DOI: 10.1590/1413-81232020253.16442018




# Human leptospirosis as a doubly neglected disease in Brazil

Mário Henrique da Mata Martins (https://orcid.org/0000-0002-1370-300X) [1]
Mary Jane Paris Spink (https://orcid.org/0000-0003-1672-505X) [2]

**Abstract** *The aim of this article is to analyze discrepancies and informational gaps which produce a doubly neglected version of human leptospirosis in the Brazilian public health policy. To achieve this goal, we compared data on morbidity, mortality, hospital and social costs, population profiles, vector habits, social health determinants and diagnostic practices related to leptospirosis with another disease of higher recognition in Brazil: dengue fever. Our analysis shows that the arbitrariness of criteria for assigning health priorities, the invisibility of the population profile of human leptospirosis in official data and its mimetic character in clinic corroborate the production of a version of human leptospirosis that is invisible and, because of that, doubly neglected by the Brazilian public health policy. We conclude that these discrepancies and informational gaps are related to the fact that human leptospirosis affects a population which the State has no interest in keeping alive.*

**Key words** *Leptospirosis, Neglected diseases, Public health policies*

[1] Fundação Getúlio Vargas. Av. 9 de Julho 2029, Edifício John F. Kennedy, Bela Vista. 01313-902 São Paulo SP Brasil. martins.mariodamata@gmail.com
[2] Pontifícia Universidade Católica de São Paulo. São Paulo SP Brasil.

## Introduction

This paper aims to analyze the discrepancies and informational gaps that produce a doubly neglected version of human leptospirosis in the Brazilian public health policy. Our objective is to promote a debate about the invisible social and economic impact of this disease and the profile of the people affected by the disease to provide means to promote its recognition and coping as a neglected disease in Brazil.

The pathogenesis of human leptospirosis is hardly known[1]. Its transmission to humans occurs accidentally through animal urine contaminated by a bacterium[2] and, while it has been historically characterized as a rural disease, it is increasingly reaching urban populations[3,4]. This disease is related to both behavioral[5] and socio-environmental conditions[6] and is recurrent in deprived areas with high levels of social inequality in developing countries, causing enormous social and economic losses[7,8].

Although potentially lethal, its impact on the health of the population is still underestimated[9]. Politically and mediatically, the disease has little or no visibility, which makes it marginalized and unknown by the general public[10,11]. Due to its close relationship with poverty, public disinterest for its resolution and the possible need for costly permanent or long-term treatment after infection, it has been classified in the international literature as a Neglected Tropical Disease (NTD), classification of diseases prevalent in populations dwelling in deprived areas, without economic and infrastructure conditions to mobilize investment in the diseases they convalesce, and not arousing the interest of large pharmaceutical companies or even their rulers for the production of drugs and vaccines[7,8].

At that time, Brazil has a high percentage of NTDs such as schistosomiasis, leprosy, trachoma, leptospirosis (almost 90% of cases), dengue fever, malaria, both forms of leishmaniasis and possibly Chagas' disease, which is directly related to the socioeconomic inequalities of the country[8]. The country has addressed this issue by investing in public tenders for these diseases through the Neglected Diseases Research and Development Program, which aims to promote innovation through the development of medicines for public health programs. Through this program, two thematic public tenders that financed 140 projects with a total investment of R$ 39 million have already been launched, in addition to public tenders issued for specific diseases. Box 1 shows the public tenders issued until 2010 that include NTDs and their respective investments.

Despite international recognition of leptospirosis as an NTD, the national tenders do not make any mention of research and intervention investments for this disease. This is because seven priority areas that underpin the Brazilian neglected diseases program have been defined through epidemiological, demographic and impact data, as follows: dengue, Chagas disease, leishmaniasis, leprosy, malaria, schistosomiasis, and tuberculosis. Concerning direct government investment, human leptospirosis is not even considered a neglected disease in the country and was not included in a joint or specific public tender[12].

Thus, we proposed to discuss in this paper the double neglect of human leptospirosis in the health network, a neglect that is related to its features and impacts typical of a neglected disease and the lack of its recognition as such by the Brazilian health policy. We compared the information with a DTN that receives much more government attention to achieve this goal, namely, dengue. We do not pretend to provide results and proof of a correlation between the two diseases, much less to say that one should not invest in dengue, but to explain the mechanisms through which disease becomes an NTD and, thus, a recognized public health problem, while the other does not. Based on that, we discussed the biopolitical assumptions that underlie this segregation and lead the State to privilege one population group over another.

