Is sanitation essential to human health? The sanitation issue in the public health field

Paulo Rubens Guimarães Barrocas
Researcher, Escola Nacional de Saúde Pública Sergio Arouca/Fiocruz.
Rio de Janeiro – RJ – Brazil
orcid.org/0000-0002-7516-9252
paulo.barrocas@ensp.fiocruz.br

Flavia Franchini de Mattos Moraes
Teacher, Escola de Medicina Souza Marques,
Fundação Técnico-educacional Souza Marques.
Rio de Janeiro – RJ – Brazil
orcid.org/0000-0002-7101-7817
ffmmoraes@ymail.com

Ana Cristina Augusto Sousa
Researcher, Escola Nacional de Saúde Pública Sergio Arouca/Fiocruz.
Rio de Janeiro – RJ – Brazil
orcid.org/0000-0002-5288-2274
crisantemo_s@icloud.com

Received on 18 July 2017.
Approved on 2 July 2018.

Translated by Rebecca Atkinson and
Paulo Rubens Guimarães Barrocas.

http://dx.doi.org/10.1590/S0104-59702019000100003

BARROCAS, Paulo Rubens Guimarães; MORAES, Flavia Franchini de Mattos; SOUSA, Ana Cristina Augusto. Is sanitation essential to human health? The sanitation issue in the public health field. *História, Ciências, Saúde – Manguinhos*, Rio de Janeiro, v.26, n.1, jan.-mar. 2019. Available at: <http://www.scielo.br/hcsm>.

Abstract

Although sanitation problems seem to have been resolved, every day thousands of children around the world die of diseases caused by the lack of it. Nevertheless, sanitation remains virtually invisible in the Brazilian health sector agenda. The objective of this study is to investigate the importance given to this topic by researchers from the public health field. The relevance of the subject was mapped out in CNPq's research groups, Brazilian scientific journals, and public health graduate programs. The results showed that few of these programs addressed the topic of sanitation. As a consequence, few public health research groups study and publish about sanitation in the journals assessed. The potential factors that could be behind the limited interest in sanitation shown by the public health academic community are discussed.

Keywords: sanitation; public health; health policy; history of sanitation; collective health.

Inadequate sanitation-related diseases affect vulnerable populations all over the world. According to the United Nations Development Programme, over seven hundred million people do not have access to clean and safe drinking water, over two billion people have no access to adequate sanitation, and around one billion have no access to any sanitary facilities. Although the number of deaths of children under five years of age caused by diseases related with inadequate hygiene, the consumption of unsafe drinking water, and improper wastewater management fell from 1.5 million in 1990 to 662,000 in 2012, every day over one thousand children in the world still die of diseases that could have been prevented by the provision of basic sanitation (UN, s.d.; WHO, 2014).

In Brazil, dengue causes deaths every year and there are thousands of families suffering the long-term consequences of zica infection. Around 17% of the Brazilian population have no access to safe piped water and half of all households do not have adequate sewage disposal (Brasil, 2016a). When these conditions are combined with the effects of rubbish dumps and flooding, the result is a sanitation-related tragedy that leads to the proliferation of diseases and epidemics, like the ones witnessed today. Even so, sanitation is still virtually invisible on the country's latest public health agenda. This was not the case in the past, when sanitation engineers and medical sanitarians worked in close cooperation to improve the sanitary conditions of the Brazilian people (Hochman, 1998).

Public/collective health emerged as an independent field in Brazil in the 1970s, drawing on knowledge from the social sciences and humanities and criticisms of traditional health, of which "sanitarianism" was a part. This movement was grounded in prevention-based interventions that involved applying technologies (sanitation, immunization, and vector control) to the population at large, but especially to the poor and excluded strata of society, with centralized, state-controlled planning and execution. It could be, then, that sanitation came to be associated with the naturalistic universalism of medical knowledge, criticized by researchers from the field of public health (Paim, Almeida Filho, 1998; Nunes, 1994; Birman, 1991).

In this article, we investigated the importance placed on sanitation by researchers from the field of public health in Brazil, and tried to understand what factors may be associated with the apparent taking schism between sanitation and this field of knowledge. The study scrutinized the presence of this topic in three main arenas of scientific research in Brazil: the databases of research groups run by the Science and Technology Development National Council (Conselho Nacional de Desenvolvimento Científico e Tecnológico, CNPq), to find out which Brazilian researchers are investigating sanitation; the major national scientific journals of public health; and public health graduate programs, to find out what subjects were investigated, and may become the research focus of novel graduate researchers. An analysis of the information gathered was then used to build up a picture of sanitation in the field of public health and to discuss hypotheses that might explain the findings.

Research procedure

Scientific research in Brazil is organized on a national level by two main institutions: Coordination for the Improvement of Higher Education Personnel (Coordenação de

Aperfeiçoamento de Pessoal de Nível Superior, Capes) and the aforementioned CNPq. The former, part of the Ministry of Education, is fundamental in guiding the expansion and consolidation of graduate education and research (master's and doctoral level) across the whole country. Meanwhile, CNPq is an agency of the Ministry of Science, Technology, Innovation and Communication, whose main attributes are to foster science and technology research and the training and development of Brazilian researchers. They both have databases with key information about research developed in the country, which served as primary sources for this study.

The Directory of Research Groups in Brazil (Diretório dos Grupos de Pesquisa no Brasil) is the CNPq's database that contains information on research groups active across the country (Brasil, s.d.-b). A research group is any group of researchers and students that is organized around one or more lines of research in an area of knowledge with the aim of developing scientific research (Ufes, s.d.). Since 2002, the directory has kept a database updated continuously by the leaders and members of the groups – researchers, students, and coordinators from the participating institutions. CNPq also holds a census every two years, taking snapshots of the database and combining information that characterizes the evolution of research activities. These periodic snapshots of the country's installed research capacity constitute the census databases. While the current database can be searched for data on existing groups, research areas, and human resources (researchers, students, staff, and foreign collaborators), the census databases offer data on the scientific, technological, and artistic output of groups in the past, plus information from the current database. Only the censuses can be searched using different variables, like institutions, key areas, human resources, scientific, technological, and artistic publications etc., and also offer information extracted from other databases, like CNPq grants and the Coleta Capes system (on graduate-level professors), which can be used as filters in the text searches of the groups. So far, ten censuses have been done of the CNPq Directory of Research Groups, but at the current time text searches can only be done of the 2000 to 2010 censuses. We conducted searches of the CNPq Directory's current database (<http://dgp.cnpq.br/dgp/faces/consulta/consulta_parametrizada.jsf>) and of the 2008 and 2010 censuses (<http://dgp.cnpq.br/buscagrupo/>).

