

Geography and public health in Brazil

Geografia e saúde coletiva no Brasil

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Abstract

This article analyzes the importance of Geography for research in Public Health in Brazil. Through a bibliographical narrative review, the author describes the key topics addressed, grouping the selected articles of the most important Brazilian journals in Public Health - *Revista de Saúde Pública*, *Cadernos de Saúde Pública e Saúde e Sociedade* - by geographical approaches. It also discusses the progress achieved, as well as the theoretical and methodological challenges of Public Health based on geographical knowledge. The importance of health geoprocessing for spatial distribution studies was observed, especially those on infectious and parasitic diseases. Similarly, it was possible to identify the growth of the scientific production in studies based on critical thinking, especially recent publications in *Saúde e Sociedade*. The comparison of published works also provided the identification of methodological challenges to be faced for the study of Public Health with an even better basis of geographical knowledge, such as the use of predictive models and trend surface analysis, as well as the development of new cartographic tools to understand social reality in transformation and movement.

Keywords: Geography; Epistemology; Public Health; Geographical Space; Spatial Analysis.

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Resumo

Este artigo faz uma reflexão a respeito da importância da geografia para a pesquisa em saúde coletiva no Brasil. Por meio de uma revisão bibliográfica narrativa, o autor descreve os principais temas abordados, agrupando os artigos selecionados de três das principais revistas brasileiras da área - *Revista de Saúde Pública*, *Cadernos de Saúde Pública* e *Saúde e Sociedade* - por escolas do pensamento geográfico. Discute também os avanços alcançados, assim como os desafios teóricos e metodológicos da saúde coletiva com base nos conhecimentos geográficos. Observou-se a importância do geoprocessamento em saúde para estudos de distribuição espacial, principalmente de doenças infectocontagiosas e parasitárias. Da mesma forma, foi possível identificar o crescimento da produção científica em estudos com base no pensamento crítico, com destaque para as publicações recentes na revista *Saúde e Sociedade*. A comparação dos trabalhos publicados também proporcionou a identificação de desafios metodológicos a serem enfrentados para o estudo da saúde coletiva com embasamento ainda maior de conhecimentos geográficos, como o uso de modelos preditivos e análise de superfícies de tendências, assim como o desenvolvimento de novas ferramentas cartográficas para a compreensão da realidade social em transformação e movimento.

Palavras-chave: Geografia; Epistemologia; Saúde Coletiva; Espaço Geográfico; Análise Espacial.

Introduction

Geography and epidemiology have always been closely related, and both are part of the central core of knowledge of Public Health (Bousquat; Cohn, 2004). In their origin, both had strong influence from positivism, postulating as truth criteria scientific neutrality and the search for the description of the facts themselves. To do this, both the geographic method and the epidemiological method preconized the critical distancing from the subject from the object of study, in order to obtain results considered clear and completely correct. In this analytical process, it would be necessary to fragment the object into as many parts as needed for its exact understanding (Guimarães; Pickenhayn; Lima, 2014).

In its origin, Geography had space as its object, understood as the physical environment, divorced from historical time (Santos, 1978). Regarding epidemiology, it emerged with an emphasis on the biological conception of disease, which was reinforced with the advent of microbiology (Bousquat; Cohn, 2004). Since the emergence of these scientific disciplines, at the end of the 19th century, cartography had a prominent position, enabling the analysis of the distribution patterns of diseases in different geographical scales (Rojas; Barcellos, 2014).

Not by accident, these young sciences have faced several scientific dilemmas early on. The main one concerns the dichotomies generated by the analytical process - society/nature, anatomical and physiological body/social body - which makes the epistemological debate on geography and epidemiology complementary. For the development of such scientific disciplines, it was necessary to criticize its own positivist postulates, facing many crucial issues, for example: (i) how to consider the processes in the explanations of phenomena? (ii) how to understand the facts through social and natural determinants at the same time? (iii) what objectives the researches should have, in addition to the establishment of general laws through a growing process of generalization? The interpretation of these issues resulted in different methodological perspectives and brought Geog-

raphy even closer to the thematic field of Public Health. Its contribution could not be limited to the field of distribution and of the causes of diseases (geography of diseases) only. It was necessary to move forward the studies that relate space and time, at different levels of reality, from local to global (Mayer, 1992).