## Methods and material

This study used three methodological strategies based on the analysis of multiple sources of research[13]: a comparative analysis of data on morbidity, mortality and financial and social costs of dengue and human leptospirosis in the health network, followed by a comparative analysis of population characteristics and social determinants of both diseases and, finally, a case study on dengue and human leptospirosis cases in the health network.

We used information from the Notifiable Diseases Information System and the Hospital Information System of Unified Health System (SIH/SUS) on dengue and human leptospirosis to comply with the first methodological strategy of this work. Also, we compared three social impact indicators of these diseases: Potential Years of Life Lost (PYLL), which quantifies the number

Ciência & Saúde Coletiva, 25(3):919-928, 2020

**Box 1.** Major thematic public tenders in the area of neglected diseases in Brazil.

| Year | Public Tender | Resource |
|---|---|---|
| 2003 | Tuberculosis Network | R$1,9 million |
| 2004 | Dengue Fever | R$945 thousand |
| 2005 | Leprosy | R$ 2,5 million |
| 2006 | Neglected Diseases | R$17,0 million |
| 2008 | Neglected Diseases | R$22,0 million |
| 2009 | Malaria | R$15,4 million |
| 2009 | Dengue Fever Network | R$22,7 million |

Source: Adapted from Ministério da Saúde [Ministry of Health][12].

of years not lived due to death at the age of premature death, Working Years Lost (WYL), which quantifies the loss of working time due to death before or during the productive age group, and the salary impact of each disease, related to wage losses due to lack of work. Based on this data, we discussed the apparent arbitrariness of the criteria for assigning health intervention priorities.

Then, we discussed the differences and similarities between the population profiles of both diseases to comply with the second methodological strategy of this work. Thus, in Sinan's database, we selected four variables related to leptospirosis (2007-2015) and dengue (2007-2012) in the recent periods available on the platform. These four variables were age, gender, skin color/ethnicity, and schooling. We then identified the main information gaps in these population profiles and sought to complement them through the association with data on the behavior of vectors and social determinants of both diseases. Based on this information, we discussed population invisibility of human leptospirosis based on the production of informational gaps that obliterate marginalized groups.

Finally, to fulfill the last methodological strategy, we sought to understand how a gap is produced in the information on human leptospirosis in health practice through an ethnographic study in which we accompany the reception, diagnosis, and treatment of cases of people with leptospirosis at a hospital specializing in infectious diseases, highlighting a case study of a user who had dengue and leptospirosis at the same time. We compared the information obtained with data previously retrieved from Sinan on the impact of both diseases on the health network, and we discussed the production of invisibility based on the mimetic nature of leptospirosis and the variance of care of the health network for the disease.

Due to this last procedure, research was submitted to and approved by the Ethics Committee of the Pontifical Catholic University of São Paulo.

## Results and discussion

### What criteria are available to prioritize a disease?

In this topic, we discuss the criteria for considering one disease, namely, dengue, as a public health problem while another, leptospirosis, is neglected twice. Table 1 shows the absolute values of confirmed cases and deaths due to human leptospirosis and dengue between 2000 and 2015. We note that dengue's case record is 174 times that of leptospirosis nationwide. Considering the column of cases, the massive investment made in this disease does not seem at all questionable. However, if we analyze the other pair of columns, we find a contradictory situation: the number of deaths from human leptospirosis is threefold that of dengue. In this case, we can think of two criteria to prioritize a disease in public policy: one criterion of morbidity, and another of mortality.

However, these criteria only make sense when compared to the costs of these diseases, since they impact public coffers differently. For this financial criterion, we proposed to analyze the hospital and social costs of both diseases.

Regarding the hospital cost, the total investment for dengue in Brazil in the last 15 years stood at R$270,739,222.53, while leptospirosis recorded a much lower cost, R$30,341,984.22. Regarding social costs, it is important to point out that PYLL, WYL and wage loss calculations are usually produced for specific years, but the available scientific literature does not show coincident years for both diseases analyzed, which implies understanding their specificities without comparing them directly.