Besides funding research, Capes is responsible for continuously monitoring and evaluating the quality of graduate programs and scientific journals in Brazil. On Capes reports, there are indicators, which are based on the information collected from these courses. Capes provides data on existing graduate programs, their sub-areas, lines of research, masters' and doctoral theses produced by students, and articles published by the faculty. To assess the quality of the academic output of graduate programs, Capes uses a set of criteria defined by each scientific field and categorized in the Qualis system, which provides a list with the classification of the journals, where the research results are published. The periodicals are classified every year by different specialized teams from each area evaluated by Capes, according to criteria relevant to the specific scientific field, defined by CNPq. Each of the publications is classified according to its quality, ranging from A1 (highest) down through A2, B1-B5, to C, which has zero weight. As this classification

is done for each scientific field, the same journal may get different evaluations for the different scientific fields, which reflect the value given to the journals' content by each field (Brasil, 1 abr. 2014).

The word "sanitation" ("*saneamento*" in Portuguese) was used as a search term in the main search fields of the aforementioned databases. For each question investigated, the search term was inserted strategically in the different search fields to obtain results that were mutually complementary and, whenever possible, mutually corroborating. Details of the search procedure are shown in Chart 1.

Chart 1: Criteria used for the data collection

Variable analyzed	Database used	Fields searched	Time period searched	Objective
Research groups	CNPq Directory	Research group name; research line name; publication title	From 2008 until 2010	Identification, quantification, and characterization of research groups that study sanitation in Brazil
Research articles in Brazilian scientific periodicals, which are classified as A1 and A2, according to the Qualis criteria of the Public Health field	Scielo	Subject	From 2008 until 2015	Assess if the most prestigious Brazilian scientific periodicals of the Public Health field (i.e. classified as A1 and A2) have published articles about sanitation
Public Health Graduate Programs	Capes' reports: Indicators of Public Health Graduate Programs	Program overview; research projects; disciplines; technical publications; academic publications; theses and dissertations	From 2010 until 2012	Assess if professors and students from Public Health Graduate programs have developed research about sanitation

Source: own research.

The first stage consisted of identifying and quantifying the research groups involved with the sanitation topic in Brazil. Next, their members were characterized, establishing in which scientific field they belonged to, and what the group had published. This enabled us to identify who studies sanitation in Brazil. To do this, we searched for the word "sanitation" (in Portuguese) in the research group title field in the CNPq Directory of Research Groups, as this would identify and characterize the research groups for which sanitation was a core topic. The last two censuses available on the site (2008 and 2010) were used.

The second stage consisted of searching academic articles about sanitation in national journals. We searched for publications on the topic in the leading national periodicals in the public health field, as well as, in other areas, to get a picture of the importance of the subject in the public health scientific agenda in Brazil. To find out whether sanitation is discussed in these important journals (i.e. Qualis A1 and A2), a search for articles, whose subject contained the keyword "sanitation," was performed in these journals, from 2008 to 2015, using the Scielo database. This Brazilian on line academic database, organizes and publishes complete texts online. It can also be used to find indicators of the use and impact of these journals. Having scanned the incidence of the subject in the journals,

the authors of the articles were identified and their academic curriculum vitae (*currículo* Lattes) assessed to check in which scientific field they declared themselves as belonging to.

To complement this stage of the investigation, we also observed whether sanitation was a subject covered in the activities of the faculty or students from public health graduate programs in Brazil, which could explain and be related to its presence in the publications. To do this, the Capes indicators for the public health programs for 2010 to 2012 were searched (Brasil, s.d.-c) using the keyword "sanitation" in the following fields: program overview; research projects; disciplines (title and summary); technical publications; academic publications; theses; dissertations. The results indicated and quantified the approach given to the sanitation issue by students and professors of public health graduate programs.

Results

The data from the last two censuses, which can be text-searched in the CNPq directory, revealed the existence of 27 research groups in 2008 that used the word "sanitation" in their title. This number went up to 40 in 2010, representing an increase of around 50% in just two years (Table 1). The main scientific field to which these research groups belong, as declared by the group leaders, was engineering, especially sanitation and civil engineering, accounting for 85.2% and 87.5% of the groups identified in 2008 and 2010, respectively. There was no group from the public health field with "sanitation" in its title in 2008, and in 2010 there was only one. The other major areas (applied social sciences, agricultural sciences, mathematics and natural sciences) accounted for 15% of the research groups focused on sanitation in both 2008 and 2010.

Table 1: Search results of CNPq's Directory of Research Groups for groups, which use the term "sanitation" in their name

Main scientific fields	Subdivisions of the main scientific fields	Databases searched		
		CNPq censuses		Current database
		2008	2010	
		n (%)	n (%)	n (%)
Engineering	Sanitation engineering	20 (74.1)	30 (75.0)	42 (72.4)
	Civil engineering	3 (11.1)	5 (12.5)	5 (8.6)
Mathematics and Natural Sciences	Probability and statistics	1 (3.7)	1 (2.5)	1 (1.7)
Agricultural science	Agricultural engineering	1 (3.7)	1 (2.5)	2 (3.4)
	Agronomy	0	0	1 (1.7)
Applied social sciences	Social services	1 (3.7)	1 (2.5)	1 (1.7)
	Architecture and urbanism	1 (3.7)	1 (2.5)	0
	Urban and regional planning	0	0	2 (3.4)
Health sciences	Public health	0	1 (2.5)	4 (6.9)
Total number of groups from all areas		27	40	58

Source: own research using data from the current database and the 2008 and 2010 censuses of the CNPq's Directory of Research Groups.