The creation of the magazine *Health and Place*, in 1995, was a significant milestone of this movement, providing continuity to the debate on the relation between Geography and Public Health to this day. According to the editor of this scientific journal, health has been area field that requires the study of a wide range of issues (Moon, 1995), among which the following stand out: the emergence of new diseases, the analysis of their etiologies and, in the case of transmissible diseases, their propagation; the resurgence of diseases that were already under control; the growth impact of chronic degenerative diseases and mental disorders; and the prevalence and etiology of diseases related to behavior, particularly, smoking, drinking, eating habits, sedentary lifestyle, sex life and drug use. Considering the dynamic and interdisciplinary nature of this thematic field, this new periodical has been willing to publish the results of researches with emphasis on theoretical aspects, promoting the dissemination of methodological pluralism on the investigation of production processes of information and on the social construction of the meanings of the term "health".

Brazilian Geography has not been unrelated to this intense debate that has been happening in recent decades. However, Marxist theory has had a more significant impact here, as in other countries of Latin America, such as Mexico and Ecuador, for example. In the same way, from the perspective of critical realism, Brazilian social epidemiology started to perform the analysis of the health-disease process considering the differences of getting sick and dying between the social classes or between people in different socio-spatial contexts (Sabroza; Leal, 1992).

Since the 2000s, the Brazilian geographical community increasingly got interested by the discussion on Public Health, the execution of the 1st

National Symposium of the Geography of Health, in December 2003, in the city of Presidente Prudente (SP), being a landmark in this process. Since then, every couple of years there have been other symposia, bringing together researchers in Geography with the challenge of understanding the new meanings of health and life in the city or in the countryside, the feeling of belonging to a community and the collective interest-generating processes and the identity of those who live in each place, as predicted by Rojas (2003).

Thus, the results obtained in the interface of Geography and Health are part of a system of evolving ideas and of a wider movement of consolidation in the field of Public Health, which needs to be deepened. To understand this system of ideas in evolution, it is necessary to review the process that happens in the complex web of associations between geographers, doctors and other professionals from related fields of Public Health. This is the aim to be developed on this paper.

Several authors have published literature reviews on this topic before in the main Brazilian journals of Public Health. In one of the oldest papers, "Considerações acerca dos fundamentos teóricos da explicação em epidemiologia", Silva (1985) discusses the contributions of geographic knowledge to the establishment of theoretical alternatives for the development of epidemiology, among other things. Ferreira (1991) has this same concern, showing central aspects of the concept of pathogenic complex by Max Sorre to analyze the integration between epidemiology and geography. This theme is brought up again by Silva (1997), when discussing the use of the concept of space in the social analysis of the distribution of infectious diseases, and by Costa and Teixeira (1999), as they address the conception of "space" in epidemiological research.

Two scientific articles published in Brazil that analyze the issue in the wide context of Latin America stand out. In the first of them, the Cuban geographer Luisa Rojas (1998) discusses the need for more integrated research on processes of spatial differentiation that generate inequalities and iniquities in the health situation of the populations

of the continent. Czeresnia and Ribeiro (2000) consider the contribution of the main authors of these Latin American studies, from Pavlovsky, Max Sorre and Samuel Pessoa to the most recent contribution from Milton Santos's theory.