Souza et al.[9] identified that, in 2007, 6,490 Potential Years of Life (PYL), 4,617 Work Years and R$22,931,116.00 in wages were lost in Brazil as a result of leptospirosis, exceeding values for chronic diseases such as AIDS and hypertension in the same year. In turn, dengue values vary depending on the occurrence or not of epidemics in the year, as shown in Table 2, but tend to exceed the values of diseases such as malaria, leishmaniasis, schistosomiasis, leprosy and meningeal infections[14].

Considering the similar limitations due to the different periods focused by social cost sur-

**Table 1.** Cases and deaths confirmed by leptospirosis and dengue fever in Brazil (2000-2015 *).

| Year | Cases* | | Deaths* | |
|---|---|---|---|---|
| | Dengue | Leptospirosis | Dengue | Leptospirosis |
| 2000 | 135,228 | 4,208 | 3 | 351 |
| 2001 | 385,783 | 3,708 | 41 | 436 |
| 2002 | 696,472 | 2,796 | 121 | 332 |
| 2003 | 274,975 | 3,005 | 52 | 353 |
| 2004 | 70,174 | 3,097 | 8 | 389 |
| 2005 | 147,039 | 3,534 | 37 | 408 |
| 2006 | 258,680 | 4,369 | 78 | 413 |
| 2007 | 496,923 | 3,331 | 148 | 349 |
| 2008 | 632,680 | 3,679 | 259 | 347 |
| 2009 | 406,269 | 3,946 | 174 | 345 |
| 2010 | 1,011,548 | 3,817 | 300 | 390 |
| 2011 | 764,032 | 4,965 | 191 | 442 |
| 2012 | 589,591 | 3,266 | 121 | 280 |
| 2013 | 1.452,489 | 4,141 | 235 | 359 |
| 2014 | 589,107 | 4,706 | 60 | 331 |
| 2015 | 1,688,688 | 4,341 | 140 | 334 |
| 2016 | 1,500,535 | 2,870 | 176 | 234 |
| Total | 11,100,213 | 63,779 | 2,144 | 6,093 |

*Data subject to revision.
Source: Ministério da Saúde [Ministry of Health]. Sistema de Informações sobre Agravos de Notificação (SINAN) [Notification of Diseases Information System].

veys for dengue and leptospirosis, we would like to point out only that they both exceed, in value and their respective years, diseases considered public health problems, including some NTDs. Hence, although hospital and social costs, as well as morbidity and mortality, are essential factors in characterizing and prioritizing a public health problem, they are not ultimately the only determinants of this process. While the number of cases and the hospital cost would justify the investment in dengue prevention and treatment, the number of deaths would justify the investment in prevention for leptospirosis. Because of this arbitrariness, we hypothesize that the reason for assigning priority to dengue over leptospirosis lies in the profile of the population affected by each disease.

### Dengue and human leptospirosis population profiles

To discuss the difference between dengue and human leptospirosis population profiles, we selected four variables related to leptospirosis (2007-2015) and dengue (2007-2012) in the SINAN in the recent periods available on the platform: age, gender, skin color/ethnicity, and schooling. The total cases and percentage values were shown in Table 3, with emphasis on the ignored cases.

Regarding gender, men (78.6%) are more affected by human leptospirosis than women (21.3%). In dengue cases, this difference between cases of men (55.1%) and women (44.8%) is subtler. Concerning the skin color/ethnicity criterion, there are predominant cases of leptospirosis in people who self-declared white (46%), followed by people who self-declared black and brown (41.2%), yellow (0.5%) and indigenous (0.3%). The proportion of self-declared white people (28.5%) in dengue cases is lower than that of self-declared black and brown individuals (35.4%), and the cases self-declared as yellow (0.9%) and indigenous peoples (0.3%) are lower.

Concerning education, most people who had leptospirosis did not complete 8$^{th}$ grade (35.6%). This number is much lower in cases of dengue (18.5%) and, regarding age, both diseases concentrate cases in the extensive productive age range of 20-59 years, and the proportion of cases of leptospirosis (72.3%) is more significant than that of dengue cases (60.6%).

However, we must take into account the fact that there were a large number of unknown cases in the skin color/ethnicity and schooling questions for both diseases. In the case of skin color/ethnicity, 12% of leptospirosis cases and 34.9% of dengue cases were unknown, while for schooling, 35% of leptospirosis cases and 51.56% of dengue cases were unknown. While we can characterize the population profile of both diseases against gender and age for the respective periods, this profile is incomplete due to the unavailability of obtaining accurate data on skin color/ethnicity and schooling. In practical terms, this number of unknown cases indicates that, somehow, the information regarding these items is not always reported in the corresponding form or, if accurately completed, is not correctly submitted and recorded in the system. Thus, this information becomes invisible.

