The scientific production in Epidemiology of the *Journal Ciência & Saúde Coletiva*

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Abstract *The aim of this article is to present a description and analysis of the scientific production in Epidemiology of the Journal Ciência & Saúde Coletiva since its creation in 1996. The titles and abstracts of all articles published in three periods (1996 to 2002, 2011 and 2019) were read and those related to Epidemiology were analyzed. These publications were classified according to the thematic area, study design, sampling method and sample size, and place of origin of the first author. The percentage of epidemiological articles published in the journal jumped from 12.8% in the first period to 31.0% in 2011, and to 55.3% in 2019. The most studied topics were chronic non-communicable diseases (20.3%), nutritional epidemiology (12.2%) and evaluation of health systems, policies, programs and services (10.9%). Descriptive/cross-sectional studies, conducted among adults and from the Southeast region, predominated. The results indicate the need for greater participation of cohort studies, case-control and clinical trials in the scope of the journal's publications, in addition to articles that use more sophisticated statistical methods and well-defined theoretical models, which may contribute in a more relevant way to prevention and control of health problems.*

Key words *Epidemiology, Public health, Editorial policies, Journal articles*

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Introduction

Epidemiology, despite its intense methodological development in recent years, is still a relatively new discipline in conceptual terms[1]. Although its basic foundations were consolidated in the second half of the last century[1], even today there is still no agreement on the real object of the discipline[2], or even on a widely accepted definition of the phenomenon of confounding[3]. The first half of the last century has seen the emergence of a new discipline, which is still in the process of being developed.

Nevertheless, in the midst of this identity crisis and the continuous process of construction of these concepts, Brazilian epidemiology has flourished. Milestones in the history of the discipline in Brazil were the formation of the first Brazilian epidemiologists in renowned universities abroad[4], the creation of Abrasco (Brazilian Association of Collective Health); the Abrasco Epidemiology Commission[5]; and the holding of Epidemiology Congresses[6]; the elaboration of four Master Plans for the Development of Epidemiology in Brazil[7]; the creation of CENEPI (National Center of Epidemiology)[8], now incorporated to the Secretariat of Health Surveillance - SVS[9]; and the implementation and consolidation of post-graduate programs in Collective Health and Epidemiology throughout the country[10,11]. Institutions such as the Pan American Health Organization (PAHO) and the National School of Public Health also played an important role in this process[5].

Throughout this period, Brazilian scientific production in Epidemiology showed vertiginous growth[5,12]. Older and more traditional journals in the area, such as Revista de Saúde Pública, created in 1967, along with new journals created in the 80s and 90s, such as Cadernos de Saúde Pública, created in 1985, have been responsible for disseminating most Brazilian scientific production in Epidemiology since then[10]. Among them, the *Journal Ciência & Saúde Coletiva*, created by Abrasco, in 1996[13], is one of the most important journals for the dissemination of scientific production in Epidemiology in Brazil.

The objective of the present article is to present a description and analysis of the scientific production in Epidemiology in *Journal Ciência & Saúde Coletiva* throughout its 25 years of existence.

Methods

This is a descriptive study, conducted to know the profile of the publications of epidemiological articles in *Journal Ciência & Saúde Coletiva* over time. Due to the large number of articles published, it was not possible to cover the whole period, thus the initial years, an intermediate year and a more recent year were chosen. No keyword search was used because it was considered that this method would have difficulty in separating epidemiological articles from articles from other areas of knowledge. Thus, an exhaustive reading of the titles and abstracts of the articles published in the journal was made through Scielo, in three periods: 1996 to 2002 (covering 15 issues from volumes 1 to 7, with a total of 196 articles), and the years 2011 (corresponding to volume 16, with 12 normal issues and one supplement, with a total of 462 articles) and 2019 (covering volume 24, with 12 issues, with a total of 425 published manuscripts). The periods were selected in order to aggregate a similar number of issues in each one of them, so as not to jeopardize the temporal comparison. For this reason, the initial period included seven years, totaling 15 issues.