At the same time that Brazilian journals debates about the importance of Geography to the study of Public Health - with emphasis on the use of the concept of space in epidemiology - there is also an effort for the methodological development of spatial analysis and geoprocessing techniques and geostatistics in the field of Health. These are mainly published in the journal *Cadernos de Saúde Pública* and provide an overview of the main techniques and methodological challenges for studies on cases of disease in space-time (Werneck; Struchiner, 1997), spatial statistical methods (Bailey, 2001) and applications of spatial analysis in ecological studies and risk areas (Carvalho; Souza-Santos, 2005).

It has been 30 years since the publication of the paper by Luiz Jacintho da Silva (1985). Thus, in addition to the comprehension of this interface between Geography and other fields of Public Health, this study has as objective the analysis of all the studies from that period, aiming at the identification of new theoretical and methodological challenges.

Methodological procedures

It was sought, through a narrative literature review (Rother, 2007), to describe the state of the topic under study, considering the articles published in three of the main Brazilian journals of Public Health: *Revista de Saúde Pública*, *Cadernos de Saúde Pública* and *Saúde e Sociedade*. The main geographical concepts used in the papers have been identified through keywords from which the search of the texts was made in these three journals on the SciELO data platform. Based on this type of bibliographical narrative review, no systematic or explicit methods have been used for the selection and assessment of the papers. According to the seizing of the central ideas of the texts, these papers were grouped by approaches of geographic thinking through the subjective judgment criterion of the author of this paper.

Choice of keywords

The keywords express the central ideas of the scientific papers and can be considered as descriptors of the most important concepts of these studies. For this reason, before choosing search terms on the SciELO platform, the reflection on the main geographical categories and concepts of interest to Public Health was taken into account. For this reflection, two important references in Brazilian Geography were considered: Armando Corrêa da Silva and Ruy Moreira.

According to A. C. Silva (1986), the categories refer to more general attributes that group together phenomena and objects of the same genre, and that can be considered abstract universal categories. Therefore, spatial categories, originally, "are points of support for knowledge" (Silva, A. C., 1986, p. 25) and for the geographical way of thinking. Geographical concepts form ideas from empirical reality and the experience that each one has from what exists. This implies an understanding of their historical and geographical dimension, established by combining actions of different subjects over time and by the spatial arrangement of real objects (Silva, A. C., 1986, p. 26).

Moreira (2007) complements these ideas by discussing the main attributes of the category space: *extension*, distribution and connection. The first term, extension, refers to the dimension of space and, at the same time, implies the ability of location of geographical objects on the Earth's surface. *Distribution* is a spatial attribute related to the order of geographical elements in space, while the term "connection" refers to the existing link between the objects and human actions in a system of relations in which no element is isolated from the others. Thus,

space may be made of crossed relations, each spatial portion -territory- being identified through a density of different relations, some of them with a thicker and some with a more modest spatial fabric, innovating the concept of density, habitat, ecumene, place, among others from classical Geography (Moreira, 2007, p. 70).

Regarding these references, we understand space and health as central categories of geographical studies in the field of Public Health. These categories are superimposed over the concepts - territory, region, place - when they assign them with concrete contents, since space and health, as categories, define the way of being in its essence. That is, as ontological modalities of being, the space and health categories are presented as abstract universals of geographical concepts, which are real objects that can be apprehended from the analysis of the reproduction of the space experienced. To do so, it is necessary to develop a geographic logical reasoning that operates the space and health categories. This is how the concepts begin to represent the concrete in the mind and the situation is reversed, since they turn into general ideas and the space and health categories, which initially were abstract universals, turn into concrete entities, as they become the synthesis of the phenomenon in its essence, determined by the ontological modalities of being (Silva, A. C., 1986, p. 26). In the words of Armando Corrêa da Silva:

The movement of reason happens as praxis - production of theory that relates with ontology -, as core of the theory - which implies epistemology -, as development of the theory. Thus, there is no ontology that does not happen first as epistemology and, therefore, as theory of knowledge, gnosiology, logic and methodology (Silva, A. C., 1986, p. 25).

