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Human and Animal Sporotrichosis in the City of São Paulo from 2016 to 2022

Esporotricose Humana e Animal no Município de São Paulo no Período de 2016 a 2022

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Abstract

Sporotrichosis is a subcutaneous mycosis that has been expanding geographically in our country. With the recent popularity of felines and the strengthening of the guardian-pet bond, zoonoses tend to gain more prominence. The absence of compulsory notification at the national level makes decision-making and the formulation of public policies difficult. The present work aimed to correlate hospitalizations and deaths in humans with new cases of animal sporotrichosis in the city of São Paulo between 2016 and 2022, in addition to analyzing the correlation of the variable average family income with the most affected regions. The number of hospitalizations for human sporotrichosis was 648 while there were 5711 new cases in animals between 2016 and 2022 in the municipality of São Paulo. There was a positive correlation between the increase in human hospitalizations and a significant increase in the number of animal cases in the city of São Paulo. Health Surveillance Units (UVIS) with the greatest number of cases were Vila Maria / Vila Guilherme (908 / 15,90%), Itaim Paulista (596 / 10,44%) e Jaçanã / Tremembé (471 / 8,25%). There was no association between income and most affected regions. It is concluded that human and animal sporotrichosis in the city of São Paulo continues to expand, with a concomitant increase in the number of cases being observed in both, which reiterates the role of zoonotic transmission, with in principle there being no positive correlation with the variable income.

Keywords: Hospitalization Rate. Spatial Distribution. Sporotrichosis in Animals. Zoonosis.

Resumo

A esporotricose é uma micose subcutânea que vem se expandindo geograficamente no nosso país. Com a recente popularidade dos felinos e o estreitamento do vínculo entre tutor e animal de estimação, as zoonoses tendem a ganhar mais destaque. A ausência da notificação compulsória no âmbito nacional dificulta a tomada de decisão e formulação de políticas públicas. O presente trabalho teve por objetivo correlacionar os internamentos e óbitos em humanos com os casos novos de esporotricose animal no município de São Paulo entre 2016 e 2022, além de analisar a correlação da variável renda média familiar com as regiões mais acometidas. O número de internamentos por esporotricose humana foi de 648. O número de casos novos em animais, no município de São Paulo, foi de 5.711, entre 2016 e 2022. Observou-se um aumento no número de internamentos em humanos e de casos novos em animais, com correlação positiva. As Unidades de Vigilância em Saúde (UVIS) com maior número de casos de esporotricose animal foram Vila Maria / Vila Guilherme (908 / 15,90%), Itaim Paulista (596 / 10,44%) e Jaçanã / Tremembé (471 / 8,25%). Não houve associação entre a renda e regiões mais acometidas. Conclui-se que a esporotricose humana e animal, no município de São Paulo, permanece em expansão, sendo observado um aumento concomitante do número de casos em ambos, o que reitera o papel da transmissão zoonótica, não havendo a princípio correlação positiva com a variável renda.

Palavras-chave: Distribuição Espacial. Esporotricose em Animais. Taxa de Hospitalização. Zoonose.

1 Introduction

The occurrence of sporotrichosis in its zoonotic form is a reality in all regions of the country. Furthermore, the recent significant increase in the number of confirmed cases of the disease in humans and animals confirms the importance of this situation (Brazil, 2023). Sporothrix brasiliensis is the most virulent species, responsible for the majority of human and animal cases in Brazil (Siqueira *et al*., 2023), being identified as responsible for 90% of sporotrichosis cases (Sales, 2021).

In the city of São Paulo, cases of animals affected by sporotrichosis have shown significant growth (Almeida Maia *et al*., 2023). In 2011, several cases of feline sporotrichosis emerged in Itaquera, in the eastern zone of São Paulo. Few studies map the progression of human sporotrichosis in São Paulo. The geographic progression of diagnosed human cases from that date suggests a possible spread of the outbreak from the eastern part of the city to other neighborhoods and neighboring cities Veasey *et al*. (2022). It is possible that the increase in the number of cases from 2010 onwards is also associated with zoonotic transmission, considering the report in the literature of the increase in the number of cases of feline sporotrichosis Montenegro *et al*. (2014).

