

Health and Environment in the 25 years of *Ciência & Saúde Coletiva*

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Abstract *The Journal Ciência & Saúde Coletiva appeared in the 1990s simultaneously to essential events that addressed the relationships between production, environment, health, and development, which generated an essential set of initiatives and scientific production and contributed to the development of Health and Environment in Brazil. We analyzed the papers published on this topic over the past 25 years to examine this Journal's contribution to the field. We examined 24 volumes and 170 issues and supplements of the Journal from 1996 to 2019. The texts were classified according to 4 domains. A total of 243 texts were included in the analysis, which represents about 5% of all scientific production published on the Journal's pages in the period. The production is quite varied, highlighting discussions about inequalities, vulnerabilities, development or economic aspects related to environmental issues and their impacts on health, the analysis of the production system and its relationship with health, and the predominance of studies on pesticides. We concluded that production in this field has been growing and tending to include affected territories, populations, and communities to produce this knowledge.*

Key words *Environmental health, Environmental pollution, Agrochemicals, Review*

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Introduction

The *Journal Ciência & Saúde Coletiva* is a publication channel for scientific production in the field of Collective Health, which arose in the 1990s at the same time as important events that addressed the relationships between production, environment, health, and development, such as the UN Conference on Environment and Development, also known as Eco-92, in Rio de Janeiro in 1992¹, and the Pan American Conference on Health and Environment in Sustainable Human Development (COPASAD), in Washington-DC, USA, in 1995². These and other events brought to center-stage the relationships established between health and the environment, understood and measured within the complex articulations of production/work, the socio-ecological system and health in the collective sphere³.

It is true that even before that, some initiatives had already been in place to articulate “health and environment” as a field of practice, such as those developed by the health services of the Secretariat of State of Cubatão (SP) since the late 1970s, and the creation of the Occupational Health and Human Ecology Study Center (CESTEH) at Fiocruz in 1985. Since then, a collaborative movement involving several teaching, research, and service institutions in public health and preventive medicine, among which USP’s Faculty of Public Health stands out in the first stages, has promoted this field’s ongoing development in Brazil. Previously considered in the field of health only by institutions related to environmental sanitation, the health-environment relationship has been recognized as an essential issue for Public Health in the last three decades^{4,5}.

This recognition initially received contributions in international conferences preceding Eco-92, where it explicitly emerged as a prominent question, although the health theme was not included. Other vital contributions occurred through complaints about worsening of environmental issues, the growing ecological movement, the contribution of Occupational Health, showing that the origin and effects on health were often not restricted to work environments, the growth of social movements such as residents’ associations, non-governmental organizations, and unions that discussed and denounced the effects on health associated with harm to the environment⁶. Other contributors were developing programs for the diagnosis of diseases related to the environment in outpatient clinics of public institutions, and the special programs

of international agencies such as the Pan American Health Organization (PAHO) and the World Health Organization (WHO). Also, within the public health network, health and environment actions were organized in municipalities, states, and at the federal level, resulting in the field of environmental health surveillance^{7,8}. As a result, an increase was observed in published papers, presentations in scientific events, dissertations, and theses in Public Health, highlighting the importance of this field of knowledge to the health sector⁹.

This area has kept its advances to date by adopting a critical view of science and its uses. It elaborated and employed innovations in its field of practice, such as the proposed bases for the constitution of a participatory model towards the construction of citizen science, the practice of popular health surveillance presented in its elements/procedures and evaluated in its possible concrete uses, and its adherence to studies and processes of implanting agroecology to replace Brazilian agriculture that adopts the intensive use of pesticides, guided by the so-called Post-World War II Green Revolution, seeking to defend the socio-environmental balance and a healthier, safer, and more sovereign diet¹⁰⁻¹³.

In 2001, the Brazilian Association of Collective Health (Abrasco) formalized in its structure the Health and Environment Thematic Group (GTSA) as responsible for issues related to the theme within the Association¹⁴. Noteworthy in this story is that a massive national training process was initiated a year before the creation of the GTSA, which included the “Basic Environmental Health Surveillance Course”, and then, the Environmental Health Surveillance was created as the Surveillance System’s subsystem of the Ministry of Health; thus, an activity integrated with the Brazilian Unified Health System (SUS)^{7,14,15}. This time synchronicity expresses not only the technical, scientific, and political maturity but also the recognition of concerns within health entities and society.

