

Review Article

Environmental health and human health-unifying strategies, conceptual framework and green prescriptions: a review

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ABSTRACT

The intricate relationship between environmental conditions and human health is increasingly acknowledged as a critical area of public health research. As global challenges such as climate change, urbanization, and biodiversity loss become more pronounced, understanding the connections between these environmental factors and health outcomes is essential for developing effective public health strategies. This analysis delves into the complex interactions that exist between environmental influences and health, emphasizing the urgent need for integrated approaches that simultaneously promote ecological sustainability and enhance community well-being. Environmental degradation has significant implications for human health, with many deaths linked to preventable environmental health risks. These risks encompass a wide range of issues, including air and water pollution, exposure to hazardous substances, and the impacts of climate change, all of which disproportionately affect vulnerable populations. A conceptual framework is proposed to elucidate the multifaceted connections between environmental exposures, health determinants, and health outcomes, enabling a clearer understanding of how these elements interrelate. Cohesive strategies, such as the one health approach, advocate for collaboration across various sectors, including public health, veterinary health, and environmental management, to address the shared challenges of health and environmental degradation. Additionally, the principles of planetary health highlight the interdependence of ecosystems and human well-being, underscoring the need for sustainable management of natural resources to safeguard health outcomes. This article also explores the concept of "green prescriptions," which involve recommending nature-based interventions to enhance physical, mental, and social well-being. These prescriptions have demonstrated effectiveness in promoting health while fostering a sense of environmental stewardship. By synthesizing current evidence and successful case studies, this review emphasizes the significance of adopting a holistic perspective that integrates environmental considerations into healthcare practices. Ultimately, fostering collaboration among various stakeholders will contribute to the development of resilient communities that are better equipped to navigate the intertwined challenges of health and environmental sustainability.

Keywords: Environmental health, Human health, Green prescriptions, Framework

INTRODUCTION

Environmental health and human health are deeply interconnected, with the well-being of individuals and

communities directly influenced by the quality of their surroundings. Environmental Health is the study of how natural factors along with human influences can affect health outcomes. It encompasses understanding how these factors contribute to both the prevention and exacerbation

of diseases.¹ As global challenges such as climate change, urbanization, and biodiversity loss intensify, there is a growing recognition of the need for integrated strategies that address both environmental sustainability and public health. Recognizing the significance of environmental health, the ministry of environment, forest and climate change established a committee on environmental health. Following the committee's recommendations, the ministry set up an environmental health cell aimed at integrating environmental health considerations into the establishment of environmental standards and guiding the creation of measures and action plans to safeguard public health from environmental pollution across the country.² Environmental health, in terms of biodiversity, is deteriorating at an unprecedented rate, endangering the quality of life for all individuals, regardless of socio-economic status.³ According to the world health organization report, it is estimated that up to 24% of overall deaths are linked to environmental health risks, many of which are largely preventable.⁴ Many common communicable and non-communicable diseases, as well as unintentional poisonings, can be significantly prevented and reduced by modifying the built environment.⁴ Thus, a thorough understanding of environmental health is crucial, as it has diverse impacts on human well-being, both beneficial and detrimental. While healthy environments can contribute positively by providing clean air, safe water, and natural spaces that promote well-being, adverse environmental factors-such as pollution, climate change, and ecosystem degradation-can significantly threaten public health. This review explores unifying strategies that link environmental health and human well-being, presents a conceptual framework for understanding this connection, and highlights the potential of "green prescriptions." These nature-based interventions, which involve using natural environments as part of medical treatment, have shown promise in improving physical, mental, and social health. By examining current evidence and successful case studies, this review aims to provide insights into effective approaches for enhancing health through a holistic perspective that integrates environmental stewardship and medical care.

ENVIRONMENTAL HEALTH AND HUMAN HEALTH-A DUAL PERSPECTIVE

What is environmental health?

