

# Reflexes of planetary health in the transdisciplinary process among health professionals

## Reflexos da saúde planetária no processo transdisciplinar entre profissionais de saúde

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### Abstract

Planetary Health has been consolidated as a transdisciplinary area of knowledge grounded in characterizing and mitigating anthropogenic impacts on the health of human beings and earth systems. The capitalist lifestyle drives environmental degradation and its consequences (such as climate emergency and biodiversity loss), and is related to the high prevalence of chronic non-communicable diseases. This information, however, usually lacks the necessary emphasis in health teaching and learning process. Thus, this essay aims to systematize information that correlates environmental factors and human health from a systemic thinking perspective, highlighting the importance of reflecting on systemic health within health professions. As the bridge between scientific knowledge and society, health professionals can play the role of integral care agent and knowledge curator. Moreover, we must encourage systemic thinking in health education to achieve these roles, both in individual and collective attitudes.

**Keywords:** Planetary Health; Health Education; Health Professionals.

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## Resumo

A saúde planetária vem se consolidando como área transdisciplinar do conhecimento, fundamentada na caracterização e mitigação dos impactos antropogênicos sobre a saúde do ser humano e dos sistemas terrestres. O estilo de vida em sociedades capitalistas impulsiona a degradação ambiental e suas consequências (como emergência climática e perda de biodiversidade), relacionando-se também à alta prevalência de doenças crônicas não transmissíveis. No entanto, essas questões não costumam receber a atenção necessária no processo de ensino e aprendizagem dos profissionais de saúde. Assim, este ensaio objetiva contribuir para sistematização das informações que correlacionam os fatores ambientais e a saúde humana na perspectiva do pensamento sistêmico, destacando a importância de se pensar a saúde sistêmica no âmbito das profissões da saúde. Observa-se que o profissional de saúde, sendo ponte entre o conhecimento científico e a sociedade, pode desempenhar os papéis de mediador do cuidado integral e curador do conhecimento. Além disso, é preciso incentivar o pensamento sistêmico no processo formativo em saúde para que esses papéis sejam alcançados, tanto em atitudes individuais quanto coletivas.

**Palavras-chave:** Saúde Planetária; Educação em Saúde; Profissionais de Saúde.

## Introduction

Planetary Health has been consolidated as a transdisciplinary field of knowledge founded on characterizing and mitigating anthropogenic impacts on the health of human beings and earth systems (Leal Filho et al., 2022). Environmental degradation, historically caused by hegemonic human groups, has produced planetary changes that are already irreversible, to the extent of configuring a new geological era—the anthropocene—whose most evident consequence is global warming. Climate change leads to reduced biodiversity, compromising food security; environmental catastrophes; and increased clinical complications resulting from heat stress, in addition to favoring the spread of arboviruses (Gakidou et al., 2017; Watts et al., 2021).

The lifestyle of capitalist societies, in addition to driving environmental degradation, is related to the high prevalence of chronic non-communicable diseases (NCDs) (Prescott; Logan, 2016). Inadequate nutrition, normalization of chronic stress and sedentary lifestyle, excessive exposure to pollutants, and reduced contact with natural environments are the basis of capitalist sociocultural standardization, which stimulates consumption and disposal behavior (Prescott; Logan, 2016). These factors combine in determining pathophysiological changes in the human body, such as chronic low-intensity inflammation and intestinal dysbiosis, which predispose to chronic NCDs (Lima, 2015).

Considering this conjuncture, systemic thinking provides an enhanced awareness of the relations between human and environmental health issues, establishing intersections between the various fields of knowledge (Capra; Luisi, 2020). According to systemic thinking, we understand that human health is embedded in planetary health, since all living beings are interdependent.

In the face of the challenges imposed by the anthropocene, it is necessary to “decolonize” the *sentipensar* (feeling-thinking), fostering new approaches to health communication and promoting interdisciplinarity and transdisciplinarity. However, these concepts do not usually receive the necessary attention in the education of health professionals, still focused on biologicist and hospital-centered

approaches. Thus, this essay seeks to contribute to the systematization of information that correlates environmental factors and human health from the perspective of systemic thinking, emphasizing the importance of health professionals considering systemic health, in order to promote planetary health (Di Giulio et al., 2021; Gakidou et al., 2017).