When the directory's current database was searched using the same conditions, 58 groups were retrieved that had the word "sanitation" in their title, representing a 45% increase over the 2010 figure and a rise of over 100% compared with 2008. Most of the groups are still from engineering (81%), followed by health sciences, with four groups (6.9%), applied social sciences and agricultural sciences (5.1% each), and the mathematics and natural (1.7%) (Table 1). This increase in the number of public health research groups was the result of new groups at research institutions in the southeast region of the country (at Fiocruz and PUC-MG), where most research groups are based (45%), according to data from the 2014 census (Brasil, s.d.-a). The rise in the number of research groups retrieved in the searches of the 2008, 2010, and current databases also showed an overall increase in the number of researchers and research groups in the period. According to the 2014 census, there was a 20.7% increase in the number of research groups between 2008 and 2010 and a 28.7% rise from 2010 to 2014, representing 55.4% growth from 2008 to 2014.

When the term "sanitation" was searched in research lines in the 2008 census of the CNPq directory, 78 groups were identified that had at least one line of research involving sanitation (Table 2). Most of these groups (79.5%) did not have "sanitation" in their name, including the six groups from the area of public health (7.7%), whose names had the word "health." Most of the groups (51.3%) were again from engineering (sanitation, mechanical, chemical, and civil). However, we found that there was a greater diversity of research areas between the groups that had research involving sanitation (e.g., economics and microbiology). The search of the 2010 census using the same conditions yielded 93 research groups with at least one line of research involving sanitation, representing an increase of around 20% in just two years. Like in the previous census, most of these groups (77.4%) did not have "sanitation" in their names, including the four groups from the area of public health (4.1%). Just one group from this area had "sanitation" both in its name and in one of its lines of research, which is consistent with the results of the previous search. Most of the groups, as observed previously, were from engineering (52.7%), but again, greater diversity could be seen, such as a research group from the geosciences.

Table 2: Search results of CNPq's Directory of Research Groups for groups, which use the term "sanitation" in the title of a research theme

Main scientific fields	Subdivisions of the main scientific fields	Databases searched		
		CNPq censuses		Current database
		2008	2010	
		n (%)	n (%)	n (%)
Engineering	Sanitary engineering	24 (30.8)	30 (32.3)	47 (31.8)
	Civil engineering	13 (16.7)	15 (16.1)	25 (16.9)
	Mechanical engineering	1 (1.3)	1 (1.1)	3 (2.0)
Health sciences	Public health	6 (7.7)	5 (5.4)	8 (5.4)

Agricultural sciences	Agricultural engineering	4 (5.1)	5 (5.4)	6 (4.1)
	Agronomy	1 (1.3)	1 (1.1)	4 (2.7)
Applied social sciences	Urban and regional planning	4 (5.1)	3 (3.2)	9 (6.1)
	Architecture and urbanism	1 (1.3)	4 (4.3)	2 (1.4)
	Economics	3 (3.8)	3 (3.2)	4 (2.7)
Mathematical and Natural sciences	Geosciences	1 (1.3)	4 (4.3)	8 (5.4)
	Chemistry	2 (2.6)	0	6 (4.1)
Life sciences	Ecology	1 (1.3)	0	4 (2.7)
	Microbiology	3 (3.8)	3 (3.2)	2 (1.4)
Humanities	Geography	0	0	3 (2.0)
Total number of groups from all areas		**78**	**93**	**148**

Source: own research using data from the current database and the 2008 and 2010 censuses of the CNPq Directory of Research Groups.

When this search was repeated, maintaining the same search term and search field, but using the current database, 148 groups were retrieved: 60% and 90% more groups with lines of research containing the word "sanitation" than retrieved from the 2008 and 2010 censuses, respectively (Table 2). As seen in the previous surveys, over half of these groups (51.4%) are from engineering, followed by applied social sciences (11.5%), mathematics and natural (10.8%), agricultural (8.1%), health sciences (7.4%), biological sciences (6.1%), and humanities (4.7%). Interestingly, there are groups with lines of research involving sanitation in practically all the main scientific field, encompassing 29 different main scientific field (Table 2 shows just the main ones), which suggests a great diversity of research approaches to sanitation.

It is worth noting that research groups normally have more than one line of research. According to the 2014 census (Brasil, s.d.-a), on average there were four lines of research per group, although this figure varied from three to five, depending on the main scientific field. It would therefore be expected for us to obtain a higher number of research groups when using the search term in the line of research field rather than in the group name field, which was in fact what was found. The increased number of researchers and research groups over the period under analysis may also have contributed to increasing the values that were obtained in the more recent databases.

In the search for the term "sanitation" in the titles of publications by the research groups in the 2008 census (Table 3), 1,114 research groups were retrieved with one or more such publications. These groups were from all the main scientific field, including linguistics, language & arts. Most of them were still from engineering (23.1%), but this time closely followed by applied social sciences (22%), humanities (17.4%), health sciences (11.8%), mathematics and natural sciences (10%), biological sciences (8.2%), agricultural science (7.5%), and linguistics, language & arts (0.2%).