Since inception, the GTSA has been responsible for discussing theoretical, conceptual, and methodological aspects of the relationship between health and the environment within Abrasco. This group has also been critically discussing the production of knowledge, policies, and actions in the more formal and classic field of Environmental Health and exerting a substantial influence on social groups that have been suffering the impacts of pollution, contamination, and disasters through research, training, cooperation,

formulation of technical texts to support changes in legislation and communication aimed at strengthening health and ecological awareness in society¹⁴.

Several initiatives have certainly contributed to the growth of the Health and Environment field of practices, such as: a) interdisciplinary dialogues that refer to causality, social determination, risk, precautionary principle, sustainability, vulnerability, indicators, models of understanding and analysis, and exposure limits; b) knowledge dialogues on a perspective of approximation and alliance with social networks and movements; c) debates on the development of the Health and Environment theme in Postgraduate courses in Collective Health; d) debates about problems in the evaluation of scientific production and ethical issues; e) holding two Brazilian Symposiums on Health and Environment; f) elaboration of Technical Notes regarding vector control, scientific studies that expose conflicts of interest in various activities, including the production of scientific knowledge and its uses in research on pesticides and transgenics, established and pending bills, such as the one that allowed the use of aircraft to spray insecticides in urban areas in order to combat *Aedes aegypti*; g) the production of a dossier on the use of pesticides in Brazil; h) realization of two caravans in partnership with other institutions and professional associations, social movements, unions, and residents of the areas to assess living and working conditions and their consequences on the environment and the health of the residents, namely, the caravan in the Rio Doce Basin and another territorial caravan for the Bahian semi-arid^{13,16}.

The 25 years of existence of the *Journal Ciência & Saúde Coletiva* mostly coincide with the development of the Health and Environment practice, post-implantation of the SUS, also named in some professional circles as Environmental Health, reflecting a particular conceptual dispute, which reflects other academic tensions between Collective Health and traditional Public Health. Analyzing the papers published on this theme throughout this period is relevant to understand the contribution of this Journal in constructing this very current field and perhaps point out new editorial perspectives for the *Journal Ciência & Saúde Coletiva (C&SC)*.

Material and methods

The Journal's 24 volumes and 170 issues and supplements in that period were distributed among the nine authors of this review, and the titles of all published texts were read in order to identify those who addressed this topic to describe and analyze Health and Environment scientific production published in the Journal between 1996 and 2019. In this initial task, the inclusion criterion was the title of the text referring to the theme of Health and Environment, and we tried to be as comprehensive as possible since the scientific production in this field is characteristically multidisciplinary.

Thus, a list of authors, year of publication, titles, and hyperlinks to abstracts and full-texts was compiled to allow a more careful review of each published text's contents later. Texts published in Portuguese, Spanish, and English were included.

Then, each text's abstract was read, and when the abstract was insufficient to obtain the necessary information, the full-text was revised and evaluated. At that moment, we used as inclusion criteria research papers, theoretical and methodological discussions, case studies, reviews, editorials, and debates. The exclusion criteria were book reviews, texts on health and the environment not fitting the inclusion criteria, texts that addressed exclusively occupational effects of pollution or other environmental problems, or simply because they did not address Health and Environment.

After reading them, abstracts or full-texts were classified according to 4 domains: a) regarding the *object*: health and environmental impact, health and environmental change, disasters, traffic accidents, conceptual or theoretical issues or methodologies, epistemologies and critical analyses, climate change and health, economy-politics-culture-society (includes studies on inequalities, vulnerabilities, development, and differentiated populations), health services and others (addressing health prevention, promotion and care, education for health and rehabilitation); b) regarding the *system/compartment/element* containing the environmental theme to which they refer: water, air, soil, food, forests, biodiversity, environmental sanitation, productive system, and territories (indigenous, quilombola, traditional populations); c) regarding *typology*: environmental exposure, surveillance or public policies-legislation-law; and d) the agent type (when applicable): physical, chemical (with emphasis on pesticides), and biological.