Another course of action may take place in the case information gap: ignoring something is taking an attitude toward what is being ignored, excluding it from the discussion spaces. It seems impossible to define the essential characteristics of the population with leptospirosis and dengue fever through epidemiological data because of insufficient data. Thus, these issues do not corroborate to delineate the field of health actions aimed at the prevention and treatment of both

diseases. After all, how can we act without knowing this primary information data about the population? The fact is that the population difference between leptospirosis and dengue is well known, but this difference is not given in numbers, but in the action of their vectors and their social determinants.

Dengue is transmitted by a species of mosquito called *Aedes Aegypti* measuring approximately 0.5 cm in length. The female of this species needs blood protein to promote the maturation of its ovaries and the development of its eggs and, thus, it looks for nutrition under the skin of other species. Unlike other mosquitoes, *Aedes Aegypti* females may sting more than one person during

**Table 2.** Comparison of social costs of dengue fever in epidemic year (2010) and non-epidemic year (2012).

| Year | PYL | WYL | Wage loss |
|---|---|---|---|
| 2010 | 13,955 | 8,244 | R$ 56,059,200.00 |
| 2012 | 7,297 | 5,124 | R$ 42,494,869.20 |

Source: Adapted from Leite[14].

**Table 3.** Population profile in cases of leptospirosis (2007-2015) and dengue fever (2007-2012) in Brazil by gender, skin colour/ethnicity,schooling and age.

| Data | | Absolute numbers* | | Percentage Values* | |
|---|---|---|---|---|---|
| | | Dengue | Leptospirosis | Dengue | Leptospirosis |
| Gender | Women | 1,671,459 | 7,367 | 44.8 | 21.3 |
| | Men | 2,057,939 | 27,162 | 55.1 | 78.6 |
| | Unknown | 1,134 | 3 | < 0.1 | < 0.1 |
| Skin Colour/ Ethnicity | White | 1,064,733 | 15,874 | 28,5 | 46 |
| | Black | 161,060 | 1,873 | 4.3 | 5.5 |
| | Yellow | 34,704 | 205 | 0.9 | 0.5 |
| | Brown | 1,153,495 | 12,329 | 30.9 | 35.7 |
| | Indigenous | 14,057 | 99 | 0.3 | 0.3 |
| | Unknown | 1,302,483 | 4,152 | 34.9 | 12.0 |
| Schooling | Illiterate | 33,730 | 562 | < 0.1 | 1.6 |
| | 1st to 4th grade incomplete | 219,056 | 3,597 | 5.8 | 10.5 |
| | Complete 4th grade | 135,522 | 2,226 | 3.6 | 6.5 |
| | 5th to 8th grade incomplete | 333,571 | 5,902 | 9.0 | 17.0 |
| | Complete primary education | 167,398 | 2,474 | 4.4 | 7.2 |
| | Incomplete High school | 203,096 | 2,344 | 5.4 | 6.8 |
| | Complete High school | 294,539 | 3,616 | 7.8 | 10.5 |
| | Incomplete higher education | 50,312 | 441 | 1.3 | 1.2 |
| | Complete higher education | 80,943 | 584 | 2.6 | 1.7 |
| | Not applied | 288,639 | 678 | 7.7 | 2.0 |
| | Unknown | 1,923,726 | 12,108 | 51.56 | 35.0 |
| Age | < 1 year | 58,672 | 243 | 1.5 | 0.7 |
| | 1-4 | 134,427 | 182 | 3.6 | 0.5 |
| | 5-9 | 252,335 | 880 | 6.7 | 2.5 |
| | 10-14 | 355,456 | 2,177 | 9.5 | 6.5 |
| | 15-19 | 388,576 | 3,355 | 10.4 | 9.7 |
| | 20-39 | 1,434,648 | 14,188 | 38.4 | 41.0 |
| | 40-59 | 828,264 | 10,758 | 22.2 | 31.3 |
| | 60-64 | 101,990 | 1,210 | 2.7 | 3.5 |
| | 65-69 | 71,133 | 732 | 1.9 | 2.1 |
| | 70-79 | 77,112 | 674 | 2.0 | 1.9 |
| | 80 and + | 22,614 | 122 | 0.6 | 0.3 |
| | Unkown | 5,288 | 11 | 0.1 | >0.1 |

*Data subject to revision.