Table 3: Search results of CNPq's Directory of Research Groups for groups, which use the term "sanitation" in the title of their scientific, technological, and artistic productions

Main scientific fields	Subdivisions of the main scientific fields	Databases searched	
		CNPq censuses	
		2008	2010
		n (%)	n (%)
Engineering	Sanitary engineering	118 (10.6)	141 (9.5)
	Civil engineering	66 (5.9)	72 (4.9)
	Mechanical engineering	7 (0.6)	5 (0.3)
Health sciences	Public health	82 (7.4)	87 (5.9)
	Medicine	15 (1.3)	14 (0.9)
Agricultural sciences	Agricultural engineering	17 (1.5)	19 (1.3)
	Agronomy	26 (2.3)	49 (3.3)
	Veterinary medicine	13 (1.2)	24 (1.6)
Applied social sciences	Urban and regional planning	36 (3.2)	40 (2.7)
	Architecture and urbanism	22 (2.0)	40 (2.7)
	Economics	50 (4.5)	60 (4.1)
	Administration	51 (4.6)	102 (6.9)
	Law	39 (3.5)	61 (4.1)
Mathematical and natural sciences	Geosciences	58 (5.2)	72 (4.9)
	Chemistry	20 (1.8)	29 (2.0)
Life sciences	Ecology	44 (3.9)	60 (4.1)
	Microbiology	8 (0.7)	18 (1.2)
	Botany	5 (0.4)	16 (1.1)
Humanities	Geography	40 (3.6)	67 (4.5)
	Education	45 (4.0)	68 (4.6)
	History	21 (1.9)	38 (2.6)
Linguistics, language, and arts	Linguistics	1 (0.1)	5 (0.3)
Total number of groups from all areas		**1,114**	**1,480**

Source: own research using data from the current database and the 2008 and 2010 censuses of the CNPq Directory of Research Groups.

The search of the 2010 census using the same procedure yielded 1,480 research groups with one or more publications whose title contained the word "sanitation:" a 32.9% increase in two years (Table 3). As in the previous census, there were research groups from every main scientific field. Although the data obtained in this search indicated that most of the research groups continued to research sanitary engineering (9.5%), for the first time, the main scientific field with the biggest number of publications – exceeding engineering as a whole – was applied social sciences, with 360 publications vis-à-vis 311 for engineering. Following them, in decreasing order, were humanities (267 groups), health sciences (140), agricultural sciences (139), mathematics and natural sciences (129), biological sciences

(126), and linguistics, language & arts (8 groups). It was not possible to do the same search of the current database because the CNPq Directory of Research Groups website does not permit this kind of search.

The difference in the number of research groups from different main scientific field with publications on sanitation could suggest that researchers from the applied social sciences are publishing more than researchers from engineering (no specific search was done to find out what type of publication or even the number of such publications in the database), or that interest in publishing on this topic is more evenly spread between the groups in one filed than in the other.

The publications retrieved from the directory come from the Lattes academic curricula vitae of the research group members. This means there could be multiple counts of the same publications, so this can be considered no more than an approximate measure of a group's production, summing the individual output of its members. Likewise, if one researcher belongs to more than one research group, as is often the case, especially in certain main scientific field, the same publication will be considered in all the research groups they are members of. It was therefore expected that the number of research groups retrieved in the searches using the search term from the titles of the group members' publications would be higher than in the previous searches, using the names of the groups and their lines of research. Nonetheless, these results suggest that although sanitation is probably not a central topic for all these groups, it is one of the subjects that they have been studying.

Once, we have defined the research groups studying sanitation from different perspectives, its academic production published in the main public health journals was assessed. First, the journals were identified, using information from the Capes Qualis system from the public health field, (Brasil, 2016b). Only those Brazilian journals with the top two ratings (i.e. A1 and A2) were selected. Using these filters, a total of 259 journals were retrieved. However, just two of these were Brazilian (0.77%), both classified as A2. The other Brazilian publications in the area have a lower Qualis rating (i.e. B1, B2 etc.).

The search of the Scielo database for articles published in the two journals from 2008 to 2015 using "sanitation" in the subject field yielded eight articles: seven in *Cadernos de Saúde Pública* and one in *Revista de Saúde Pública*. This represents around 0.3% of the total of 2,743 articles published by these two journals between 2008 and 2015. Even if the number of journals consulted was expanded, for example taking in two journals rated as B1 (*Ciência e Saúde Coletiva* and *Revista Brasileira de Epidemiologia*), the situation does not change materially: we would have 19 articles, again representing less than 1% of the articles published in the journals from 2008 to 2015. However, if we had considered a longer time period (from the late 1990s or early 2000s, for instance), the figure would have been slightly higher, suggesting that interest in the subject has diminished in recent years, despite the continued sanitation problems in the country. Meanwhile, a search of the same (Scielo) database for the same time period (2008-2015) using the same search term (sanitation) in all the search fields (title, abstract etc.) retrieved over 200 articles in around 70 different journals. The journal that published the most articles on the subject was *Revista de Engenharia Sanitária e Ambiental* (14.3%).

To conclude the analysis, an attempt was made to identify the presence of the subject in graduate programs by looking at the reports produced by these programs for their three-yearly evaluation by Capes for 2010-2013 (Brasil, s.d.-c). The results show that although there was an almost 20% increase in the number of graduate programs in the field of public health in the period, the presence of sanitation remained practically unchanged, no matter what search field was used (Table 4).

Table 4: Citation of the term "sanitation" (%) in public health graduate programs

Fields searched	2010 (n = 54 programs)	2011 (n = 60 programs)	2012 (n = 64 programs)
Program overview	16.67%	16.67%	17.19%
Theses	0.61%	1.57%	1.30%
Academic publications	0.42%	0.29%	0.50%
Technical publications	0.37%	0.89%	1.42%

Source: own research.

For instance, sanitation was cited in fewer than 20% of the texts presenting the programs' goals, areas of concentration, lines of research, and curricula. Likewise, fewer than 2% of the masters' and doctoral theses from programs in public health addressed sanitation. Accordingly, less than 1.5% of the academic and technical articles produced by the teaching and student bodies of these programs cited sanitation.

Discussion

To adequately analyze the results presented above, the historical trajectory of the sanitation sector in Brazil should be reconstituted in order to shed light on and contextualize how it fits into the Brazilian public health agenda nowadays.

Long before any scientific evidence, like Snow's work into cholera in London or the discoveries about microorganisms by Pasteur and others, man already had empirical knowledge that associated the environment with the occurrence of disease. In his best known book, *On Airs, Waters, and Places*, Hippocrates (460-377 B.C.) already referred to environmental factors as causing endemic and epidemic diseases. Throughout the nineteenth and twentieth century, the development of collective sanitation systems in different cities around the world reduced mortality from certain diseases, thereby increasing life expectancy and quality of life. The secure supply of safe drinking water to populations was a determinant in reducing the incidence of diarrheal diseases and the control of typhus and cholera epidemics in Europe and North America between 1860 and 1920 (Heller, 1998).