Thus, the category health is presented abstractly as “a right for all”, but also allows mediation between spatial objects (spatial distribution of health facilities and services, range of control and monitoring programs of dissemination of certain diseases, among other examples). It is a more general idea (pre-idea) of concepts that begin to be formed in thought, gaining concreteness in different shapes and space configurations, such as region, territory, place.

These more general references of the relation between categories and concepts, discussed by Silva and Moreira, find resonance in the field of

Public Health. According to Castellanos (1990), the category space has been the foundation of the concept of epidemiological risk. The triad time/place/people enables the correlation of social, economic and environmental variables with the health situation of the human population (Castellanos, 1990). Similarly, for Monken and Barcellos (2005), the category space in the field of Health has a very wide explanatory power, depending on the level of objectification of its own concepts, such as territory, which involves the materiality of the space experienced by a given human group, but also the creation of a space for the exchanging of experiences, disputes and settlements of the sense of well-being (Monken et al., 2008, p. 38-39).

Based on these considerations, the following keywords have been selected for the search for papers on the SciELO database: space, social space, territory, territorialization, region, regionalization, place, space analysis, spatial pattern, spatial distribution, spatial modeling. The relation of these keywords with the geographical categories and concepts will be brought up again in the discussion of the results.

Analysis parameters

A huge part of the papers based on geographic knowledge published in journals of Public Health do not reference Geography. Apparently they would be papers on geoprocessing, based on statistical and geometrical models of spatial information. In accordance with Ferreira (2014), this dissociation has no grounding in the history of thought, since the algorithms used in techniques and models of geospatial analysis have been developed, largely, by geographers in the second half of the 20th century¹. Based on that argument, these papers have been considered in the analysis of the contribution of Geography to the development of Public Health, which points out important aspects to be considered in the discussion of theoretical and methodological challenges, that will be resumed later.

The selected papers have been split into large groups of the scientific basis of the geographic

¹ Ferreira (2014) refers mainly to classical studies by Schaefer (1953) and Berry (1964), among others.

classic schools of thought, between the spatial differentiation school or chorology school, as well as the locational school², and critical thinking groups.

The papers gathered in the group of spatial differentiation or chorology school are characterized by the description of particular aspects of specific areas and regions, based on case studies. The studies gathered in the locational school group understand space as a geometric plan, in which the location and distribution of geographic objects can be analyzed through geostatistical models, models of analysis of spatial dependence, space-time processes and spatial prediction (Gatrell, 1983).

The papers considered from the locational school were subdivided according to the spatial questions that subsidize each study, and may refer to distribution, association, interaction or change (Ferreira, 2014). The papers gathered in the critical thinking group are not part of a single school of thought, but a myriad of studies with differentiated methodological approaches, from Marxism to poststructuralism, unified by a commitment to the questioning of the political and social order and the search for alternatives to the existing models.

Results

Despite the importance of geographical knowledge in the development of the field of Public Health, the publication of scientific papers on the topic in Brazilian academic journals is still very incipient. Out of a universe of 11.898 published papers in the three journals surveyed since the first issue up to December 2015, only 113 articles related to geographical knowledge were identified (0.9% of the total). Most of these studies (50.6%) refer to studies of spatial analysis based on quantitative computational models grounded in the locational school. Together with the descriptive studies based on the chorography school, these classical geographic studies represent more than 2/3 of the published studies, and less than 20% left for studies related to critical thinking (Figure 1).

Due to this more expressive production in geospatial analysis, the main concept of Geography used in the selected publications is space, understood in its Euclidean geometric dimension (flat surface). In this case, there is a strong predominance of spatial questions related to the distribution of the phenomena by space (62.5%), using the spatial smoothing techniques through Moran's index or Empirical Bayesian Estimation (Orsi; Carvalho; Cruz, 2005; Dias; Nobre, 2001; Reis et al., 2008) and agglomerates based on the Kernel methods (Diniz; Pinheiro; Proietti, 2015; Santos et al., 2001).