Source: Ministério da Saúde [Ministry of Health]. Sistema de Informações sobre Agravos de Notificação (SINAN) [Notification of Diseases Information System].

this period and not necessarily in the same environment. Its flight range is 300 meters, but the breeding female can fly up to three kilometers in search of a suitable place for spawning. This place can be any space with, preferably, still and crystal clear waters.

In turn, the primary vector of human leptospirosis is the rat, especially the *Rattus Norvegicus*, which originated in Asia but is now widespread in all inhabited regions of the planet. The species expanded from East Asia by replacing the *Rattus Rattus* populations due to its size (on average 25 cm and 300g), resistance, aggressiveness and ability to produce holes and inhabit hard-to-reach places near human households. Currently, *Rattus Norvegicus* species lives in a synanthropic condition, looking for human-built spaces with available water and regular food. It has nocturnal habits and circulates through a specific territory, usually near its nest[15].

The difference between these species as vectors of diseases is their relationship with humans and their circulation space. Mosquitoes must fly towards humans, coming into direct contact with our body to transmit the dengue virus. Concerning leptospirosis, one must be in a place where the infected mice can reach food and waste, mice urinate in a place accessible to humans, humans come into contact with the urine of the infected rat and bacteria access the bloodstream.

Struggling to prove the best vector efficacy, the *Rattus Norvegicus* loses because its food interest is not in the human body and because its habits and its anatomy restrict its circulation: it is incapable of taking flight. Mosquitoes are much more efficient vectors, reaching larger population groups and transmitting the dengue virus more effectively. That is why the dengue-affected population is broader and more heterogeneous than that affected by leptospirosis (the gender and age distribution shown in Table 3 indicates this heterogeneity of the dengue population profile). *Aedes Aegypti* is more democratic in the distribution of the virus.

Moreover, what would be the population affected by human leptospirosis? One must associate the characteristics of its principal vector with the social determinants of the disease to reach this conclusion. Social determinants are a set of economic, environmental, cultural and psychological criteria that characterize the living and working conditions of people and population groups and determine their health status. These determinants, known as SDH, have been particularly influential in understanding health inequities; inequalities among population groups that are not only systematic and relevant but are avoidable[16]. Behavioral factors such as the elimination of still water in conducive mosquito breeding grounds in the case of dengue, or infrastructure issues such as basic sanitation in the case of human leptospirosis, not only indicate the characteristics of a disease but also point to the way in which different illnesses enter different bodies.

Research in this area indicates that people who are infected and develop leptospirosis usually live in areas without sanitation such as favelas and precarious settlements, work in places or perform activities in which contact with mouse urine is possible[17,18]. These people are marked by poverty, racial segregation, and low schooling, precisely the most underreported data. Thus, data invisibility keeps the population in a situation of vulnerability to marginalized leptospirosis concerning care with this disease. This population segregation defines what Foucault[19] called state racism:

*In fact, what is Racism? It is, first of all, the means of introducing, finally, a dividing line in this life realm that power has been entrusted with: a line between what must live and what must die. In the biological continuum of the human species, the emergence of races, the distinction of races, the hierarchy of races, the qualification of certain races as good, and others as inferior, all this will be a way of fragmenting this field of the biological that power has been entrusted with; a way of phasing out some groups within the population in relation to others*[19](p.214).

In the extension of sovereign power to power over life, the sovereign right to let live and die is reversed for a right to make those of interest to the State live and let the "inferiors" die. Thus, as Foucault points out[19] "racism is linked to the functioning of a state which is obliged to use race, the elimination of races and the purification of the race to exercise its sovereign power"[19](p.217). The state emphasis on dengue is shown under these terms because the population with better social conditions for coping with the disease can also become ill, and this is a population much more valuable in the perspective of the State than the population in a situation of vulnerability to leptospirosis.

If we were to consider the data previously presented, we would hardly come to this conclusion. This is invisibility of leptospirosis that makes it a neglected disease: unlike dengue, the lack of data in cases of leptospirosis obliterates

a particular population, historically neglected by other mechanisms of government. Thus, it is understood that from the viewpoint of the population profile, public health policy opts to invest in a disease that may affect the country's elites in some way than a disease that affects a specific social group: poor, black, peripheral and made invisible to the public health policy.