In the early twentieth century, sanitation was a banner that united physicians and sanitation engineers around the development of a national public health policy in Brazil (Hochman, 1998). Public health campaigns, with a focus on sanitation actions, meant that certain endemic and epidemic diseases in the country, which were deemed responsible for making its population "unproductive" and "inept," were successfully contained and even eradicated. The idea that its disease-ridden population was the root cause of the country's backwardness made public health a strategic priority issue for the Brazilian state.

The main aim of this movement was the creation of a federal government agency that would introduce hygiene and prophylaxis measures throughout the country and provide a uniform, country-wide health service (Hochman, 1998; Lima, Hochman, 1996).

A milestone in this movement was the founding, in 1918, of the Pro-Sanitation League (Liga Pró-saneamento). The league was instrumental in raising awareness and lobbying political agents to pass sanitation-related legislation and ensure that the authorities at every level of government were held accountable for the population's health. It set up delegations in some states, engaging in a variety of actions with the aim of alerting the population as to the importance of hygiene and encouraging state and local governments to build healthy housing, providing prophylaxis of preventable diseases, engaging in hygiene education programs, setting up rural centers, and providing basic sanitation infrastructure (Setemy, 2015). The importance of safe drinking water and especially sewage systems to prevent the spread of diseases was also a strong rallying cry of its members (Penna, 1923).

These activists ended up winning over a good many of the political elite in the National Congress to the cause of state intervention in the field of public health. Federal rural prophylaxis and sanitation services multiplied across the country, and in 1919 the National Department for Public Health (Departamento Nacional de Saúde Pública) was created to coordinate public health actions throughout the country, thereby satisfying the league's main demand. Its leading members were invited onto its staff and not long afterwards, in 1930, this institution gave rise to the Ministry of Health.

After 1930, federal and state departments were set up to expand water and sewage services across the country. However, many municipalities were unable to maintain or manage their systems. In the 1940s, the Special Service for Public Health (Serviço Especial de Saúde Pública) was created, as an outcome of a long process of cooperation with the United States. It was also geared towards improving the sanitary conditions of the Brazilian population, and ultimately took over responsibility for the sanitation program for the Amazon and other sanitation initiatives in strategic parts of the country (Andrade, Hochman, 2007). In 1960, it was turned into a foundation, FSESP, under the auspices of the Ministry of Health, and was given responsibility for executing the country's sanitation policies on a federal level, alongside the National Department for Works and Sanitation (Departamento Nacional de Obras de Saneamento) and the National Department of Rural Endemics (Departamento Nacional de Endemias Rurais). Expanding its scope, the foundation started operating in every state of the country and also on a municipal level through contracts for the construction of drinking water distribution and sewage collection systems. It also introduced health promotion programs to the north-east of the country in partnership with international entities, like USAID, the Pan-American Health Organization, and the United Nations Children's Fund, UNICEF (Rezende, Heller, 2002).

As described above, a whole set of different institutional arrangements for sanitation management coexisted in Brazil until the late 1960s, when the federal government finally resolved to unify these services under state water and sewage companies. This decision was taken in response to the rapid expansion of the country's biggest cities, itself caused by the industrial and developmentalist model adopted since the 1950s, which called for greater infrastructure investments.

The expansion of the sanitation services started to be funded by loans taken from international agencies, which, in exchange, demanded greater administrative autonomy for sanitation service providers. The prioritization of autonomous municipal services, and later, of state companies, as preferential providers of sanitation services in the 1960s, was a structural landmark of the disconnection process between the sanitation issue and the public health field. Sanitation services supply started to be structured around revenues paid by consumers, instead of a universal health promotion policy. The sanitation companies created from the 1960s had mixed public-private ownership, which meant they could recover their costs and investments by charging tariffs (Rezende, Heller, 2002). In the 1970s, they started to control the supply of sanitation services throughout almost the whole country, focusing on the most economically wealthy areas in Brazil, which would give a good return on investments, like the major metropolitan areas and big cities.

When the government was taken over by a civil-military dictatorship in 1964, not only was the sanitation policy altered, but the policies and institutions from other areas like public health also started to be curbed. The first decade of the regime saw a purge of the most progressive political forces from the state apparatus, which had a major impact on the Ministry of Health, a key locus for the implementation of the defeated nationalist and developmentalism-oriented policy. Normatively and financially weakened, the Ministry of Health lost significant human resources, competences, and funding. While it may still have been in charge of formulating the nation's health policies, its dwindling budget meant it could only exist as an inefficient, conservative entity restricted to campaigns of limited efficacy.

As a foundation of the Ministry of Health, FSESP did not go unscathed. Its budget was slashed and it gradually lost its powers until its work was finally taken over by entities linked to the National Sanitation Plan, Planasa, created in the early 1970s. This process involved some important policy changes in the field of housing and civil construction, like the creation of the National Housing Bank (Banco Nacional de Habitação), in 1964, which became responsible for the management of all the funds and resources for the sector (unified under the Sanitation Funding System in 1968) and the expansion of credit for civil construction. It was at this time that the biggest national firms working in civil construction and related areas acquired unprecedented power and influence (Campos, 2014). With the passing of law n.5318 on September 26, 1967, basic sanitation was progressively transferred to the Ministry of the Interior, under the management of the National Department for Works and Sanitation. Finally, in 1973, a new agreement between the Ministry of the Interior and the Ministry of Health virtually stripped FSESP of its executive powers, restricting it to providing technical assistance, research, and development, and transferring the administration of municipal water and sewage systems to the state sanitation companies, as recommended by Planasa (1971). As its executive responsibilities gradually waned and it was increasingly left in advisory role, FSESP was removed from the decision-taking arena of the country's sanitation policy (Andrade, 1976).