Among the studies that involve questions related to associations between different geographical variables and spatial structure (33.3%), those which stand out are the methodological procedures with the LISA function, or local autocorrelation function (Galli; Neto, 2008; Paredes et al., 2010; Ferreira et al., 2012). Not many studies that involve more complex spatial questions about interaction and change were found; in these cases, the spatial prediction techniques stand out, such as Kriging (Camargo et al., 2008; Teixeira; Cruz, 2011).

In the studies of critical thinking, the oldest studies also refer to the concept of space, such as the paper by Luiz Jacintho da Silva on Chagas disease in the state of São Paulo (1986). However, over time, the concept of territory has become central in the studies of critical thinking, with emphasis on several papers which have become references in the field, such as the study of Monken and Barcellos (2005) about the possibilities of the theoretical and methodological use of territory on health surveillance; the one by Rigotto and Augustus (2007), on the relation of territorial development and iniquities in health in Brazil; and the paper by Antas Jr. and Almeida (2015) about the corporate use of the Brazilian territory by companies in the industrial complex of health.

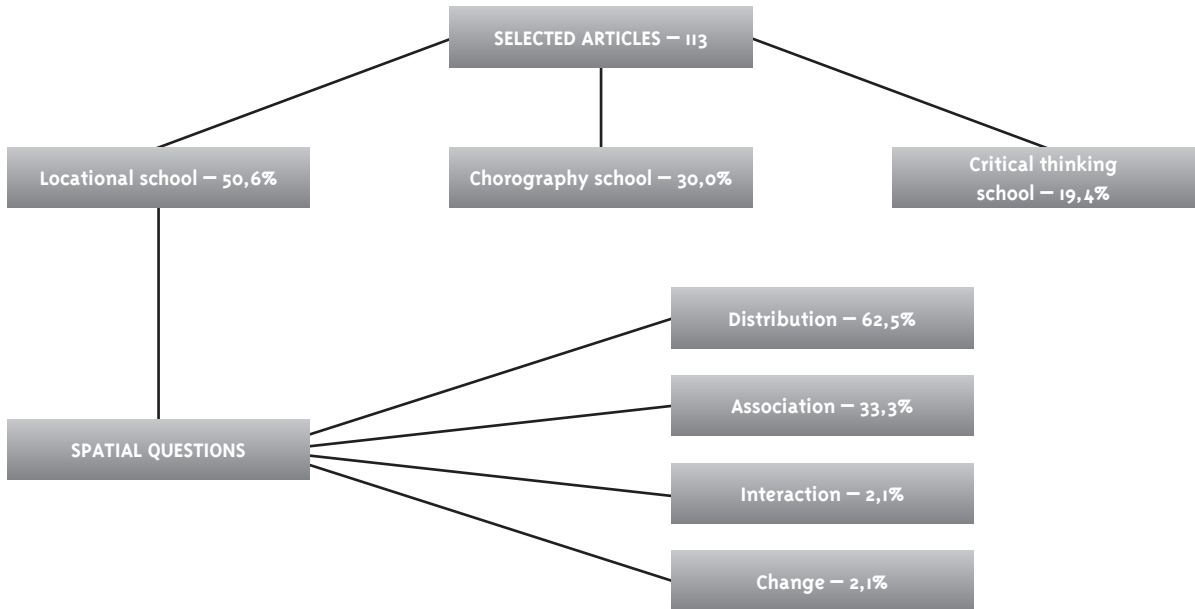
In the descriptive studies of chorologic tradition, the concept of space is also the most employed (54%), although, in this case, it refers to the empirical form, and may be related to the idea of place or region as area of influence. Given the need for regional

² For a more comprehensive geospatial analysis in the context of the schools of geographic thought, Ferreira (2014) suggests reading HAGGETT, P.; CHORLEY, R. *Network analysis in Geography*. London: Edward Arnold, 1969.

planning in the Unified Health System (SUS), several papers were published on this topic, although based on critical thinking, such as the paper by Guimarães (2005), which discusses the concept of region of the Operating Standard of Health Care; the paper

by Contel (2015) about different concepts of region and regionalization and their possible uses in the national health policy; and various papers published in 2015 in number 2 of volume 24 of the *Saúde e Sociedade* journal.