The search criteria and text classification were considered satisfactory to meet the objectives of this work. Finally, a quantitative analysis of the published texts was made, examining temporal aspects, the most frequent domains and subdomains, and considerations made in the qualitative analysis from reading the texts of those considered most relevant.

Results

A total of 172 editorials, 102 debates, 238 book reviews, 38 letters to the editor, and 4,707 papers were published from 1996 to 2019, totaling 5,257 texts. After reading these texts' titles, we identified 261 papers (editorials, debates, opinion papers, and papers on empirical studies, collectively referred to here as "papers") addressing Health and Environment. Eighteen papers were excluded after reading the abstracts or full-texts: six because they addressed only the effects on occupational health; two addressed spatial analyses, but without direct association with the environment; one book review, and nine did not directly address the topic under study.

In the end, 243 publications were included, with the first in 1998, on the occasion of a special issue of the Journal *Health and Environment in the Development Process*, inaugurating this theme in the pages of *Ciência & Saúde Coletiva*. Thus, on average, 11 studies were published yearly over that period. However, it is noted that this average is due to some specific years when the number of publications was relatively high, such as in 2012 (35 papers), 2014 (39 papers), and 2016 (28 papers). In 2001, no paper on this topic was published in the Journal's issues (Figure 1).

In 2012, two issues of the Journal on the theme Health and Environment were published. The first was in February 2012 ("Environmental Issues from the Health Perspective") and the other in June 2012 during Rio+20. Two special issues were published in 2014, one on disasters and the other on environmental justice. In 2016, one issue was published on water and another on accident surveillance. It should be noted that six other thematic issues have been published addressing various aspects of the relationship between health and the environment over the past 25 years, with emphasis on four of them that focused on the work-environment-health relationship, one on pesticides, and the other on the territory.

Approximately 25% of the 243 evaluated papers' primary object of analysis was economy,

policy, culture, or society. That is, they addressed discussions about inequalities, vulnerabilities, development, or economic aspects related to environmental issues and their impacts on health. Two other most frequent themes were analyzing impacts on both the environment and health and studies that addressed conceptual, theoretical, and methodological issues (Table 1).

Regarding the analysis category "system/compartment/element", Table 2 shows that "water", "air", and "productive system" dominate, making up 76% of approximately half of the total papers in which this category was identified. Some papers included more than one "system/compartment/element" and the environment was mostly (44%) addressed in expanded fashion, and this categorization was not possible.

Most of the papers with a well-defined typology addressed analyses of "public policies or legislation or law" (47.4%), followed by studies that examined exposure to environmental agents (38.8%) and the others on surveillance (13.8%).

As for the agent examined, it is interesting to note that among studies with specific mention of an agent (128, or 53% of the total), most were related to pesticides (39.1%), which added to "other chemical agents" (32%), make up almost 70% of all the published production (Table 3).

In general, we observed that publications with an evident health-environment theme revealed broad and diversified interfaces. There is no predominant focus. It appears in dialogue with other disciplines and contemporary issues. Many papers result from empirical studies that address various objects and methods, showing the field's vitality. We also identified papers with theoretical, conceptual, and methodological reflections. In a smaller number, but very significant, we found papers of theoretical, conceptual, and epistemological nature that aimed to analyze the challenges of building this theme in Public Health, among other dimensions. No less important, we identified opinion papers on policies, especially related to the country's context, either in their governmental initiatives, to face public health problems, or as a result of disasters, environmental polluting, and contaminant processes.

Discussion

This review unveiled that about 5% of all scientific production published in the *Journal Ciência & Saúde Coletiva* pages in the last 25 years addressed the relationship between health and the