However, this is not the only blind spot that produces double neglect of leptospirosis. Not only the population profile of these diseases varies but also its clinical picture. Sometimes leptospirosis is quickly diagnosed. At other times, it is not possible to see even its manifestation and eventually it is confused with dengue. Thus, it is not just numbers that obliterate. The body's response to infections also interferes with the process of making the disease visible.

### The mimetic character of human leptospirosis

Although the population profiles of dengue and leptospirosis are crucial for the characterization of these diseases, their prevention and treatment, they are not always considered necessary in the process of defining and differentiating one disease from the other. Case diagnoses, for example, tend to favor the clinical-laboratory criterion over the clinical-epidemiological criterion, in which this population profile is expressed. This is because laboratory data can express relationships that sight and touch of doctors and physicians cannot access to make a diagnosis. Besides, epidemiological data are not sufficiently reliable: as we have seen in the previous section, they may be non-existent, non-specific or inaccurate. All that health professionals and users do not want while they are looking for solutions to the problems afflicting sick people are these qualifiers.

Although the diagnostic criteria are distinct, the presence of signs and symptoms is a crucial factor in both cases. However, they are not always present. The manifestation of leptospirosis in the bodies of specific people can also generate invisibility. In some cases, the signs and symptoms are clear and the diagnosis accurate even before the examination, while in others, leptospirosis only exists in specific exams and is clinically invisible. The excerpt below is from a field diary produced in July 2015 that illustrates a clinically apparent case of the disease:

*As we entered the room, we were impressed by what we saw. A woman about fifty years of age was lying on a stretcher with utterly orange skin, moaning in pain with her eyes shut. Beside her was a young woman with a calm look who said quietly, "Calm down, Mother. The doctors will take care of this." Also, she looked at both of us, the nursing student and me as if asking for an affirmative answer. I remember when the doctor asked the user to open her eyes quickly. Her black eyes were bouncing, with orange sclera (white part of the eye) and marked ocular veins like red webs. She closed them quickly. The hospital light over her eyes mistreated her. In the medical records, the doctor had written: fever, conjunctival congestion, jaundice, myalgia, calf pain, respiratory failure, headache, vomiting, prostration, diarrhea, abdominal pain and choluria (dark urine). All typical symptoms of leptospirosis. None were left out. "Have you ever seen such a case?" The doctor asked me. "No, no ... I've never seen such a case." I followed-up the woman and her daughter for a few weeks. She was referred to a hemodialysis reference hospital, and I visited them for a few days. The last time I saw them, the situation had gotten worse. In the ICU room, the user was babbling, unable to communicate, her lips completely dry and glued together. She passed away a few days later.*

The case of this user is prototypical. The signs and symptoms, the laboratory tests, as well as the epidemiological background were congruent with the case diagnosis for human leptospirosis. The doctor clinically identified the case. This is a version of leptospirosis that is visibly manifested in the body.

However, not always leptospirosis manifests itself so naturally and severely. Sometimes the body does not expose what we need to see. It also hides. This was what happened to a patient who had leptospirosis, but the disease was not identified by either epidemiological or straightforward clinical or laboratory criteria that were not specific for the disease. The excerpt below is from a field diary produced in July 2015 and reports the moment when a doctor introduces me to a user who was infected while working on a construction site. However, the disease did not manifest as expected:

*The doctor said that he had been diagnosed with dengue a few days earlier, but when returning for evaluation, another doctor requested exams for leptospirosis because he had reported contact with dirty water in his workplace. The tests confirmed the infection. The user had both illnesses at the same time. I was a bit scared. I did not know that was possible. The first thing that crossed my mind was to ask if he was all right. The user himself replied bewildered that, yes, with some headaches,*

*but nothing more. Then the doctor explained that the user had a mild form of both diseases in which dengue predominated.*

Leptospirosis is known to be a mimetic disease: its milder version tends to be confused with other diseases such as dengue, which has required improved monitoring and diagnostic practices to increase case detection[20]. This diagnostic confusion has aroused the attention of the area scholars because infections by different pathogens that evidence similar symptoms require different treatments, and the application of an incorrect treatment is a factor that increases the likelihood of death[21]. Currently, retro-orbital pain (behind the eyes) is used by physicians as a reference symptom for the differential diagnosis of dengue, while calf pain is a symptom of the differential diagnosis of leptospirosis.