Through this procedure, articles considered by both authors as belonging to the field of knowledge of epidemiology were identified. From the identification of epidemiological articles, the percentage of participation of these articles in the total scientific production published in *Journal Ciência & Saúde Coletiva* in the three periods analyzed was calculated.

The selected scientific production was categorized according to the thematic classification used in the submission of abstracts for the 11th Brazilian Congress of Epidemiology of Abrasco[14]. In addition, the following information was also verified: type of epidemiological study, population group studied, type of sampling procedure employed, sample size (coded at ≤100, 100 to 499, 500 to 999, 1000 to 4999 and ≥1000) and main author's workplace. Additionally, qualitative evaluation of the articles was performed regarding the statistical methods used, control of confounding, use of theoretical models, among other aspects that could help the characterization of the evaluated productions.

The data were compiled and analyzed using Excel® programs, from the Microsoft Office package, version 2010, and Stata® version 14.0 (StataCorp

LLC, College Station, TX), and presented in tables, with absolute and relative frequencies.

Results

The percentage of epidemiological articles published in *Journal Ciência & Saúde Coletiva* jumped from 12.8% in 1996 to 2002 to 31.0% in 2011. It then increased again to 55.3% in 2019 (Table 1).

The most studied topics were epidemiology of chronic non-communicable diseases (20.3%), nutritional epidemiology (12.2%), evaluation of health systems, policies, programs and services (10.9%), oral health epidemiology (10.9%), epidemiology of the elderly (8.4%), epidemiology of communicable diseases (7.2%), worker health (6.5%) and epidemiology of accidents, violence and physical injuries (5.5%), with little variation between 2011 and 2019. However, in the first period (1996 to 2002), topics related to social epidemiology and social determinants of health (20.0%) and articles addressing theoretical-conceptual aspects in epidemiology (16.0%) were the most published. Some relevant themes, such as evaluation of medical and health technologies; education and training in epidemiology; interdisciplinarity and intersectoriality in epidemiology; sustainability, integrity and ethics in epidemiological research; use of qualitative methods in epidemiological studies; and epidemiological surveillance and health surveillance did not have any participation in the three evaluated periods (Table 2).

Table 3 presents some characteristics of the epidemiological articles published in each of the periods analyzed. About 77% of the epidemiological studies were descriptive or cross-sectional, followed by systematic reviews (5.5%), ecological studies (4.7%), with small fluctuations in the two most recent periods. Considering the

three analyzed periods, studies conducted among adults (22.5%), all age groups (18.8%) and among the elderly (17.8%) were more frequent than those that included the maternal and child population (15.7%) and adolescents (9.7%). Probabilistic population-based samples (35.3%) and intentional or convenience-based samples (33.6%) predominated, while probabilistic restricted population samples (15.8%) and studies covering the whole population (15.3%) were less frequent. Studies with sample sizes from 100 to 499 individuals were more frequent (38.6%), but studies with large sample sizes (≥ 1000) were also well represented. Regarding this aspect, some variations were observed throughout the three periods investigated, drawing attention to the predominance of articles using population-based probabilistic samples and large samples (≥ 5000) in the first investigated period (Table 3).

Regarding the regional distribution of the main authors of the articles (Table 4), 46.4% came from the Southeast, 20.6% from the South, 18.9% from the Northeast, 6.0% from the Center-West, 6.5% from abroad and only 1.7% from the North. In the first period, the Southeast concentrated 80.0% of the authors, but its participation decreased to less than 50% in 2011 and 2019. The participation of articles by authors from abroad was higher in the last period, when it reached 8.5% of the total (Table 4).