First, the term environment can be broadly defined as the conditions, circumstances, and factors-physical, chemical, and biological-that surround individuals and communities. This includes elements like climate, soil, and living organisms, which collectively shape ecosystems and determine their survival. In the context of human health, the environment encompasses all external, non-genetic factors-such as physical, behavioural, social, and nutritional influences-that impact individuals and populations.⁵

The broad definition of human health as stated by world health organization is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". This definition includes various dimensions of human health. It defines well beyond performing lab investigations or doing any procedures. This holistic view underscores the critical need to consider environmental factors in public health practices, as the external conditions and circumstances individuals are exposed to directly shape health outcomes, resilience, and overall quality of life.⁶

The relationship between the environment and human health can be understood through a variety of perspectives, reflecting the complexity of this connection. A system-based ecological approach considers the broader interplay between natural ecosystems and human health, recognizing that changes in environmental factors-such as air quality, climate, and biodiversity-can significantly impact health on a population level. Alternatively, a more targeted focus might involve examining specific environmental health conditions, such as the effects of chemical pollutants on chronic diseases or air pollution's link to respiratory conditions. This connection can also extend to specific hazards, like chemical or physical risks, and encompass broader influences like the social and built environments, which shape health outcomes through urban design, access to green spaces, and community infrastructure.

Human and environmental health are intrinsically linked, as environmental factors have a direct influence on well-being, while human activities, in turn, affect the environment.⁷ This dual perspective requires a balanced approach that includes both mitigating risks and fostering health-promoting environments. Efforts to control harmful exposures-such as reducing air pollution or managing chemical hazards-must be paired with strategies to enhance environments that support well-being. This includes sustainable urban planning, ensuring access to safe drinking water, and protecting natural spaces. The interplay between environment and health is informed by a range of fields, including environmental science, public health, urban planning, and social policy, all aiming to enhance individual and community well-being by addressing both the challenges and opportunities presented by our surrounding environments.

UNIFYING STRATEGIES FOR ENVIRONMENT AND HUMAN HEALTH

Unifying strategies for environmental and human health focus on the interconnectedness of our natural surroundings and well-being which requires a holistic approach. By integrating environmental stewardship with public health initiatives, we can create healthier ecosystems that support both individual and community well-being, ensuring long-term resilience for future generations.

Understanding the pressing nature of environmental concerns and the urgent need to address these issues, the United Nations has established seven sustainable development goals (SDGs) that are directly linked to human health and the environment⁸

SDG 6-clean water and sanitation: Addresses critical challenges such as water scarcity, water pollution, and inadequate sanitation practices, all of which are essential for promoting human health and ensuring environmental sustainability.

SDG 7-affordable and clean energy: emphasizes the promotion of renewable energy sources and energy efficiency, both vital for reducing greenhouse gas emissions and mitigating climate change.

SDG 11-sustainable cities and communities: Tackles issues related to urbanization, pollution, waste management, and access to green spaces, making the creation of sustainable cities and communities crucial for enhancing both human well-being and environmental integrity.

SDG 12-responsible consumption and production: Encourages resource efficiency, waste reduction, sustainable management of chemicals and waste, and the implementation of environmentally sound practices.

SDG 13-climate action: Calls for actions aimed at reducing greenhouse gas emissions, increasing resilience to climate-related disasters, and promoting adaptation measures to combat the life-threatening impacts of climate change.

SDG 14-life below water and SDG 15 life on land: Address critical issues such as marine pollution, overfishing, deforestation, habitat loss, and the essential conservation of biodiversity, all vital for environmental sustainability and human health.

SDG 17-partnerships for the goals: Underscores the importance of collaboration across various sectors, including government, business, civil society, and other relevant stakeholders, to mobilize resources, share knowledge, and implement effective environmental initiatives.

Another significant initiative by the world health organization aimed at unifying environmental and human health is the concept of “one health”. One health is an integrated approach that aims to balance and optimize the health of people, animals, and the environment, which is crucial for preventing, predicting, detecting, and responding to global health threats like the COVID-19 pandemic.⁹ By mobilising various sectors, disciplines, and communities, this framework fosters collaboration that leads to innovative solutions addressing root causes of health issues. It encompasses public health, veterinary, and environmental sectors, focusing on food and water

safety, nutrition, zoonoses control, pollution management, and combating antimicrobial resistance. Effective implementation relies on the cooperation of government officials, researchers, and community members, who must engage in joint responses and develop shared databases and surveillance systems.¹⁰