## All living things are interdependent: the importance of systemic thinking

Who is smarter, more attractive, more important? Since childhood, we are used to a classificatory thinking and competitiveness is encouraged in social relations. However, in biological interactions it is difficult to establish hierarchies. Could we elect an organ as the most important in the human body? Would it be the brain, the heart? Without the central nervous system, the heart does not receive the command to throb; without the blood pumped by the heart, the brain would collapse within minutes; but it is the bone marrow that produces the cells that oxygenate the blood. For our proper functioning, the integration of all organs and systems is fundamental. Similarly, no species survives in isolation. In the body of the Earth, as in the human body, interdependence prevails.

The notion of living beings as interdependent in the web of life remained in the feeling-thinking of several indigenous peoples. If we consider the 300,000-year biological history of our species, only recently did a portion of humans have assumed the alleged position of superiority and dominance over nature, accentuated after the Industrial Revolution and the acceleration of capitalism, based on the mechanistic-Cartesian paradigm (Capra; Luisi, 2020; Gayoso, 2020). The anthropocentric (or as Eliane Brum suggests, “white-centric”) (Brum, 2021) and utilitarian way of relating to natural “resources” has been determining extreme environmental changes, to the point of configuring the new geological era of the anthropocene (Gakidou et al., 2017).

Systemic thinking, an interdisciplinary scientific field that integrates the biological, social and philosophical dimensions of human knowledge, restores the expanded view of life, demonstrating that the various current crises (health, environmental,

social, and political crises) result from a “crisis of perception” associated with the reductionist Cartesian paradigm (Capra; Luisi, 2020).

Systems are composed of interdependent and interconnected parts. In the biosphere, autotrophic beings (cyanobacteria, algae, and plants) support the base of food chains, use the carbon dioxide eliminated by the respiration of heterotrophs, producing nutrients with solar energy and releasing oxygen—the wastes of some are raw material for others. Over the four billion years of biological history, co-participatory relationships have been produced in the cycling of matter and energy (Capra; Luisi, 2020).

Systemic thinking shows that hyperspecialization and the disjunction of knowledge prevent the interdisciplinarity necessary to discuss the issues of our time. The reductionist view contributes to a belief in life as a competitive struggle for existence, stimulated by the current capitalist model, which links the notion of success to material accumulation, engaging the attitude of utilitarianism and exploitation of nature (Capra; Luisi, 2020). The systemic view, on the other hand, defines prosperity as the strengthening of connectivity, recognizing that we are all members of interconnected ecological communities.

The education of health professionals based on the biomedical model encourages hyperspecialization and a more interventionist than preventive approach to health care (Capra; Luisi, 2020). Morin (2000) analyzes how qualified and disjunctive knowledge is harmful to humanity:

There have been giant advances in knowledge in the scope of disciplinary specializations during the twentieth century. However, these advances are scattered, disunited, due precisely to specialization [...]. In these conditions, the minds formed by the disciplines lose their natural abilities to contextualize knowledges, as well as to integrate them into their natural sets. The impairment of the perception of the global leads to the impairment of responsibility (each one tends to be responsible only for their specialized task), as well as the impairment of solidarity (each one no longer feels the bonds with their fellow citizens). (Morin, 2000, p. 40-41, our translation)

## Earth has a metabolism – the Gaia theory

*Life is not on the surface of the Earth. It is the surface of the Earth. (Margulis; Sagan, 2002, p. 36, our translation)*

Why would health professionals need to know the Gaia theory and Earth science subjects? Let us remember the essential: in order to have good health, we need drinking water, clean air, and food, which come from the lives of other beings.

In the 1970s, scientists James Lovelock and Lynn Margulis formulated the Gaia hypothesis (later established as a theory), demonstrating that the Earth is a large living organism that self-regulates and maintains itself (according to the concept of autopoiesis, proposed by Maturana and Varela) with complex metabolic processes involving all ecosystems (Capra; Luisi, 2020). Apparently abiotic factors, such as soil and atmosphere, are also the result of the activity of living beings.