Most cross-sectional studies aimed to estimate prevalence and study risk factors for a given condition and some answered a more specific question, with an exposure and an outcome. In general, the methods used were those of risk factor epidemiology, such as relative frequencies, calculation of risk ratios, prevalence ratios or odds ratio in multivariable models, usually Poisson or logistic regression with robust variance adjustment. The strategy used to control confounding was rarely mentioned. However, the most used method was based on p values, often performed in an automated way (stepwise). The vast majority of studies did not have a more elaborate underlying theoretical model that would assist in the interpretation of the findings. Among the few theoretical models used the most frequent was hierarchical modeling. More sophisticated statistical analysis, such as multi-level models or analysis with propensity scores, were rarely used. In the studied periods, no article was published using DAGs (directed acyclic graphs), counterfactual approach, structural equations modeling, analysis with big data or Bayesian models (data not shown in tables).

Table 1. Number and percentage of publications of Epidemiology in *Journal Ciência & Saúde Coletiva*, 1996-2002, 2011 and 2019.

Years	Total published articles*	% Epidemiology
1996-2002	196	12.8
2011	462	31.0
2019	425	55.3

* Excluding opinion articles, reviews and letters.

Table 2. Thematic classification of epidemiological articles published in *Journal Ciência & Saúde Coletiva*, 1996-2002, 2011 and 2019.

Thematic	1996-2002		2011		2019		Total	
	n	%	n	%	n	%	n	%
Theoretical-conceptual aspects in epidemiology	4	16.0	-	-	-	-	4	1.0
Evaluation of health systems, policies, programmes and services	3	12.0	23	16.1	18	7.7	44	10.9
Evaluation of medical and health technologies	-	-	-	-	-	-	-	-
Education and training in epidemiology	-	-	-	-	-	-	-	-
Oral health epidemiology	-	-	14	9.8	22	9.4	36	8.9
Epidemiology of child health	-	-	4	2.8	5	2.1	9	2.2
Epidemiology of adolescent health	-	-	3	2.1	2	0.9	5	1.2
Epidemiology of adult health	-	-	1	0.7	-	-	1	0.2
Epidemiology of elderly health	2	8.0	8	5.6	24	10.2	34	8.4
Chronic Noncommunicable Disease Epidemiology (NCD)	3	12.0	30	21.0	49	20.9	82	20.3
Epidemiology of communicable diseases	3	12.0	13	9.1	13	5.5	29	7.2
Life course epidemiology	-	-	1	0.7	-	-	1	0.2
Epidemiology of accidents, violence and physical injuries	1	4.0	3	2.1	18	7.7	22	5.5
Epidemiology in specific population subgroups	-	-	-	-	8	3.4	8	2.0
Genetic and molecular epidemiology	2	8.0	-	-	-	-	2	0.5
Nutritional Epidemiology	-	-	14	9.8	35	14.9	49	12.2
Social epidemiology and social determinants of health	5	20.0	2	1.4	7	3.0	14	3.5
Pharmacoepidemiology	-	-	6	4.2	4	1.7	10	2.5
Interdisciplinarity and intersectoriality in epidemiology	-	-	-	-	-	-	-	-
Methods and techniques in epidemiological studies	-	-	4	2.8	1	0.4	5	1.2
Other topics in epidemiology	-	-	1	0.7	2	0.9	3	0.7
Environmental health and disasters	1	4.0	4	2.8	6	2.6	11	2.7
Health of the worker	-	-	8	5.6	18	7.7	26	6.5
Health information systems	1	4.0	4	2.8	3	1.3	8	2.0
Sustainability, integrity and ethics in epidemiological research	-	-	-	-	-	-	-	-
Use of qualitative methods in epidemiological studies	-	-	-	-	-	-	-	-
Epidemiological and health surveillance	-	-	-	-	-	-	-	-

Discussion

Epidemiology is the field that currently concentrates most of the publications of *Journal Ciência & Saúde Coletiva*, as it already occurs with other Brazilian public health journals, such as Cadernos de Saúde Pública[15] and Revista de Saúde Pública[5]. However, it calls attention that despite the large participation of national journals, a relevant part of the Brazilian epidemiological production, especially that of best quality, is concentrated in international journals[5].