Meanwhile, the state health care system started to focus more of its resources on social welfare, in line with a model that gave precedence to individual, specialized medical care to the detriment of preventive public health initiatives of collective interest (Escorel, 2008).

Rather than seeing the environment as a cause of disease, the control of specific diseases became the primary focus of health services. The approach shifted from prevention to curative medicine. In this context, each disease was understood as having an identifiable cause, which could be cured, establishing a new paradigm in the health-disease process (Pignatti, 2004; Ribeiro, 2004; Sobral, Freitas, 2010).

The health sector started to develop several different disease control and eradication programs, which incorporated the new therapeutic resources developed since the Second World War, like: insecticides, antibiotics, sulfa drugs, and antimalarials, which were enthusiastically received by governments, bilateral cooperation agencies, and international organizations (Hochman, 2009). Thus, in the following decades, the welfare-oriented rationale in public health field prompted the creation of a pharmaceutical/industrial complex rooted in medical practices oriented towards the profitability of the health sector. While engineers, working in civil construction, took control of the sanitation sector agenda, which was included in the country's housing and urban development policy. Health and sanitation sectors were splitted into arenas driven by quite distinct interests and dynamics, this situation was not reverted, even after democratic rule was restored in the 1980s. Even though the period's epidemiological challenges already called for their integration clearly.

In the 1980s, the articulation of the Sanitary movement overcame several of the challenges imposed by the adoption of the welfare rationale for health access, assuring that a universal health access was included in the federal constitution enshrined in law. However, it was not capable of incorporating the agenda of universal access to sanitation services. Sanitation services remained bound to the rationale developed during the dictatorship, commodities to be acquired in the public service marketplace (whether state-run or privatized), as recommended by the adopted Planasa model.

The Brazilian Sanitary movement, which had a major role ensuring Brazilian universal health care system, was both influential and was influenced by the development of public/collective health field in Brazil. Internationally the roots of this field lie in preventive and social medicine, while in Brazil they stem from the country's social issues, which gave rise to different social movements, including for the democratization of Brazil. In this context, despite being defined as a multidisciplinary scientific field of inter-sectorial practices, where knowledge is produced about "health" and actions are taken by specialized and lay agents inside and outside institutions from the "health sector," the production of knowledge and practice of public/collective health counts on the strong participation of the humanities. The core disciplines of the field, which to this day provide its theoretical groundwork and fundamental tools of analysis, are epidemiology, health administration and planning, and social sciences (Freitas, 2005; Osmo, Schraiber, 2015).

The field of public/collective health first emerged and was consolidated in Brazil at the same time that environmental concerns were starting to gather global momentum. The incorporation of environmental issues into the field of public/collective health started in the 1970s, when knowledge about occupational health drew a link between the workplace and workers' health. Later, it became widely accepted that man-made changes to the environment, not just those stemming from production processes, were responsible for the appearance or exacerbation of diseases. Thus, some studies have shown the inclusion

of environmental topics in the public/collective health research agenda, with more lines of research at research groups and in masters' and doctoral programs, bringing about their institutionalization (Tambellini, Câmara, 1998; Freitas, 2005).

Paradoxically, the incorporation of environmental topics seems to have had the unexpected consequence of reducing interest in sanitation on the part of actors from the public/collective health area, as was seen until the 1970s. Alongside the reasons already mentioned for this process, stemming from its political and institutional evolution as a separate sectors, sanitation also lost its dominant role amongst the environmental determinants of health with the advent of industrial development and urbanization. Other factors, like air pollution and water and soil contamination with pesticides and trace metals gained more attention as more harmful to health. This importance could be explained by the fact that the impacts of these types of environmental pollution are felt equally across all social strata, while the health impairment caused by poor or non-existent sanitation infrastructure affects primarily vulnerable population groups, which will have less interest in the society (Tambellini, Câmara, 1998; Heller, 1998). In this context, as observed by Freitas (2005) in a study of academic publications on environmental issues in public/collective health between 1992 and 2002, most of the articles published focused on pollution and contamination by chemicals, while more traditional subjects, like vector control and sanitation, were the subject of increasingly fewer publications. Meanwhile, the increasing global awareness of environmental issues has brought the sanitation and environmental sectors closer together, to the detriment of public health. For example, Soares, Bernardes, and Cordeiro Netto (2002) stated that in recent years, sanitation projects had incorporated the environment, taking in issues such as environmental conservation, even without proposing any adequate instruments for assessing their impacts on public health.

Therefore, the approach used to include environmental issues into the scientific field known as "public/collective" may also explain why so few research groups from this filed study sanitation, as can be seen in Tables 1, 2 and 3. The results obtained from different searches of the CNPq Directory of Research Groups, no matter how one analyzes them, all indicate that: (1) the number of researchers investigating sanitation has increased over the period studied (from 2008 to the current database); (2) there is a predominance of research groups from engineering, but this disparity could well be declining, as groups from other areas are studying and publishing on different aspects of sanitation; (3) the number of groups from the public/collective health area – or even from the broad area of health – researching sanitation has remained not important, never exceeding 12% of the groups working on this topic in Brazil.

Corroborating the hypothesis of the limited interest given to sanitation by the public/collective health field, it was found that although academic publications on the subject have risen, this was not observed in the main public health journals; in fact, the number of articles seems to have declined, representing less than 1% of articles published in the study period. An increase in publications on sanitation was also found by Souza and Freitas (2010), in a study ranging from 1973 to 2007. Similarly to our study, they found that publication numbers peaked in the late 1990s and early 2000s. However, although they found that the highest number of articles were published in *Revista de Engenharia Sanitária e Ambiental*, they retrieved more articles from periodicals of the public health

area than were found in our research. Probably due to the time period they have searched compared to our study (i.e. older period).

Although the method used for this study did not enable us to ascertain the rates of submission to and refusal of articles on sanitation at the leading public health journals, the scant presence of such studies in these publications could be indicative of limited interest on the part of journal editors in this subject, or even their perception that the subject is beyond the scope of their periodicals. In view of this, the researchers working in this area may feel less inclined to submit manuscripts to these journals, since the subject does not appear in their pages. This could lead to a vicious circle, reinforcing the apartheid between sanitation studies and the public health research agenda.