However, things do not always go according to medical books. Sometimes what is made invisible are not numbers, but signs and symptoms. If there are no signs and symptoms, there is nothing to report. If there is nothing to report, there is no diagnosis, and the problem does not exist, at least formally. The user would not be represented by a number in the leptospirosis charts shown above and would be just another number for dengue fever.

This draws attention to the issue of underreporting of leptospirosis cases. How many cases of the disease are diagnosed as dengue in the health network and how much does it contribute to the valuing of one disease over another? Studies on the underreporting of leptospirosis cases in Brazil have pointed out this weakness. In Fortaleza, considering the cases reported by surveillance authorities, such as dengue, that were later discarded based on laboratory tests, it is estimated that the number of cases of leptospirosis may be 26 to 49-fold than that diagnosed and reported by the health services[22].

In addition, some studies point to the fact that the increased number of records of leptospirosis cases in the rainy season may be due to a greater attention and emphasis by health professionals in identifying symptoms of the disease in this period, and the associations and correlations are coincident or even accidental in many cases, while in non-rainy periods this attention is not required[23].

Finally, in the case of this user, both dengue and leptospirosis were mild, so that his own body was able to resist diseases. It is a case in which the request for serology was fundamental so that he was not excluded from the statistics. Therefore, questioning this clinical invisibility implies decisions about the sites in which interventions will be performed and the bodies that will be affected by them: given that bodies react differently to leptospirosis, a coworker of this user, under the same conditions, may not have developed only a mild form of the disease.

## Conclusion

As the definition of a public health problem is always a dispute, it is necessary to justify our classification of human leptospirosis in these terms. Our choice to study this disease stems from a set of factors that can be summarized as follows: it is a high-impact disease, but doubly neglected in the health sector because of unclear criteria for prioritizing and producing invisibilities relative to the affected population and its clinical picture.

To reach this conclusion, we showed how the criteria of morbidity, mortality, and hospital and social costs are ambiguous to justify decision-making that classifies a particular disease as a public health problem that requires massive investment over another. Also, we attempted to show that the population profile of the disease and its clinical manifestation may generate invisibilities that contribute to human leptospirosis being less critical than dengue in the public space. By giving visibility to the social determinants of the disease and its diagnostic slips, we point to the fact that human leptospirosis affects a population that the State has no interest in keeping alive, while dengue affects a broader group of people, including those that the State has the interest to preserve.

Therefore, what happens with leptospirosis is that it is a poverty-related disease, with a population camouflaged by the invisibility of population data and whose mimetism and seasonality generate clinical-diagnostic invisibilities that prevent a greater recognition of the population affected by the disease. Thus, it becomes an easy target for State racism, and the visibility of these issues is the first way of coping with this mechanics that not only doubly neglects the disease but people affected by it.

## Collaborations

MHM Martins participated in the conception, design, analysis and interpretation of data, and also in the drafting of the article. MJP Spink participated in the critical revision and approval of the version to be published.

## Acknowledgments

The authors would like to thank the CNPq for the doctoral scholarship and to the members of the Laicos group of the Autonomous University of Barcelona for the discussions that fostered the production of this paper.