In the city of São Paulo, surveillance, prevention, and control of zoonoses, as well as the receipt of notifications of suspected and confirmed cases in animals, are carried out by the Zoonosis Surveillance Division (DVZ) of the Health Surveillance Coordination (COVISA), in conjunction with the Health Surveillance Units (UVIS) of the Regional Coordination Offices, which are part of the Executive Secretariat for Primary Care, Specialties, and Health Surveillance of the Municipal Health Department.

The UVIS are decentralized units under the coordination of COVISA (Health Surveillance Coordination). They are located in the six regions of the municipality of São Paulo – North, South, East,

Central, West, and Southeast – and operate in Environmental Surveillance, Sanitary Surveillance, and Epidemiological Surveillance (List of UVIS, 2023).

This study aims to verify if there is a concomitant progression between hospitalizations for sporotrichosis in humans and new cases of the disease in animals in the period from 2016 to 2022. Furthermore, this work aims to distribute cases of animal sporotrichosis by administrative district and correlate this with average family income.

2 Material and Methods

A survey of hospitalizations and deaths in humans due to human sporotrichosis and new cases in animals, dogs and cats, in the municipality of São Paulo, was carried out from 2016 to 2022.

To compose the database necessary for the execution of this study, secondary data available in the Hospital Information System (SIH - SUS) of the Department of Informatics of the Unified Health System (DATASUS), belonging to the Unified Health System (SUS), were obtained for cases in humans and for cases in animals, from secondary data available in the information systems of the Zoonosis Surveillance Center, through the website of the Transparency Portal of the municipality of São Paulo (http://transparencia.prefeitura.sp.gov.br/). The use of public data made approval by a Research Ethics Committee unnecessary for conducting this research.

The SIH database includes hospitalizations and deaths related to hospitalizations due to human sporotrichosis. It is worth highlighting the importance of the Mortality Information System (SIM), where we can find mortality data by specific cause, associated or not with hospitalization, being considered the official system regarding the outcome of death.

In the case of human patients, the variables age, age group, gender, clinical form (ICD), death, and federative unit were evaluated based on data obtained from SIHSUS. In turn, in animals, the number of new cases per district in the years was evaluated.

The study population consisted of hospitalizations and deaths of humans and new cases of animals in the municipality of São Paulo, from 2016 to 2022.

The database (Excel) was used to store the information, which was subsequently analyzed with the aid of the libraries of the free access program R. The statistical methods used for analysis included calculations of absolute and relative frequency, mean, and percentage. To assess the association between variables, Pearson's correlation was used with a significance level of 5%.

For data analysis, the hospitalization rate was calculated by dividing the number of confirmed hospitalizations by the resident population during the period, and multiplying the result by 100,000. In turn, the case fatality rate was calculated by dividing the number of confirmed deaths by the resident population during the period and multiplying the result by 100,000. The values used in the denominator were taken from the results of the 2022 Census, based on population estimates from the Brazilian Institute of