In India, the governance, financing, and operation of the health system are shared between the central and state governments, creating a dual responsibility for public health. The ministry of health and family welfare (MoH and FW) oversees health policy, disease control, and regulation, while state governments are responsible for healthcare delivery, monitoring the workforce, implementing national programs, and managing health data. At the federal level, the ministry of fisheries, animal husbandry, and dairying (MoFAH and D) oversees livestock management, and the Ministry of Environment, Forests, and Climate Change (MoEF and C) handles environmental policies. Despite clear roles, distinct governance structures across ministries lead to complex implementation, with different operational approaches at the local level. This complexity poses challenges for one health initiatives in India, as varying state capacities, a siloed approach to health programs, and limited inter-sectoral collaboration hinder effective integration. The central government's influence, differing priorities among sectors (e.g., wildlife, veterinary, and human health), and fragmented goals contribute to difficulties in adopting a unified one health strategy, making the implementation of comprehensive, cross-sectoral policies challenging.¹¹

Another emerging field relating environment to human health is planetary health. Planetary health is an interdisciplinary approach that stresses the interconnectedness between the health of the planet's ecosystems and human well-being. It recognizes that environmental changes that directly impact human health, necessitating sustainable management of natural resources to ensure long-term health outcomes for both the planet and its inhabitants.¹² The core ideas of planetary health have existed for decades within fields like global health, conservation medicine, one health, and EcoHealth. These themes also play a significant role in the study of climate change and health. However, the planetary health framework unifies these concepts, offering a comprehensive perspective on the interconnectedness of environmental and human well-being.¹³ The concept of planetary health provides a pathway to advance the 2030 agenda for sustainable development by identifying co-benefits across various targets, promoting effective cross-sector collaboration and partnerships, and ensuring alignment and coherence in policy-making.¹⁴

From an ethical standpoint, health professionals have a duty to “do no harm” and act in the best interests of their patients. Failing to address planetary health issues compromises this responsibility. Bioethicist David Resnik emphasizes the need to elevate not only awareness but

also the moral consciousness of healthcare professionals to respond to environmental changes. It is crucial to consider the broader determinants of health, including the changing environment, our role in these changes, and the direct and indirect consequences on human health.¹⁵

CONCEPTUAL FRAMEWORK LINKING ENVIRONMENT TO HEALTH

The conceptual framework-linking environment to health systematically examines how environmental factors impact human health, enabling risk identification and the development of proactive, evidence-based strategies. By integrating interdisciplinary research and cross-sector

collaboration, it ensures policies address core health challenges comprehensively.¹⁶ Considering complexities and uncertainties, this framework evaluates the broad influences of the environment on health, including traditional hazards and any environmental aspects affecting well-being. Health effects are comprehended as outcomes of environmental exposures, access to resources, and socio-cultural factors, reflecting diverse susceptibilities.¹⁷

The framework (Figure 1) illustrates the complex relationship between human and environmental health, providing structured insights for targeted intervention. Components of the conceptual framework (Figure 1).