In an analysis of the output of graduate courses in the area of public/collective health between 1998 and 2007, Viacava (2010) observed an exponential increase in the number of articles published. However, much of this growth was in periodicals specialized in clinical areas and health care, rather than the traditional public/collective health journals. As sanitation falls outside the scope of such biomedical publications, it is not covered in these articles and is not expressed in this observed increased output. When the pattern of scientific publications in the sub-areas of public/collective health is analyzed, it becomes clear that there is a quantitative difference between them. Iriart et al. (2015) found that epidemiology stood out from the other sub-areas in the field due to some of its features, resulting in the production of more articles in a shorter period of time. This was particularly noticeable in very specialized journals with a high impact factor, where there is no space for sanitation to be addressed too.

One question that may be related to these results, albeit indirectly, is the great interest on the part of researchers from the area of public/collective health in internationalizing their work, which can be inferred from the rigor employed by the area in journal evaluations, overvaluing international periodicals and undervaluing Brazilian ones. Since sanitation is a subject that is largely resolved in developed countries, being a concern only to the poorest population strata in developing countries, articles on the subject would be of little international relevance. This would be precisely the opposite of what the periodicals most want, which is to have more citations of their articles, resulting in improved impact factors.

Finally, when evaluating the graduate programs from the public/collective area as a whole (Table 4), it was found that just a few programs at a handful of institutions (i.e. Fundação Oswaldo Cruz, Federal University of Bahia, and University of São Paulo) account for almost all the disciplines and research projects addressing sanitation (data not given). It was precisely at these institutions that we identified the groups, cited in this study, who are working on sanitation. These results further suggest that new human resources (researchers or research groups) are not being developed at other institutions, where sanitation is studied in the context of public health, unlike what is seen in other scientific fields, as shown here. This phenomenon indicates a major schism between sanitation and an intrinsically related area, public health. These results on graduate programs reinforce the other evidence presented in this study that sanitation is not perceived as an important subject by most in the academic community who are active in the field of public/collective health.

Final considerations

The institutionalization of public health began in Brazil when the concerted actions of medical sanitarians convinced the top decision-making bodies in the Brazilian state of the need to make sanitation a strategic priority for national development. Unfortunately, this work was cut short before it achieved this goal. The defense of sanitation, previously a banner of medical sanitarians, seems to have lost prestige in the public/collective health academic community, as the data obtained in this study suggest. Currently, few graduate programs in public/collective health address sanitation, which means few public/collective health research groups study or publish on the subject in the main public/collective health journals.

According to the hypothesis proposed here, the absence of sanitation from the public health research agenda is associated with historical process that progressively marginalized the sanitation services from the political agenda of public health after the 1960s, when its provision was transferred from health sector to the housing and urban development sector in the following decades. Another factor that might have contributed also, was the way environmental issues were incorporated into the field in the late 1970s, which eroded the perceived importance of sanitation amongst the environmental determinants of health. Finally, Sanitation, or "sanitarianism," may also have remained associated with the traditional public health approach, from which criticism gave rise to the field of public/collective health. However, the data gathered here is not adequate to assess this supposition, which would have to be investigated in another study, designed specifically to examine the perceptions of key players in the public/collective field.

The apparent lack of interest on the part of public/collective health researchers and journals about sanitation is a cause for concern, since the ultimate goal of all sanitation actions is to foster the health of populations. However, far from being exhausted here, it is important that we open this academic debate, recognizing the need for further and more in-depth studies into this issue. After all, only when public health professionals included the claim for universal access to adequate sanitation services in their praxis and political demands, which include making this issue more noticeable in the public health scientific agenda, that sanitation can become part of the effective state-assured social right to health of all Brazilian citizens, instead of a commodity of commercial interest to civil construction. In fact, "access to safe drinking water and adequate sanitation" was explicitly recognized by the United Nations as a human right in 2010. Understanding human rights to be universal, interdependent, and interrelated, the right to sanitation should be considered a fundamental precondition for the full enjoyment of all other human rights.

REFERENCES

ANDRADE, Márcio M. de. Proposta para um resgate historiográfico: as fontes do Sesp/FSESP no estudo das campanhas de imunização no Brasil. *História, Ciências, Saúde – Manguinhos*, v.10, supl.2, n.30, p.843-848. 1976.

ANDRADE, Rômulo de P., HOCHMAN, Gilberto. O plano de saneamento da Amazônia, 1940-1942. *História, Ciências, Saúde – Manguinhos*, v.14, supl., p.257-277. 2007.

BIRMAN, Joel.
A physis da saúde coletiva. *Physis: Revista de Saúde Coletiva*, v.1, n.1, p.7-11. 1991.

BRASIL.
Ministério da Educação. Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Censo atual*. Disponível em: <http://lattes.cnpq.br/web/dgp/censo-atual>. Acesso em: 8 nov. 2018. s.d.-a.

BRASIL.
Ministério da Educação. Conselho Nacional de Desenvolvimento Científico e Tecnológico. *Diretório dos grupos de pesquisa no Brasil*. Disponível em: <http://lattes.cnpq.br/web/dgp>. Acesso em: 8 nov. 2018. s.d.-b.

BRASIL.
Ministério da Educação. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. *Cadernos de indicadores*. Disponível em: <http://conteudoweb.capes.gov.br/conteudoweb/CadernoAvaliacaoServlet>. Acesso em: 8 nov. 2018. s.d.-c.

BRASIL.
Ministério das Cidades. *Sistema Nacional de Informações sobre Saneamento*: diagnóstico dos serviços de água e esgotos, 2015. Brasília: Ministério das Cidades. 2016a.

BRASIL.
Ministério da Educação. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. Plataforma Sucupira. *Qualis periódicos*. Disponível em: <https://sucupira.capes.gov.br/sucupira/public/consultas/coleta/veiculoPublicacaoQualis/listaConsultaGeralPeriodicos.jsf>. Acesso em: 8 nov. 2018. 2016b.