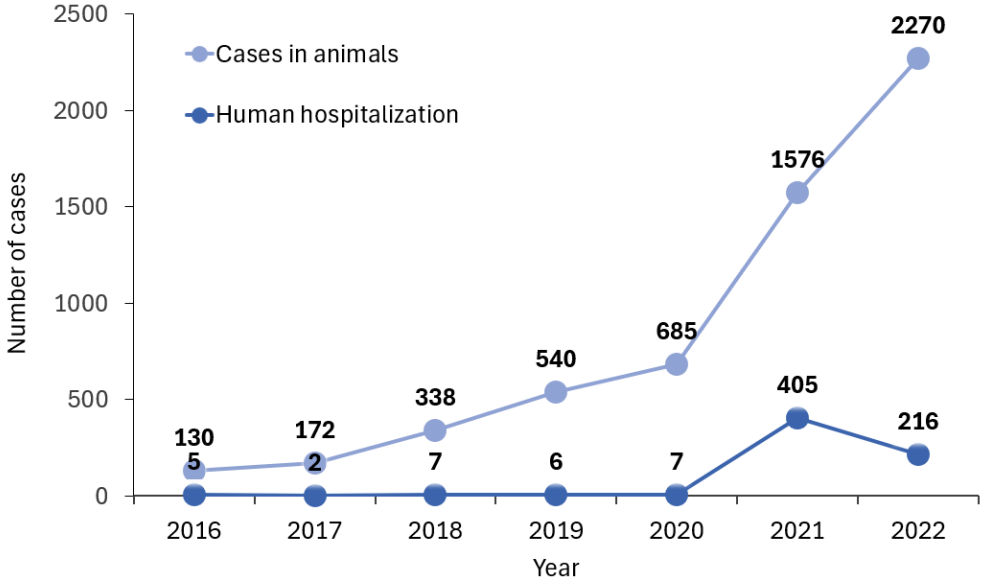
Geography and Statistics (IBGE). The Brazilian population in 2022 was 203,062,512, while the population of the State of São Paulo was 44,420,459 and the population of the capital São Paulo was 11,451,245.

The average monthly family income for each of the 28 UVIS was obtained by using the arithmetic mean of the average monthly family income of the districts that make up each UVIS.

3 Results and Discussion

In the city of São Paulo, the number of hospitalizations for human sporotrichosis recorded between 2016 and 2022 was 648, while the number of new cases in animals over the years was 5,711, as detailed in Figure 1.

Figure 1 - Number of cases in animals and hospitalizations in humans registered in São Paulo city between 2016 and 2022



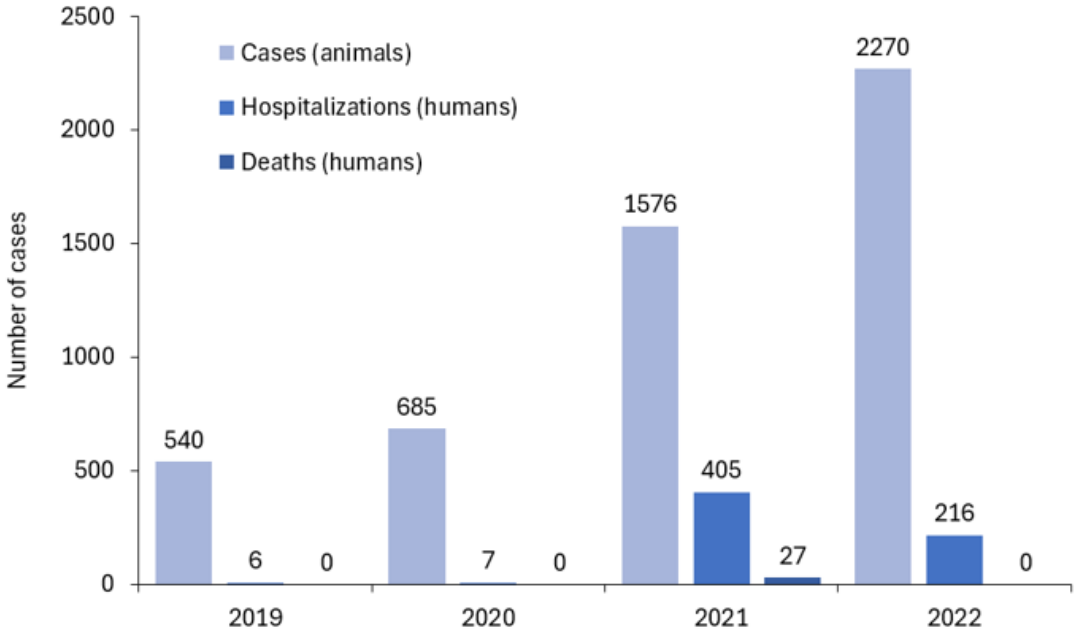
Source: dados da pesquisa.