Figure 1 – Geographic knowledge in Public Health: results of the literature review



Source: Collection of scientific papers of *Revista de Saúde Pública*, *Saúde e Sociedade* and *Cadernos de Saúde Pública*

The distribution of the topics of the papers and their relation with different geographical approaches also result in interesting aspects to our analysis (Figure 2). Almost 40% of the selected studies deal with the spatial characteristics of infecto-contagious and parasitic diseases, which is a prevalent theme in studies referring to the locational school (75%). Other topics with fewer publications are also based on this classical geographical school, such as papers on mortality by external causes (12.4% of the total), mortality by neoplasias and cardiovascular diseases and infant morbidity and mortality.

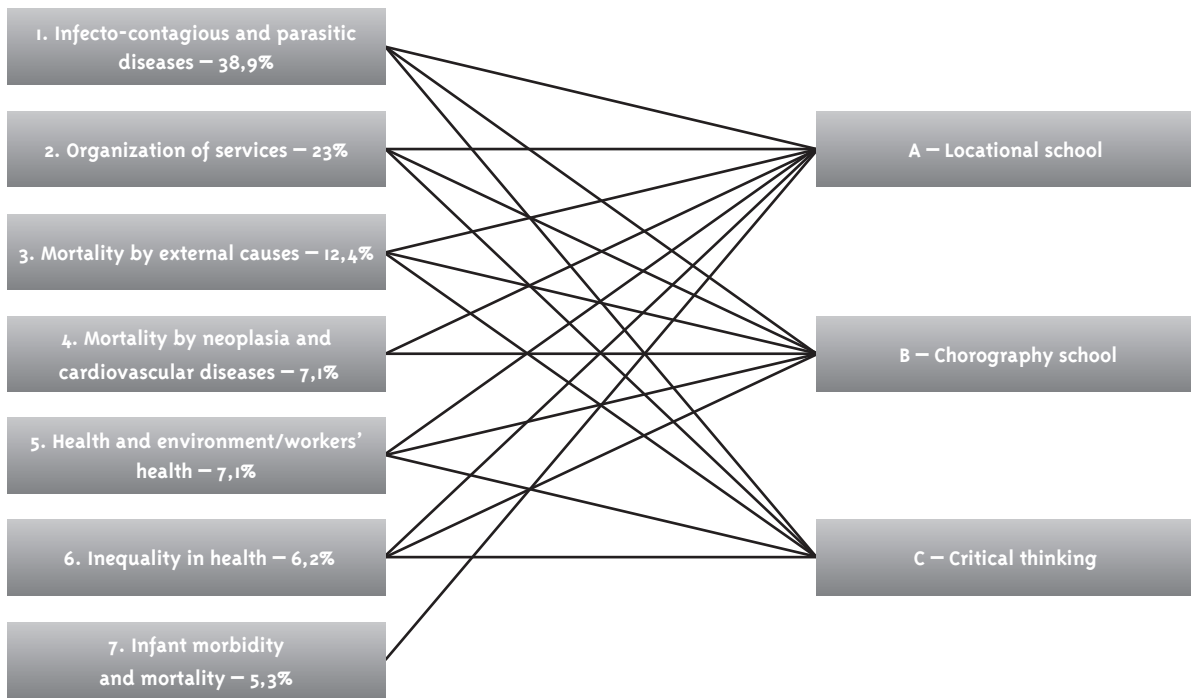
The second theme with the largest number of publications is related to the organization of services and territorial planning of the SUS, based on approaches of critical thinking (77% of published studies on this topic). This also occurs with other

topics, such as health and environment/workers' health (7.1% of the total number of papers) and inequality in health (6.2%).