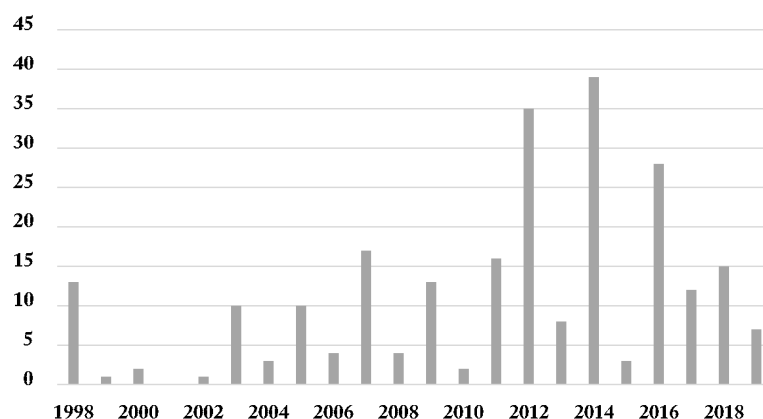


Figure 1. Number of publications per year on Health and Environment in the *Ciência & Saúde Coletiva*, 1998-2019.

Table 1. Distribution of papers on Health and Environment published in the *Ciência & Saúde Coletiva*, according to the object of analysis, 1998-2019.

Object	n	%
Economy, politics, culture, society	61	25.1
Conceptual, theoretical, methodological issues	48	19.8
Environmental impact and health	47	19.3
Environmental change and health	21	8.6
Disasters	18	7.4
Climate change and health	13	5.3
Health and other services	12	4.9
Epistemologies and critical analyses	5	2.1
Traffic accidents	3	1.2
Others	15	6.2
Total	243	100

Table 2. Distribution of papers on Health and Environment published in the *Ciência & Saúde Coletiva*, according to the system, compartment, or element of analysis, 1998-2019.

System/compartment/element	n	%
Water	43	35.5
Productive system	25	20.7
Air	24	19.8
Ground	7	5.8
Foods	7	5.8
Biodiversity	7	5.8
Environmental sanitation	5	4.1
Indigenous territories, quilombola, traditional populations	2	1.7
Forests	1	0.8
Total	121	100

environment. However, this number may be underestimated since the initial selection was made from the titles of the texts, and in some cases, it may not have been evident in the reading that the text belonged to this area.

Four of the 13 thematic issues centered on Health and Environment published over these 25 years were dedicated to the work-environment-health articulation, which can be the result of historical roots, since many Collective

Table 3. Distribution of papers on Health and Environment published in the *Ciência & Saúde Coletiva*, according to the analyzed agent, 1998-2019.

Agent	n	%
Chemical-pesticides	50	39.1
Chemical-other	41	32.0
Biological	20	15.6
Physical	12	9.4
Two or more agents	5	3.9
Total	128	100

Health researchers and professionals who built the field of Health and Environment in the late 1990s were firmly immersed in the construction of Occupational Health since the late 1970s, considering, for example, the initial establishment of the Abrasco Health and Environment WG, whose members, many from the field of Occupational Health, already considered the environmental dimension in their analyses^{14,16}. Also, this work-environment-health articulation can be considered as a result of the influence of Italian physician Giovanni Berlinguer, who stated that pollution stemmed from the productive processes and workers were the first and the most intensely exposed¹⁷. The articulation with the theme of development appears in three other thematic issues due to reflections related to events such as Rio+20. The other numbers are distributed in themes where Collective Health has greater scientific production and more significant political insertion, such as water, pesticides, disasters, and accidents. Among the novelties are the themes “territories” and “vulnerabilities”. Cross-sectional themes allow leaving the classic causal analysis of risk factors and incorporating more complex and dynamic processes.

Thematic issues were essential to boost the development of this field within Brazilian Public Health, but it is clear that there has been a gradual increase in production in more recent years, such as in 2017 and 2019, when there were no thematic issues on health and the environment, but even so, the number of papers in the field was high.

It is worth noting that about 25% of the analyzed production addressed discussions about inequalities, vulnerabilities, development, or economic aspects related to environmental issues and their health impacts. This shows how this theme is congruent with the field of Collective Health when seeking in its praxis an interdisciplinary, intersectoral articulation, and valuing other non-strictly academic knowledge. The presence of the policy dimension, at the State and societal level, in its academic making, is the main characteristic of Health and Environment field¹⁶.