In this biospherical being-doing, there is a protagonism of bacteria. We all descend from a common bacterial ancestor. With metabolomic evolution, it is known how bacteria are still determinant for the maintenance and balance of biogeochemical cycles. During the first billion years of evolution, bacteria covered the planet in an intricate web of metabolic processes and began to regulate the temperature and chemical composition of the atmosphere, which became conducive to the evolution of more complex life forms. We emerged and remained dependent on an invisible microcosm. Diversities of bacteria that live in soil, rocks and oceans, as well as within plants, animals, and humans, continuously regulate life on Earth (Ugarte-Barco; Zhiñin-Huachun; Hernández-Pérez, 2022).

## Anthropocene and its challenges

Environmental degradation, historically caused by hegemonic human groups, has produced already irreversible planetary changes that are configuring the anthropocene (Pörtner et al., 2022).

Climate change leads to loss of biodiversity and compromised rainfall, impacting water and food security. Environmental disasters, such as floods, storms, and droughts, induce migration and an increase the number of climate refugees, with repercussions on various social impacts, such as the expansion of peripheral populations in urban centers and the predisposition to mental disorders (Pörtner et al., 2022).

Clinical complications secondary to heat stress (which can lead to deaths from hyperthermia, dehydration, and hypovolemia) are increasingly prevalent, with older adults, children and patients with chronic diseases being the groups with the highest incidence (Watts et al., 2021). In addition, high temperatures and deforestation favor the proliferation of arbovirus vectors, such as *Aedes aegypti*, increasing the incidence of diseases such as dengue, Zika, yellow fever, and chikungunya fever (Watts et al., 2021).

## Relations between anthropocene and chronic non-communicable diseases

Biotechnological advances have promoted unquestionable benefits to human health, such as reduced infant mortality and increased life expectancy. However, we live the contemporary challenge of the high prevalence of chronic NCDs, the major global causes of morbidity and mortality, significantly related to the lifestyle in capitalist societies (Gakidou et al., 2017). Inappropriate nutrition (foods rich in xenobiotics and poor in nutrients), sedentary lifestyle, exposure to toxins, excessive working hours, and chronic stress generate a series of physiological consequences that are at the root of the high prevalence of these diseases (Gakidou et al., 2017; Prescott; Logan, 2016).

The advertising stimulus to consumerism and cultural standardization is one of the main challenges faced by public health around the world. This culture of consumption driven by globalized capitalism keeps the gears of extractivism and pollution in full operation, thereby contributing to environmental degradation and to the deterioration of the health of the populations. In addition, the commercial determinants of health also have a

significant impact on the health of the population. For example, the food industry can influence food and beverage choices, leading to an increase in obesity, diabetes, and other chronic diseases. Similarly, neoliberal politics perpetuates a colonization of the popular imagination and individual subjectivities, resulting in colonized minds that reproduce a lifestyle that sickens and degrades. In the face of these challenges, it is crucial that health policies address these complex and multidimensional issues, seeking to promote the health and well-being of populations in an integrated and sustainable way (Gayoso, 2020; Prescott; Logan, 2016).

### **Globalization, lifestyle and xenobiotics**

The neoliberal model has determined, for poor and developing countries, the emphasis on production for export, promoting the allocation of natural resources for products to be exported, with a consequent compromise of production for local inhabitants (Capra; Luisi, 2020). This has been predicted for decades by scholars of globalization and associated damages (Santos; Silveira, 1996). There is promotion of deforestation and diversion of watercourses for monocultures and extensive cattle ranching. As the Indian scientist and environmentalist Vandana Shiva denounces, “transnational companies use the rules of free trade to relocate their polluting resource-intensive industries to the South—resources move from the poor to the rich, and pollution moves from the rich to the poor” (Capra; Luisi, 2014, p. 447, our translation).