	A	B	C	TOTAL
1	75%	20,5%	4,5%	100%
2	7,7%	15,3%	77%	100%
3	71,4%	14,3%	14,3%	100%
4	62,5%	37,5%	—	100%
5	25%	25%	50%	100%
6	14,3%	28,6%	57,1%	100%
7	100%	—	—	100%

Source: Collection of scientific papers of *Revista de Saúde Pública*, *Saúde e Sociedade* and *Cadernos de Saúde Pública*

Figure 2 – Topics in Public Health versus geographical schools



Source: Collection of scientific papers of *Revista de Saúde Pública*, *Saúde e Sociedade* and *Cadernos de Saúde Pública*

Discussion

Despite the incipient bibliographical production expressed in scientific papers in the journals surveyed, the authors who focused on spatial analysis from quantitative computational models stand out, which can be verified by the volume of papers published as well as the number of citations of these papers by other authors, such as the paper by Carvalho and Souza-Santos (2005). However, even in the publication of papers on geoprocessing and spatial analysis in Health, there are still lots of advancements to be made, especially in studies that deal with the spatial prediction of topics of Public Health by applying tendency surface models and modeling through variogram, and interpolation through universal Kriging, for example. Another important agenda is the dissemination of space inference methods for decision support in health surveillance and monitoring actions.

There is also a recent increase in papers of the critical thinking school, which has been favored by

publications in the *Saúde e Sociedade* journal. These papers' conception of space becomes incompatible with its representation in an Euclidean geometric surface, because it is not about mapping the territory itself - the shapes -, not even acknowledging the mere distribution of things in the territory, but the use and appropriation of the territory in a set of possibilities of the constantly moving world (Silveira, 2012). Because of this, the selected papers based on critical thinking in the journals surveyed make little use of cartographic language in the discussion of socially built spatialities of Health.

However, this incompatibility of ideas and forms of representation and spatial modelling does not excuse us from discussing what would be the most appropriate cartography to represent the topics studied by this critical geography. It would be necessary to develop a new type of cartography, a cartography of movement, to address in a more integrated way the space produced and the social time based on experiences and concrete actions (Silveira, 2013). Making progress on this issue is de-

sirable, considering the importance of cartographic language for the development of spatial reasoning.

This is where we resume the initial discussion on categories and geographical concepts. Although there is no doubt about the immense advances in spatial analysis provided by geoprocessing in Health, the geometric conception of space imposes limits to the understanding of social reality. From the point of view of critical thinking, to represent reality geometrically is to conceive it in a static way. To go beyond the forms and spatial structures in an effort of theorization and interpretation of the world, a permanent work of updating of the categories is needed to make them concepts which are historically positioned in time (Silveira, 2013, p. 24), as is the case of space and health in the field of Brazilian Public Health. To do so, cartographic models based on non-Euclidean metrics must be developed, such as contemporary or topological geometry which operates with three-dimensional space, linear topological classifications of technical networks, star-shaped topologies, or even models of computational representation of ontologies and non-cartographic spaces (Fonseca, 2007; Câmara et al., 2000).

Final considerations

The literature review that was carried out provided an overview of the use of geographical knowledge in the study of Public Health in Brazil. The importance of health geoprocessing for spatial distribution studies was found, especially those on infectious and parasitic diseases. Similarly, it was possible to identify the growth of the scientific production in studies based on critical thinking, especially recent publications in *Saúde e Sociedade*. The comparison of the published works also provided the identification of methodological challenges to be faced for the study of Public Health with an even better basis of geographical knowledge, such as the use of predictive models and surface analysis of tendencies, as well as the development of new cartographic tools to understand social reality in transformation and movement.

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