real-time monitoring of environmental parameters like levels and biodiversity • ML models to analyze sensor data and predict natural disasters like wildfires, hurricanes, and earthquakes 	Collaborate with AI/ML experts to interpret and validate environmental data, ensuring accurate analysis and actionable insights. Apply domain knowledge to inform decision-making and policy formulation for environmental conservation
Sustainable agriculture	<ul style="list-style-type: none"> • AI-based precision farming techniques for optimizing resource allocation, such as water, fertilizers, and pesticides • ML algorithms to analyze soil data and provide recommendations for optimal crop selection, planting patterns, and irrigation schedules • AI-powered robots for weed detection and autonomous pest control • Predictive models for early detection of crop diseases and pests 	Collaborate with AI/ML specialists to integrate technology into agricultural practices. Assess the effectiveness and safety of AI-driven solutions in improving crop productivity, nutritional value, and environmental sustainability. Guide on implementing AI/ML approaches in farming communities
Conservation and wildlife protection	<ul style="list-style-type: none"> • ML algorithms to identify and track endangered species using image recognition and pattern analysis • AI-powered systems for monitoring and preventing illegal wildlife trade and poaching activities • ML models for analyzing large-scale ecological data to identify conservation priorities and develop effective conservation strategies • AI-driven predictive models for habitat restoration and wildlife management 	Work closely with AI/ML experts to curate and validate species data, ensuring accurate identification and tracking. Collaborate in designing AI systems that assist in wildlife protection and combating illegal activities. Utilize healthcare expertise to support wildlife health assessments and veterinary interventions
Public health management	<ul style="list-style-type: none"> • AI-based algorithms for analyzing health data, predicting disease outbreaks, and identifying patterns and risk factors • ML models to enhance disease diagnosis, treatment planning, and drug discovery • AI-powered chatbots and virtual assistants for providing personalized health information and telemedicine services • Monitoring and analyzing social media data to identify public health concerns and trends 	Partner with AI/ML professionals to develop robust healthcare AI systems. Contribute healthcare expertise to ensure accurate interpretation and implementation of AI/ML outputs in disease management. Collaborate in designing AI-driven telemedicine platforms and chatbots that provide reliable clinical information and support
Energy efficiency and climate change	<ul style="list-style-type: none"> • AI/ML algorithms for optimizing energy consumption, load forecasting, and demand response • ML models for predicting renewable energy generation and optimizing energy storage systems • AI-driven smart grids for efficient energy distribution and management • Climate modeling using AI/ML to predict climate patterns and assess the impact of interventions 	Collaborate with AI/ML experts to assess energy-related health impacts and develop strategies for sustainable energy transition. Utilize healthcare knowledge to inform policies and interventions that mitigate climate change and promote public health. Work with AI systems to monitor and analyze health data related to energy use and climate change effects

challenges such as pollution, climate change, and habitat loss requires immediate action to reduce their impact on human health and natural systems. This includes engaging in sustainable activities, reducing greenhouse gas emissions, protecting natural habitats, and advocating for environmentally

beneficial laws. Concurrently, envisioning a healthy and resilient environment for future generations entails investing in research, enhancing green technologies, and creating international partnerships to confront mounting dangers and promote sustainable development. The current generation is

crucial in this endeavor, taking on duty as planet caretakers to address pressing issues such as environmental degradation and climate change. People may help reduce global warming by adopting environmentally conscious practices, supporting renewable energy sources, and advocating for environmental policies.

Simultaneously, active participation in long-term planning, research investment, and advocacy for sustainable legislation are critical initiatives to guarantee the well-being of future generations. Recognizing the gravity of the situation and acting decisively, the current generation can leave a positive and enduring legacy for the planet and its people, ensuring a healthy and vibrant environment for future generations. By integrating present-day management and long-term planning in planetary health, we may ensure harmonious cohabitation between humans and the environment, ensuring the long-term health of our planet and its inhabitants.

Limitations

Our study being a narrative review offers flexibility and a broader scope, however faces several limitations. First, the selection and interpretation of studies rely on our perspective, potentially introducing bias. Systematic methods for literature search reduce the risk of missing relevant research. Second, the conclusions might not be based on the strongest available evidence as study quality was not assessed systematically. Despite these limitations, our study was valuable for providing an overview of the emerging fields of planetary health and identifying gaps in knowledge.

Conclusion

Planetary health is a crucial concept that recognizes the interdependent relationship between human health and the environment. The modern era has witnessed unprecedented levels of environmental degradation and climate change, leading to significant implications for human health. Planetary health takes a holistic approach to health, recognizing the need to address social, economic, and environmental factors that impact human well-being. Climate change is the most pressing challenge facing planetary health, with the potential to cause catastrophic consequences for human health.

Addressing the complex challenges facing planetary health requires a collaborative and interdisciplinary approach, including working across sectors to promote sustainable development and reduce the impact of human activities on the environment. Also, health systems can take action against climate change by strengthening infrastructure (including providing financial resources and trained health workers), using clean energy in the health facilities, engaging patients and the community (educating patients about climate change and encouraging active participation in social events), and participating in political movements about health and climate change.⁵³

Investing in research is essential to better understand human health and the environment's complex interactions and develop innovative solutions to address these challenges. By protecting our planet's and its inhabitants' health, we can ensure a healthy future for generations to come. The time has come to act boldly and decisively to safeguard our planet and promote the well-being of all its inhabitants, recognizing that the health of our planet is inseparable from the health of humanity.

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