In the last century, the topic of transmissible diseases and maternal-infant health predominated in Latin American epidemiological production[5,10,16]. Perhaps because it is a newer journal,

the predominant epidemiological production in *Journal Ciência & Saúde Coletiva* is about chronic noncommunicable diseases, similar to what is observed in journals of high income countries[17]. This greater production on the theme of non-communicable diseases and illnesses reflects the greater global burden of diseases of these groups of causes for the Brazilian population[18], demonstrating an alignment between the production of the area and the health profile of the population.

In general, there is a great diversity of themes approached in the investigations of Brazilian epidemiologists[12], as observed in the productions of the *Journal Ciência & Saúde Coletiva*. Between 2011 and 2019, the Nutritional Epidemiology area grew remarkably, reaching 14.9% last year,

Table 3. Types of epidemiological studies, population, type of sampling and sample size of the epidemiological articles published in *Journal Ciência & Saúde Coletiva*, 1996-2002, 2011 and 2019.

Variables	1996-2002		2011		2019		Total	
	n	%	n	%	n	%	n	%
Type of study								
Descriptive/Cross-sectional	18	72.0	114	79.7	179	76.2	311	77.2
Cohort	-	-	2	1.4	11	4.7	13	3.2
Case Control	-	-	1	0.7	6	2.6	7	1.7
Ecological	-	-	6	4.2	13	5.5	19	4.7
Trends in time series	-	-	6	4.2	5	2.1	11	2.7
Spatial analysis	-	-	1	0.7	1	0.4	2	0.5
Systematic review	-	-	6	4.2	16	6.8	22	5.5
Experimental pre and post	-	-	3	2.1	2	0.9	5	1.2
Clinical trial	-	-	-	-	1	0.4	1	0.2
Other	7	28.0	4	2.8	1	0.4	12	3.0
Population*								
Mother-child	-	-	16	11.8	44	19.2	60	15.7
Adolescent	-	-	13	9.6	24	10.5	37	9.7
Adult	1	5.6	40	29.4	45	19.7	86	22.5
Elderly	2	11.1	12	8.8	54	23.6	68	17.8
Adult and elderly	4	22.2	1	0.7	19	8.3	24	6.3
All	9	50.0	35	25.7	28	12.2	72	18.8
Child and adolescent	-	-	8	5.9	7	3.1	15	3.9
Woman	2	11.1	11	8.1	8	3.5	21	5.5
Type of Sampling*								
Intentional	1	5.6	40	29.4	80	38.8	121	33.6
Probabilistic population based	13	72.2	39	28.7	75	36.4	127	35.3
Probabilistic restricted population	1	5.6	30	22.1	26	12.6	57	15.8
Whole population	3	16.7	27	19.9	25	12.1	55	15.3
Sample Size*								
< 100	1	6.7	12	9.8	22	10.9	35	10.3
100 a 499	1	6.7	60	48.8	70	34.8	131	38.6
500 a 999	-	-	19	15.4	42	20.9	61	18.0
1000 a 4999	2	13.3	16	13.0	34	16.9	52	15.3
≥ 5000	11	73.3	16	13.0	33	16.4	60	17.7

* The numbers are lower than the totals of articles evaluated in each year, because the systematic review articles and theoretical and methodological aspects were not classified in terms of these characteristics.

which had already been described previously[5]. Other areas that stand out are oral health epidemiology, accident epidemiology, violence and physical injury epidemiology, communicable diseases epidemiology, and epidemiology of the elderly. The important presence of the area of evaluation of services, policies and health programs is also noteworthy, demonstrating the strong interaction between academic research and health service practices, which is considered one of the defining characteristics of Brazilian epidemiology[19]. As negative trends, the virtual disappearance of studies covering theoretical-conceptual aspects of epidemiology and a large reduction in the percentage of publications on Social Epidemiology and social determinants in Health stands out. In addition, it is interesting to note that there was only one publication on life course epidemiology in 2011, which is an emerging theme in the area[6]. Another noteworthy point is that several published systematic reviews did not follow the recommendations of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)[20], reflecting the diversity of terminologies and understanding of what systematic reviews are[21].