It is noted that new cases in animals have been on the rise over the years, with significant peaks in 2021 and 2022. This result is consistent with Almeida Maia *et al*. (2023). In turn, hospitalizations in humans registered a vertiginous increase in 2021 and to a lesser extent in 2022, as well as in Cognialli *et al*. (2022), who found a higher incidence of cases between 2019-2021 in Curitiba. The ratio between the number of hospitalizations in humans and the number of cases in animals between 2016 and 2020 was 1% to 4%, rising to 26% in 2021 and 10% in 2022. This significant increase in cases of sporotrichosis in Brazil between 2021 and 2022 can be attributed to a complex scenario of interconnected factors, reflecting the consequences of the COVID-19 pandemic. The overburdening of healthcare services and restrictions on movement altered the flow of care, resulting in late diagnoses of neglected diseases such as sporotrichosis. Simultaneously, an expansion of the feline population was observed, especially in areas of social vulnerability where the disease is more prevalent. The work of animal protection NGOs and independent caregivers, while essential, may have faced difficulties in managing the treatment and isolation of infected

animals, contributing to the spread of the fungus *Sporothrix brasiliensis*. Although surveillance and awareness campaigns have been carried out, underreporting, still present in many states, suggests that the actual number of cases may be even higher, reinforcing the need for a more robust epidemiological surveillance system. Although the time interval is short for monitoring purposes, there is a linear correlation of 0.79 (p-value=0.03182; CI: [0.11; 0.97]) between the number of new cases in animals and the number of hospitalizations in humans. This is a moderate and positive correlation and indicates that as the number of cases in animals increases, so does the number of hospitalizations in humans due to the disease.

Figure 2 shows the number of cases in animals and the number of hospitalizations and deaths in humans recorded in the municipality of São Paulo in the years 2019, 2020, 2021, and 2022. A progressive increase in the number of new cases in animals and an increase in the number of human hospitalizations can be observed in the years 2021 and 2022. Human deaths due to sporotrichosis occurred only in 2021, which, in turn, concentrated the highest number of hospitalizations for the disease. In 2016, 2017, and 2018 there were no deaths from the disease, which is why this period is not included in the graph, and the number of cases in animals and the number of human hospitalizations are already detailed in Figure 1.

Figure 2 - Number of cases in animals, hospitalizations in humans, and number of deaths in humans recorded in the city of São Paulo, between 2016 and 2022

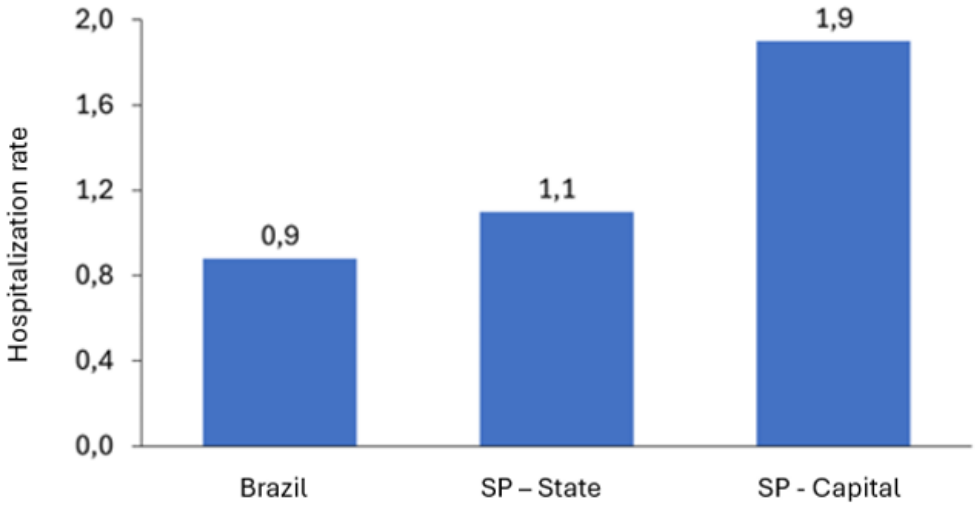


Source: dados da pesquisa.