## References

1. Ko AI, Goarant C, Picardeau M. Leptospira: The Dawn of the Molecular Genetics Era for an Emerging Zoonotic Pathogen. *Nat Rev Microbiol* 2009; 7(10):736-747.
2. Haake DA, Levett, PN. Leptospirosis in Humans. *Curr Top Microbiol Immunol* 2015; 387:65-97.
3. Ko AI, Reis M, Dourado M., Johnson-Júnior W, Riley L. Urban epidemic of severe leptospirosis in Brazil. *Lancet* 1999; 354(9181):820-825.
4. Hotez PJ. Global urbanization and the neglected tropical diseases. *PLoS Negl Trop Dis* 2017; 11(2):e0005308.
5. Araújo WN, Finkmoore B, Ribeiro GS, Reis RB, Felzemburgh, RD, Hagan JE, Reis MG, Ko AI, Costa F. Knowledge, Attitudes, and Practices Related to Leptospirosis among Urban Slum Residents in Brazil. *Am J Trop Med Hyg* 2013; 88(2):359-363.
6. Guimarães R, Cruz O, Parreira V, Mazoto M, Vieira J, Asmus, C. Análise temporal da relação entre leptospirose e ocorrência de inundações por chuvas no município do Rio de Janeiro, Brasil, 2007-2012. *Cien Saude Colet* 2014; 19(9):3683-3692.
7. Hotez PJ. *Forgotten people, forgotten diseases: the neglected tropical diseases and their impact on global health and development.* Washington: ASM Press; 2008.
8. Hotez PJ, Fujiwara R. Brazil's neglected tropical diseases: an overview and a report card. *Microbes Infect* 2014; 16(8):601-606.
9. Souza V, Arsky M, Castro A, Araujo W. Anos potenciais de vida perdidos e custos hospitalares da leptospirose no Brasil. *Rev Saude Publica* 2011; 45(6):1001-1008.
10. Cavaca A, Vasconcellos-Silva P. Doenças midiaticamente negligenciadas: uma aproximação teórica. *Interface (Botucatu)* 2015; 19(52):83-94.
11. Halliday JE, Allan KJ, Ekwem D, Cleaveland S, Kazwala RR, Crump JA. Endemic zoonoses in the tropics: a public health problem hiding in plain sight. *Vet Rec* 2015; 176(9):220-225.
12. Brasil. Ministério da Saúde (MS). Doenças negligenciadas: estratégias do Ministério da Saúde. *Rev Saude Publica* 2010; 44(1):200-202.
13. Galindo D, Martins M, Rodrigues R. Jogos de armar: narrativas como modo de articulação de *múltiplas fontes* no cotidiano de pesquisa. In: Spink MJ, Brigagão J, Nascimento V, Cordeiro M, organizadoras. *A produção de informação na pesquisa social*: *compartilhando ferramentas*. Rio de Janeiro: Centro Edelstein de Investigações sociais; 2014. p. 295-323.
14. Leite P. *Impacto da dengue no Brasil em período epidêmico e não epidêmico: incidência, mortalidade, custo hospitalar e Disability Adjusted Life Years (DALY)* [dissertação]. Brasília: Universidade de Brasília; 2015.
15. Santoianni F. *Todos os ratos do mundo: do flautista de Hamelin a Mickey Mouse: o irresistível charme dos roedores*. São Paulo: Best Seller; 1993.
16. Buss P, Pellegrini-Filho A. A saúde e seus determinantes sociais. *Physis* 2007; 17(1):77-93.
17. Hagan JE, Moraga P, Costa F, Capian N, Ribeiro S, Wunder E A, Felzemburgh RD, Reis RB, Nery N, Santana FS, Fraga D, Santos BL, Santos AC, Queiroz A, Tassinari W, Carvalho MS, Reis MG, Diggle PJ, Ko AI. Spatiotemporal Determinants of Urban Leptospirosis Transmission: Four-Year Prospective Cohort Study of Slum Residents in Brazil. *PLoS Negl Trop Dis* 2016; 10(1):e0004275.
18. Gonçalves N, Araújo E, Sousa Júnior A, Pereira W, Miranda C, Campos P, Matos M, Palácios V. Distribuição espaço-temporal da leptospirose e fatores de risco em Belém, Pará, Brasil. *Cien Saude Colet* 2016; 21(12):3947-3955.
19. Foucault M. *Em defesa da sociedade*. WMF Martins Fontes: São Paulo; 2010.
20. Izurieta R, Galwankar S, Clem A. Leptospirosis: The "mysterious" mimic. *J Emerg Trauma Shock* 2008; 1(1):21-33.
21. Priya SP, Sakinah S, Sharmilah K, Hamat RA, Sekawi Z, Higuchi A, Ling MP, Nordin SA, Benelli G, Kumar SS. Leptospirosis: molecular trial path and immunopathogenesis correlated with dengue, malaria and mimetic hemorrhagic infections. *Acta Trop* 2017; 176(1):206-223.
22. Fontes RM, Cavalcanti LPG, Oliveira ACA, Bezerra LFM, Gomes AMM, Colares JKB, Lima DM. A new possibility for surveillance: do we identify all cases of leptospirosis? *Rev Inst Med Tropical São Paulo* 2015; 57(5):443-446.
23. Àvila-Pires FD. Leptospirose e enchentes: uma falsa correlação? *Rev Patologia Tropical* 2006; 35(3):199-204.

Article submitted 31/03/2018
Approved 25/06/2018
Final version submitted 27/06/2018

This is an Open Access article distributed under the terms of the Creative Commons Attribution License