Industrial waste, air pollutants from the burning of fossil fuels, toxic metals, plastic products, food additives, agrobusiness residues, pesticides, and various synthetic compounds are potentially harmful to living organisms (called xenobiotics) (Fontenele et al., 2010)—also including hygiene products, cleaning products, and medicines. The first major warning about impacts caused by chemical agents occurred in 1962, with the work of American biologist Rachel Carson, demonstrating that pesticides based on dichlorodiphenyltrichloroethane (DDT) attacked not only “pests,” but also several other species, including the human species (Carson, 1964). Through the publication of her book, *Silent Spring*, she succeeded

in mobilizing the population to pressure politicians in the United States of America (USA), culminating in the prohibition of the sale of DDT worldwide (this is an example of the action of a well-informed population allied to socially-committed science) (Carneiro et al., 2015).

Eleven million chemicals are known worldwide. Of these, around 3,000 chemicals are produced on a large scale for domestic, industrial, and agricultural use (Fontenele et al., 2010). However, a minimum amount of these substances is tested as to water potability standards and can be a source of contamination of an entire food chain.

In addition to the carcinogenic and teratogenic effects of several xenobiotics, visibility has been given to the hormonal changes caused by some substances, known as endocrine disruptors (EDs), which are present in the environment and are capable of interfering with the endocrine system, causing adverse effects on an intact organism or its offspring (Fontenele et al., 2010). The reproductive, nervous, and immune systems are the main targets of EDs. As for other species, impacts on the reproductive function of seals, birds of prey and alligators, fish feminization, invertebrate population decline, among others, have been previously documented (Fontenele et al., 2010).

Pesticides are xenobiotics used at alarming levels in Brazil. According to the dossier of the Brazilian Association of Collective Health (ABRASCO), since 2008 Brazil has been the largest consumer of pesticides in the world (Carneiro et al., 2015). Data published by researcher Larissa Bombardi, in *“Geografia do uso de agrotóxicos no Brasil e conexões com a União Europeia”* [Geography of pesticide use in Brazil and connections with the European Union], indicate that pesticide consumption grew 100% between 2000 and 2010 worldwide, reaching 200% in Brazil (Bombardi, 2017). Since 2015 our country has consumed 20% of all pesticides sold worldwide (Bombardi, 2017).

Brazilian agriculture has been consolidated worldwide as an exporter of commodities, such as soybeans, corn, and sugarcane, which require massive use of pesticides (about 72% of all national consumption). The land used for Brazilian staples—such as rice, beans, wheat, and cassava—occupies

an area close to 8.5 million hectares, while soybean monocultures occupy around 33.3 million hectares (Bombardi, 2017).

Multinational companies that produce agrochemicals – mainly based in the USA, the European Union, and Canada—leverage the permissiveness of Brazilian legislation to sell in Brazil several pesticides not authorized in their countries of origin, since foreign legislation is more restrictive in this regard. In the case of the insecticide malathion (used in agriculture and urban spraying campaigns), for example, in broccoli, the level allowed in Brazil is up to 250 times higher than that allowed in the European Union, while for beans the limit is 400 times higher. The case of glyphosate is insulting: in Brazil, the amount allowed is 5,000 times higher than that established in the European Union (Bombardi, 2017).

Human exposure to xenobiotics is virtually inevitable in modern environments (Stapleton et al., 2023). In addition to the contamination of water, soil, and food by pesticides, the polluted air of cities is also a source of absorption of toxic agents. The term “particulate matter” defines a class of materials (solids and liquids, such as the by-products of burning fossil fuels) capable of propagating in suspension in the atmosphere due to their reduced weight and dimensions, which enables their absorption by the pulmonary alveoli. They are also related to cardiovascular diseases and various types of cancers (Yanagi; Assunção; Barrozo, 2012).

### **Human Microbiota and Biodiversity**

Excessive exposure to xenobiotics occurs simultaneously with the reduction of human interaction with preserved natural environments. There has been thousands of years of biological evolution in broad contact with the environment, which also influenced our own ecosystem—the human microbiota (Dominguez-Bello et al., 2019).

The study of the human microbiota is a rising interdisciplinary subject. Each human being is their own ecosystem, inhabited by viruses, protozoa, fungi, archaea, and, mainly, bacteria. Quantitatively, we have more bacterial cells than somatic cells in our bodies. The gastrointestinal tract alone contains around 100 trillion bacteria, of about 1,000 different

species, which benefit us with a 150 times broader genetic repertoire (Ghaisas; Maher; Kanthasamy, 2016). There is no “human self” dissociable from its prokaryotic guests, with which we have co-evolved (Dominguez-Bello et al., 2019).