Almost half of the publications were not categorized by the system/compartment/element analyzed. Every effort to categorize indeed involves some degree of reductionism, and many of the studies analyzed examined several systems/compartments together or treated the environment as nature and not as part of a population-space/territory. Water and air were the most frequently categorized subjects. These are traditionally more

linked to health, possibly due to waterborne diseases' importance as a public health problem in our environment. Also, due to water and air pollution and contamination caused by the modes of production and consumption, which include a lack of sanitation, a large number of fossil-fuel-based vehicles, the use of pesticides in agriculture, and toxic industrial effluents⁴. Interestingly, soil contamination had little emphasis on the analyzed production. However, the loss of soil quality, which is fundamental, for example, for food sovereignty and security, is not yet adequately valued by the health sector, as one of the guarantees of the quality of life^{18,19}.

The analysis of the productive system and its relationship with health is a great novelty brought by Collective Health compared to traditional Public Health. With increasing visibility, both concerning industrial disasters, the production of agricultural and mineral commodities, and in pollution more generally, as ontogenic determinants of social and environmental inequalities and injustice intrinsic to the capitalist production mode¹³.

Concerning typology, we note that most papers addressed analyses of “public policies, legislation, or law”, evidence that the *Journal Ciência & Saúde Coletiva* has a sensitive opening for intellectual production that reflects eco-sanitary intervention, both by the aspect of the actions and the legal norms supporting them, congruent with the characteristics of Health and Environment, as described above.

Regarding the agents examined, the large number of papers on pesticides causes a stir. This problem was and is in evidence in public health because Brazil has become one of the largest consumers of these products globally, strongly denounced since 2008, with a series of research and policy review initiatives¹³. It is interesting to note that other chemical agents appeared in about one-third of the publications, possibly due to the country's intense mining process and other polluting industries.

Indeed, other analyses would be possible on Health and Environment scientific production published on the *Journal Ciência & Saúde Coletiva*. For example, it could be an interesting exercise to make an in-depth analysis of the historical trend of this theme, showing how it accompanied the growth and movement of this field within the SUS, or even as it is currently elaborated given the stage of knowledge about it in the country and the world. Another question for reflection is whether the production of Health and Environ-

ment papers is in line with our field's significant challenges in the current national and planetary situation. On the other hand, a critical gap evidenced in our analysis was the absence of studies on the relationship between Health and Environment and the urbanization process, mainly considering the past and current consequences of urbanization in our context. When present, the issue of urbanization was addressed only indirectly in some papers. While the subcategory "productive system" is mentioned in some studies, we failed to identify a more significant debate on the "production-consumption" *per se* and its environmental impacts on health.

These points remain open and, at the same time, an invitation is made to continue analyzing the Journal's publications, including knowledge gaps that can guide editors to produce relevant thematic issues. It is necessary to continue to reflect on the significant Brazilian and global contemporary issues where the intersection of Health and Environment is updated and is present with increasing strength in the crisis of capital and the civilizing model.

Conclusions

The *Journal Ciência & Saúde Coletiva* has made an essential contribution to Health and Environment in Brazil over these 25 years. The analysis of the 243 texts published in this period allowed us to draw an overview of the socio-environmental determination of our environment's health-disease process. This scientific production helped the organization and maturation of this field, contributed to the structuring of Environmental Health Surveillance within the Unified Health System, and, consequently, the Brazilian population's health.

Besides the diversity of objects, breadth of approaches, and political intersection, this analysis also highlights the growing trend, which has been gaining space in the production of knowledge, of including, as subjects in scientific practice, of territories, populations, and communities whose health was affected, supposedly or concretely by new and different types of processes and events as socio-environmental changes took place.

Collaborations

N Gouveia worked on the conception, design, analysis, interpretation of data, and drafting of the text. AT Tambellini contributed to the design, analysis and interpretation of data, and critical review of the text. LG Silva contributed to the design, analysis, and interpretation of data, drafting, and critical review of the text. FF Carneiro and G Franco Netto contributed to the analysis and interpretation of data and drafting of the text. VM Câmara and M Kuhn contributed to data analysis and drafting of the text. A Miranda and H Castro contributed to the analysis of data.