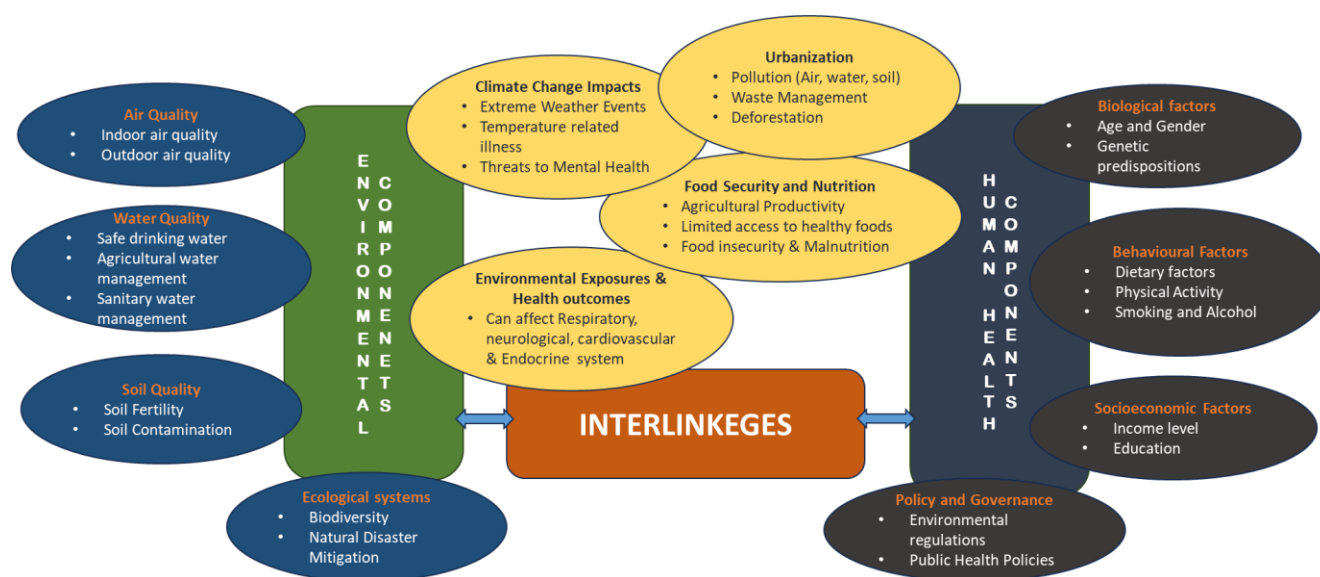


Figure 1: Conceptual framework linking environmental health to human health.

Human health

Physical health: Encompasses both infectious and chronic disease outcomes, with susceptibility shaped by environmental factors such as air and water quality, as well as individual behaviors.

Mental health: Psychological well-being and stress levels are increasingly influenced by urbanization, air quality, and access to natural environments, highlighting the mental health benefits of sustainable development.

Social health: Community cohesion, social networks, and access to healthcare services are shaped by both environmental conditions and infrastructure, impacting health equity and resilience within communities.

Environmental health

Air quality: Critical to respiratory and cardiovascular health, air quality reflects broader environmental issues, such as emissions from industrial and vehicular sources, which are influenced by policy and urban planning.

Water quality: A fundamental determinant of public health, water quality impacts gastrointestinal and reproductive health outcomes and is affected by factors including waste management practices and agricultural runoff.

Soil quality: Soil health underpins agricultural productivity, influencing nutritional health, while soil contamination from industrial activities poses risks to public health through food and water exposure.

Ecosystems: Biodiversity and ecosystem services, such as disaster mitigation, support resilience in both environmental and human health systems, underscoring the need for conservation efforts.

Determinants of health

Biological, behavioral, socioeconomic, and policy factors: These determinants shape health directly through factors such as genetics, lifestyle, income, and education, while policy measures influence the regulation of environmental exposures and resource access.

Interlinkages

Environmental exposures and health outcomes: Environmental exposures, such as extreme temperatures due to climate change and vector-borne diseases influenced by habitat changes, underscore the interconnected nature of these domains.

Health impact on the environment: Healthcare resource use and waste management practices, if unsustainable, can negatively impact ecosystems, contributing to pollution and biodiversity loss.

Climate change impacts: Extreme weather events and temperature fluctuations disproportionately affect vulnerable populations, highlighting the intersection of climate change adaptation and public health.

Food security and nutrition: Agricultural productivity and access to nutritious foods are intricately linked to environmental conditions, affecting population health through nutrition and disease prevention.

Urbanization and infrastructure: Rapid urban growth introduces challenges in pollution control and waste management, which have cascading effects on both human health and ecosystem sustainability.

GREEN PRESCRIPTIONS-A BRIDGE BETWEEN ENVIRONMENT AND HEALTH

"Green prescriptions" represent a unique approach to healthcare that bridges environmental and human health by encouraging nature-based interventions as part of medical treatment.¹⁸ These prescriptions involve recommending outdoor activities and time spent in natural settings-such as parks, forests, and green spaces-to promote physical, mental, and social well-being. Grounded in growing evidence of nature's restorative effects, green prescriptions aim to alleviate stress, enhance mood, improve cardiovascular health, and reduce symptoms of chronic illnesses.¹⁹ By fostering a connection to nature, green prescriptions not only benefit individual health but also support environmental awareness and stewardship, creating a holistic approach to health that aligns personal well-being with ecological sustainability.