BRASIL.
Ministério da Educação. Fundação Capes. *Classificação da produção intelectual*. Disponível em: <http://www.capes.gov.br/avaliacao/instrumentos-de-apoio/classificacao-da-producao-intelectual>. Acesso em: 8 nov. 2018. 1 abr. 2014.

CAMPOS, Pedro Henrique P.
Estranhas catedrais: as empreiteiras brasileiras e a ditadura civil-militar, 1964-1988. Niterói: UFF. 2014.

ESCOREL, Sarah.
História da política de saúde no Brasil: 1964 a 1990: do golpe militar à reforma sanitária. In: Giovanella, Ligia et al. *Políticas e sistema de saúde no Brasil*. Rio de Janeiro: Fiocruz; Cebes. p.385-434. 2008.

FREITAS, Carlos M.
A produção científica sobre o ambiente na saúde coletiva. *Cadernos de Saúde Pública*, v.21, n.3, p.679-701. 2005.

HELLER, Léo.
Relação entre saúde e saneamento na perspectiva do desenvolvimento. *Ciência e Saúde Coletiva*, v.3, n.2, p.73-84. 1998.

HOCHMAN, Gilberto.
O Brasil não é só doença: o programa de saúde pública de Juscelino Kubitschek. *História, Ciências, Saúde – Manguinhos*, v.16, supl., p.313-331. 2009.

HOCHMAN, Gilberto.
A era do saneamento: as bases da política de saúde pública no Brasil. São Paulo: Hucitec. 1998.

IRIART, Jorge Alberto Bernstein et al.
A avaliação da produção científica nas subáreas da saúde coletiva: limites do atual modelo e contribuições para o debate. *Cadernos de Saúde Pública*, v.31, n.10, p.2.137-2.147. 2015.

LIMA, Nísia Trindade; HOCHMAN, Gilberto.
Condenado pela raça, absolvido pela medicina: o Brasil descoberto pelo movimento sanitarista da Primeira República. In: Maio, Marcos Chor; Santos, Ricardo Ventura. *Raça, ciência e sociedade*. Rio de Janeiro: Editora Fiocruz. p.23-40. 1996.

NUNES, Everardo Duarte.
Saúde coletiva: história de uma ideia e de um conceito. *Saúde e Sociedade*, v.3, n.2, p.5-21. 1994.

OSMO, Alan; SCHRAIBER, Lilia B.
O campo da saúde coletiva no Brasil: definições e debates em sua constituição. *Saúde e Sociedade*, v.24, supl.1, p.205-218. 2015.

PAIM, Jairnilson Silva; ALMEIDA FILHO, Naomar de.
Saúde coletiva: uma "nova saúde pública" ou campo aberto a novos paradigmas? *Revista de Saúde Pública*, v.32, n.4, p.299-316. 1998.

PENNA, Belisário.
Saneamento do Brasil. Rio de Janeiro: Jacinto Ribeiro dos Santos. 1923.

PIGNATTI, Marta G.
Saúde e ambiente: as doenças emergentes no Brasil. *Ambiente e Sociedade*, v.7, n.1, p.133-143. 2004.

REZENDE, Sonaly Cristina, HELLER, Leo.
O saneamento no Brasil: políticas e interfaces. Belo Horizonte: Editora UFMG. 2002.

RIBEIRO, Helena.
Saúde pública e meio ambiente: evolução do conhecimento e da prática, alguns aspectos éticos. *Saúde e Sociedade*, v.13, n.1, p.70-80. 2004.

SCIELO.
Scientific Eletronic Library Online. Disponível em: <http://www.scielo.br/>. Acesso em: 8 nov. 2018. s.d.

SETEMY, Adrianna.
Liga Pró-saneamento do Brasil. In: Abreu, Alzira Brandão de. *Dicionário histórico-biográfico da Primeira República, 1889-1930*. Rio de Janeiro: FGV Editora. 2015.

SOARES, Sérgio R.A.; BERNARDES Ricardo S.; CORDEIRO NETTO, Oscar M.
Relações entre saneamento, saúde pública e meio ambiente: elementos para formulação de um modelo de planejamento em saneamento. *Cadernos de Saúde Pública*, v.18, n.6, p.1.713-1.724. 2002.

SOBRAL, André.; FREITAS, Carlos M.
Modelo de organização de indicadores para operacionalização dos determinantes socioambientais da saúde. *Saúde e Sociedade*, v.19, n.1, p.35-47. 2010.

SOUZA, Cezarina M.N.; FREITAS, Carlos M.
A produção científica sobre saneamento: uma análise na perspectiva da promoção da saúde e da prevenção de doenças. *Engenharia Sanitária Ambiental*, v.15, n.1, p.65-74. 2010.

TAMBELLINI, Anamaria T.; CÂMARA, Volney M.
A temática saúde e ambiente no processo de desenvolvimento do campo da saúde coletiva: aspectos históricos, conceituais e metodológicos. *Ciência e Saúde Coletiva*, v.3, n.2, p.47-59. 1998.

UFES.
Universidade Federal do Espírito Santo. Pró-reitoria de Pesquisa e Pós-graduação. *Grupos de Pesquisa – CNPq/Ufes*. Disponível em: <http://www.prppg.ufes.br/grupos-de-pesquisa-cnpqufes>. Acesso em: 6 jun. 2017. s.d.

UN.
United Nations. United Nations Development Program. *Sustainable development goals*. Goal 6: Ensure access to water and sanitation for all. Disponível em: <https://www.un.org/sustainabledevelopment/water-and-sanitation/>. Acesso em: 6 jun. 2017. s.d.

VIACAVA, Francisco.
Produção científica dos cursos de pós-graduação em saúde coletiva no período 1998-2006. *Ciência e Saúde Coletiva*, v.15, n.4, p.1.977-1.988. 2010.

WHO.
World Health Organization. *Preventing diarrhoea through better water, sanitation and hygiene*: exposures and impacts in low- and middle-income countries. Genebra: WHO. 2014.