References

1. Novaes W. Eco-92: avanços e interrogações. *Estud avançados* 1992; 6(15):79-93.
2. Porto MFS. Saúde, ambiente e desenvolvimento: reflexões sobre a experiência da COPASAD-Conferência Pan-Americana de Saúde e Ambiente no Contexto do Desenvolvimento Sustentável. *Cien Saude Colet* 1998; 3(2):33-46.
3. Tambellini AT, Miranda AC, Santos E, Carneiro F, Franco Netto G, Castro H, Cândia J, Finkelman J, Escamilla J, Amorin LC. Subsídios ao plano diretor de Saúde e Ambiente no âmbito do Sistema Único de Saúde. *Cad Saude Colet* 2005; 13(1):294-316.
4. Ribeiro H. Saúde Pública e meio ambiente: evolução do conhecimento e da prática, alguns aspectos éticos. *Saúde Soc* 2004; 13(1):70-80.
5. Tambellini AT, Almeida MG, Magalhães Câmara V. Registrando a história da saúde do trabalhador no Brasil: notas sobre sua emergência e constituição. *Rev em Pauta* 2013; 11(32):21-37.
6. Finkelman J, Netto G, Galvão L. Prefácio. In: Minayo C, Miranda AC, organizadores. *Saúde e Desenvolvimento Sustentável: Estreitando nós*. Rio de Janeiro: Editora Fiocruz; 2002. p. 344.
7. Franco Netto G, Carneiro FF. Vigilância ambiental em saúde. *Ciência e Ambiente* 2002; 25:47-58.
8. Augusto LGS. Saúde e vigilância ambiental: um tema em construção. *Epidemiol e Serviços Saúde* 2003; 12(4):177-187.
9. Tambellini AT, Câmara VM. A temática saúde e ambiente no processo de desenvolvimento do campo da saúde coletiva: aspectos históricos, conceituais e metodológicos. *Cien Saude Colet* 1998; 3(2):47-59.
10. Brito PF, Gomide M, Câmara VM. Agrotóxicos e saúde: realidade e desafios para mudança de práticas na agricultura. *Physis Rev Saude Coletiva* 2009; 19(1):207-225.
11. Bortolotto CC, Hirschmann R, Martins-Silva T, Facchini LA. Exposição a agrotóxicos: estudo de base populacional em zona rural do sul do Brasil. *Rev Bras Epidemiol* 2020; 23:e200027.
12. Nasralla Neto E, Lacaz FAC, Pignati WA. Health surveillance and agribusiness: the impact of pesticides on health and the environment. Danger ahead! *Cien Saude Colet* 2014; 19(12):4709-4718.
13. Carneiro FF, Rigotto RM, Augusto LGS, Friedrich H, Búrigo AC. *Dossiê ABRASCO: um alerta sobre os impactos dos agrotóxicos na saúde*. Rio de Janeiro: EPSJV/Expressão Popular; 2015.
14. Augusto LGS, Câmara VM, Carneiro FF, Cândia J, Gouveia N. Saúde e ambiente: uma reflexão da Associação Brasileira de Pós-Graduação em Saúde Coletiva-ABRASCO. *Rev Bras Epidemiol* 2003; 6(2):87-94.
15. Carneiro FF, Oliveira MLC, Netto GF, Galvão LAC, Cândia JA, Bonini EM, Corvalan CF. Meeting report: development of environmental health indicators in Brazil and other countries in the americas. *Environ Health Perspect* 2006; 114(9):1407-1408.
16. Augusto LG da S, Carneiro FF, Bedo CNG, Friedrich K, Búrigo AC, Tambellini AT. Análise do percurso histórico e das ações do Grupo Temático de Saúde e Ambiente da Associação Brasileira de Saúde Coletiva, ABRASCO. *Rev Salud Ambient* 2018; 18(1):52-61.
17. Berlinguer G. *A saúde nas fábricas*. São Paulo: CEBES-HUCITEC; 1983.
18. Marins BR. *Segurança alimentar no contexto da vigilância sanitária: reflexões e práticas*. Rio de Janeiro: EPSJV; 2014.
19. Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA). *Relatório da FAO com participação da Embrapa revela que 33% dos solos do mundo estão degradados* [Internet]. 2015 [cited 2020 Jun 18]. Available from: <https://www.embrapa.br/busca-de-noticias/-/noticia/8104410/relatorio-da-fao-com-participacao-da-embrapa-revela-que-33-dos-solos-do-mundo-estao-degradados>

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