The historical roots of green prescriptions trace back to practices in ancient civilizations. The Romans, influenced by Greek health traditions, built spa baths around natural hot springs as places of social and physical rejuvenation, emphasizing the healing properties of water and natural surroundings.¹⁹ During Hippocrates' time (460-370 BC), lifestyle adjustments, including changing one's environment were recommended as treatments for various ailments. Similarly, in Germany, a health practice called the Kur (meaning "cure" or "treatment") emerged in the 1700s, adopting Roman therapeutic bathing traditions and

expanding to include other environmental stimuli, which are now part of the country's rehabilitation medicine.²⁰

These ancient practices reflect an early understanding of the connection between nature and health, a principle that underpins modern green prescriptions as a means to integrate environmental exposure into healthcare for physical and mental health benefits.

The core of Green prescriptions involves three main components-contact with nature, doing meaningful activities, and a social context.²⁰ This framework stresses that activities incorporating these elements can benefit both mental and physical health.²¹ These can include broad spectrum of activities such as therapeutic horticulture (e.g., curative gardening and cultivating plants), biodiversity conservation, and care farming (in which agricultural practices support health, social, and educational outcomes). Other options include green exercise (like hiking or biking in natural settings) and wilderness arts and crafts, which allow for creative expression in nature. These varied interventions highlight the flexibility and adaptability of green prescriptions to meet diverse health and wellness needs.^{22,20}

Numerous studies highlight the benefits of nature-based health interventions, reinforcing the growing evidence for the nature-health relationship. However, there is a significant knowledge gap regarding the functionality and sustainability of green prescribing schemes, necessitating more empirical research through longitudinal studies with robust evaluations.²³ Practical challenges include the need for planners to bridge the communication gap between healthcare and ecology to ensure that both fields recognize their co-benefits. Additionally, there is a call for a shift in public health thinking towards more place-based, preventative healthcare systems that collaborate with urban planners and environmental managers.²⁴ Despite the challenges of multi-stakeholder collaboration, embracing integrative approaches like green prescriptions is essential as we address the intertwined issues of non-communicable diseases and environmental degradation.

CONCLUSION

The intricate relationship between environmental health and human well-being necessitates a unified approach that recognizes and addresses the multifaceted challenges posed by environmental degradation. As outlined in this review, environmental health is not merely an isolated concern but is deeply woven into the fabric of public health. The ongoing degradation of natural resources, driven by urbanization, climate change, and biodiversity loss, poses significant risks to both individual and community health. Acknowledging that nearly a quarter of global deaths are linked to preventable environmental health risks underlines the urgency for integrated strategies that bridge the gap between environmental sustainability and human health.

The conceptual frameworks discussed in this review, including the one health initiative and the principles of planetary health, offer essential pathways to foster collaboration across disciplines and sectors. By embracing these frameworks, policymakers and health practitioners can better understand and mitigate the impacts of environmental factors on health outcomes. The SDGs further provide a robust framework for promoting environmental stewardship alongside public health initiatives, ensuring that both domains are addressed in a complementary manner.

Moreover, the introduction of "green prescriptions" signifies a progressive shift in healthcare practices, encouraging the incorporation of nature-based interventions to enhance physical, mental, and social health. By promoting activities that connect individuals with their natural environments, these prescriptions not only improve health outcomes but also cultivate a sense of environmental stewardship among communities. However, as highlighted, there is a pressing need for empirical research to evaluate the effectiveness and sustainability of such initiatives, ensuring that they are rooted in solid evidence and can be effectively integrated into public health systems.

In conclusion, addressing the interdependence of environmental health and human health is not just a responsibility but a necessity for achieving a sustainable future. By fostering collaboration among government entities, healthcare providers, and community stakeholders, we can develop innovative, holistic strategies that prioritize both human well-being and the health of our planet. The path forward demands a concerted effort to shift our focus from reactive to preventive health practices, integrating ecological principles into the core of healthcare systems. In doing so, we pave the way for a healthier society that is resilient to the evolving challenges of our time, ensuring that future generations inherit a world where both people and the planet can thrive in harmony.

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