Table 4. Place of the main author's institution of the epidemiological articles published in *Journal Ciência & Saúde Coletiva*, 1996-2002, 2011 and 2019.

Regions and States	1996-2002		2011		2019		Total	
	n	%	n	%	n	%	n	%
North region	-	-	4	2.8	3	1.3	7	1.7
Rondônia	-	-	-	-	-	-	-	-
Acre	-	-	-	-	1	0.4	1	0.2
Amazonas	-	-	4	2.8	1	0.4	5	1.2
Roraima	-	-	-	-	-	-	-	-
Pará	-	-	-	-	-	-	-	-
Amapá	-	-	-	-	-	-	-	-
Tocantins	-	-	-	-	1	1	1	0
Northeast region	1	4.0	24	16.8	51	21.7	76	18.9
Maranhão	-	-	2	1.4	4	1.7	6	1.5
Piauí	-	-	1	0.7	2	0.9	3	0.7
Ceará	-	-	4	2.8	6	2.6	10	2.5
Rio Grande do Norte	-	-	3	2.1	5	2.1	8	2.0
Paraíba	-	-	-	-	8	3.4	8	2.0
Pernambuco	-	-	9	6.3	11	4.7	20	5.0
Alagoas	-	-	2	1.4	2	0.9	4	1.0
Sergipe	-	-	1	0.7	1	0.4	2	0.5
Bahia	1	4.0	2	1.4	12	5.1	15	3.7
Southeast region	20	80.0	64	44.8	103	43.8	187	46.4
Minas Gerais	4	16.0	21	14.7	46	19.6	71	17.6
Espírito Santo	-	-	3	2.1	8	3.4	11	2.7
Rio de Janeiro	13	52.0	12	8.4	19	8.1	44	10.9
São Paulo	3	12.0	28	19.6	30	12.8	61	15.1
South region	2	8.0	36	25.2	45	19.1	83	20.6
Paraná			9	6.3	11	4.7	20	5.0
Santa Catarina			8	5.6	8	3.4	16	4.0
Rio Grande do Sul	2	8.0	19	13.3	26	11.1	47	11.7
Center-Western region	-	-	11	7.7	13	5.5	24	6.0
Mato Grosso do Sul	-	-	4	2.8	3	1.3	7	1.7
Mato Grosso	-	-	-	-	2	0.9	2	0.5
Goiás	-	-	-	-	2	0.9	2	0.5
Distrito Federal	-	-	7	4.9	6	2.6	13	3.2
Abroad	2	8.0	4	2.8	20	8.5	26	6.5
Portugal	-	-	-	-	7	3.0	7	1.7
Spain	-	-	-	-	4	1.7	4	1.0
United States	2	8.0	1	0.7	-	-	3	0.7
Canada	-	-	1	0.7	-	-	1	0.2
Mexico	-	-	2	1.4	4	1.7	6	1.5
Chile	-	-	-	-	1	0.4	1	0.2
Colombia	-	-	-	-	1	0.4	1	0.2
Turkey	-	-	-	-	3	1.3	3	0.7

In contrast to other international epidemiological journals, where the predominant type of study is cohort[17], among the epidemiological articles published in *Journal Ciência & Saúde Cole-tiva*, descriptive/transverse articles were predominant, which generally study several risk factors for a given outcome, being mostly exploratory in nature. Among the risk factors, generally more

emphasis is placed on those related to lifestyle than on structural and socioeconomic determinants of diseases. The simultaneous study of several risk factors, usually carried out without an underlying theory to support it, may mislead the interpretation of the effect of more distal variables. In many situations, the direct effect of a distal variable is interpreted as representing the total effect, leading to the false conclusion that the variable would not be associated with the outcome. This problem was well analyzed and denominated "the fallacy of table 2" in a previous study[22].