The gut microbiota performs essential functions in our physiology, from the production of nutrients and neurotransmitters to tissue differentiation and immune system modulation (Lynch; Pedersen, 2016).

The Western lifestyle, with its eating patterns and excessive use of substances with antibiotic action, has interfered with the diversity of the intestinal microbiota, which is called “dysbiosis.” Intestinal dysbiosis reduces the balancing capacity of the immune response promoted by the microbiota, contributing to the onset of an insidious and prolonged inflammatory reaction, a pathophysiological basis common to several chronic NCDs (Dominguez-Bello et al., 2019; Lima, 2015).

A biodiverse environment favors the presence of more beneficial strains of bacteria (Dominguez-Bello et al., 2019; Von Hertzen et al., 2015). This fact can be illustrated by comparing rural and urban environments. In rural dwellings, dust contains greater variability of microorganisms, which implies better immunomodulatory capacity for these inhabitants. The ecosystem contained in soils is the most diverse on the planet (Von Hertzen; Haahtela, 2006). When we inhale this dust, many of its microorganisms are directed from the respiratory to the gastrointestinal tract (transported by airway cells to the pharynx, being swallowed), where they settle. Inhabitants of urban environments, in turn, inhale air rich in pollutants and poor in biodiversity, and are exposed to air conditioning systems, which favor the proliferation of pathogenic microbes (Von Hertzen; Haahtela, 2006). In addition to having lower access to sources of microbial diversity, urban residents commonly consume more food and water containing xenobiotics (Von Hertzen et al., 2015).

Emotional patterns also influence the diversity of the microbiota. Chronic stress and mood disorders promote changes in the hypothalamic-pituitary-adrenal axis, leading to increased levels of cortisol (“stress hormone”) that result in increased pro-inflammatory cytokines, insulin resistance, hypertension and consequent chronic NCDs (Robles-Vera; Toral; Duarte, 2020).

In a social structure marked by inequalities and violence, with the imposition of sociocultural patterns that associate the notion of success with the accumulation of goods and productivism, the feeling of inadequacy of individuals who do not “achieve the goals” contributes to the high prevalence of mood disorders, such as depression, anxiety, and burnout syndrome, predisposing them to intestinal dysbiosis and chronic NCDs (Ahmed et al., 2017; Oliveira, 2018; Prescott; Logan, 2016).

## Final considerations

Health professionals, as agents of health care and promotion, have an important role to play in addressing the environmental challenges that impact the health of populations. As a bridge between scientific knowledge and the population, they can raise people’s awareness of the effects of environmental degradation on human health and help them adopt preventive measures to reduce these impacts (Gómez et al., 2013; Kotcher et al., 2021). Environmental degradation, driven by the current economic model, is directly related to an increase in chronic diseases and other public health issues. Accordingly, it is important that the health sector works in partnership with other sectors, such as the environmental and economic sectors, in order to tackle these complex and multidimensional challenges. This includes adopting effective measures to reduce pollution, promote sustainability, and ensure the protection of natural ecosystems. To this end, health professionals have a fundamental role to play in raising awareness and mobilizing the population to ensure a healthy and sustainable future for all (Floss et al., 2021).

It must be recognized that the high prevalence of seemingly unrelated diseases, such as depressive disorder and dengue fever, has roots in capitalism and the anthropocene. It is necessary to foster systemic thinking in the education of health professionals so they undertake the social role of agents of transformation. Such conduct can be exercised individually or collectively, by modifying consumption patterns, demanding and building public policies, including planetary health in daily guidance on life habits, and encouraging people

to plant or seek local organic food producers, for example.

We must reflect on the world and the challenges we are leaving for future generations. Protecting children’s futures also implies ensuring the best environment for them to develop. Caring is the essence of the work of health professionals. Sowing the subject of planetary health is planting the culture of care.

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### Authors' contributions

All authors declare to have contributed substantially to the conception of this manuscript according to the requirements of ICMJE: information collection, critical reading of the studies, writing and critical review.

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