A qualitative analysis of the articles published in *Journal Ciência & Saúde Coletiva* shows that there is little use of theoretical models that help in the interpretation of data and these models, when used, are quite simple. Likewise, it is generally not made explicit how the adjustment variables to control for confounding were selected, and in this selection more emphasis is given to cutoff points based on significance than on an underlying theory. All these characteristics are not exclusive to the articles published in *Journal Ciência & Saúde Coletiva*. In an editorial of great repercussion, published in 2013, the publishers of Cadernos de Saúde Pública described these issues in that journal and called this vicious circle "more of the same"[15]. Reasons for this lack of creativity and use of automated ways of doing science can be partially attributed to the academic pressure to publish in order to be successful in the academic career, the phenomenon called "publish or perish"[15]. In Brazil, this situation was probably enhanced by the Capes post-graduation evaluation model, currently under review, which attributed greater importance to the quantity of products, to the detriment of their quality[23]. This may be one of the factors responsible for the fact that Brazilian production in Collective Health has little international visibility[23].

Regarding the regional distribution of publications, one can notice in the first two periods, a strong concentration of production in the Southeast, especially in Minas Gerais, São Paulo and Rio de Janeiro, as previously described[10,13]. In the last period, there was an important geographical deconcentration of the epidemiological production observed in *Journal Ciência & Saúde Coletiva*, with an increase in the participation of authors from the Northeast and South regions, although articles by authors linked to institutions in the Southeast still predominate. This distribution of publications is consistent with the regional distribution of Post-Graduate Programs in the area of Collective Health in Brazil, which despite the great expansion observed in recent years, is still concentrated in the Southeastern region, with about 45% of the total number of programs, while the North and Center-West concentrate only 11% of this total[24]. When compared to the percentage of publications from outside the country, there is a clear supremacy of the productions of Brazilian authors, concentrating 94% of the articles, which is in line with the trend observed in international epidemiology journals, which presents a predominance of publications from the authors' own country[25].

Currently, the rate of refusals in *Journal Ciência & Saúde Coletiva* is very high, around 90%. In the area of Epidemiology, this high rate is due to several factors: descriptive articles with small sample size and/or based on convenience samples; cross-sectional studies answering questions that have been elucidated for a long time; analyses with little theoretical component; and very superficial discussions, comparing rather than interpreting the data. The lack of creativity produces articles containing "more of the same"[15] with little relevant contribution to the advancement of knowledge. In addition, the large number of submissions obliges the editorial staff to make selection based on priority, comparing articles and choosing the most promising ones.

The interpretation of the results presented in this paper should consider the analysis of only three periods, over the 25 years of the journal, due to the difficulty of adequately evaluating the entire production of the journal, which totaled 4,928 articles between 1996 and 2019. Thus, some information described in this publication, such as themes addressed in the articles, type of study and regional distribution, do not represent the entire production of *Journal Ciência & Saúde Coletiva*. However, it is important to emphasize that the periods were chosen in order to represent the profile of the journal's publications in the initial years, in an intermediate year, and in the most recent year of its existence, allowing a detailed analysis and a temporal comparison of the published articles in each period. Furthermore, the results show trends similar to those described for other national and international journals, of constant increase of scientific production in the area of Epidemiology[5,12,17], demonstrating the possible representativeness of this evolution.

What do editors see as the future of Epidemiology in *Journal Ciência & Saúde Coletiva*? It would be important to increase cohort, case-control and randomized controlled trials focused on

one exposure at a time, instead of studying several risk factors simultaneously. The use of more sophisticated and appropriate statistical methods to answer new questions are welcome. Articles that start from well-established theoretical models and that have the analysis more guided by theory and less by statistical significance will produce better quality responses with greater influence in the prevention and control of health-related diseases, the main purpose of epidemiology.

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AAM Silva and SV Peixoto: study design, data extraction, analysis and interpretation, manuscript writing and review, and approval of the final version.

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