Figure 3 shows the hospitalization rate for the disease in 2022 in Brazil, in the state of São Paulo, and in the capital city. The hospitalization rate for the disease in the capital of São Paulo was 1.9 cases per 100,000 inhabitants in that year. These values are higher than the hospitalization rate recorded in the state of São Paulo and in the country. Falcão (2018) presents data for Brazil, between 1992 and 2015, and this

rate varied between 0.04 and 0.38 per 1 million inhabitants, and in São Paulo, the rate varied between 0.03 and 0.34 per 1 million inhabitants.

Figure 3 - Hospitalization rate for sporotrichosis in 2022 in Brazil, in the state of São Paulo and in the city of São Paulo. Data obtained from DATASUS, Brazil



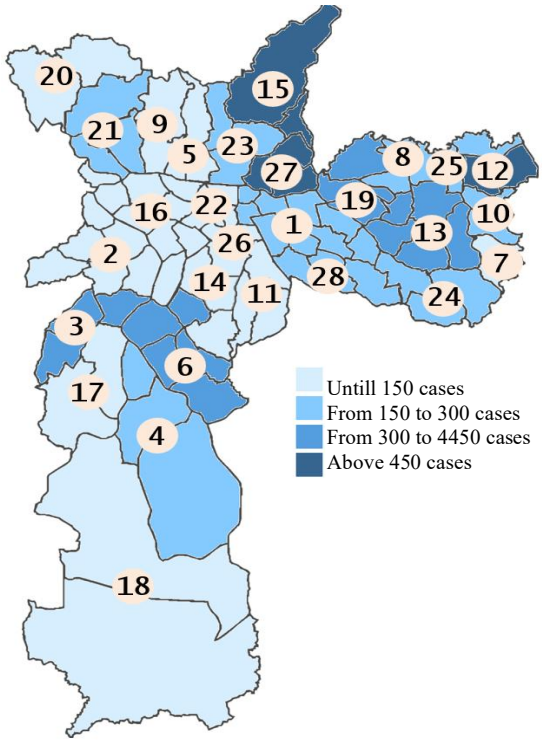
Source: dados da pesquisa.

The fatality rate of the disease in 2021 was 6.6%, while in 2022 the capital city recorded no deaths from the disease. Gold *et al*. (2016), in a study on human sporotrichosis in the United States, found a hospitalization rate of 0.35 per 1 million people and a hospital fatality rate of 3.3%. Falcão (2018) states that in Brazil, despite the limitations of the databases, it can be estimated that the fatality rate is close to 8.3%.

The number of new cases of sporotrichosis in animals in the period between 2016 and 2022 was 5711 cases, with the cases registered in 2021 and 2022 representing 67% of the total cases, which shows the recent advance of the disease.

Figure 4 shows the spatial distribution of the number of new cases in animals in the municipality of São Paulo by UVIS. Between 2016 and 2022, there were 5,711 new cases in animals. The regions of the city of São Paulo that registered the most new cases of the disease are: Vila Maria / Vila Guilherme (908 / 15.90%), Itaim Paulista (596 / 10.44%), Jaçanã / Tremembé (471 / 8.25%). Almeida Maia *et al*. (2023), studying the historical series from 2011 to 2022, highlighted Itaim Paulista with 10.1% (n=869), Vila Maria 8.6% (n=742) and Itaquera 5.1% (n=443) as the districts with the highest frequency, and observed a pattern of disease expansion among the districts with maintenance of intensity in the place of origin.

Figure 4 - Spatial distribution of the number of cases registered in animals in the city of São Paulo, by UVIS (Unit of Veterinary Surveillance), from 2016 to 2022



Region	Number of Cases
1. Aracanduva/ Mooca	215
2. Butantã	65
3. Campo Limpo	322
4. Capela do Socorro	195
5. Casa Verde	38
6. Cidade Ademar	312
7. Cidade Tiradentes	33
8. Ermelino Matarazzo	152
9. Freguesia do Ó/Brasilândia	121
10. Guaianases	177
11. Ipiranga	44
12. Itaim Paulista	596
13. Itaquera	184
14. Jabaquara/Vila Mariana	93
15. Jaçanã/ Tremembé	471
16. Lapa/Pinheiros	43
17. M'Boi Mirim	147
18. Parelheiros	17
19. Penha	301
20. Perus	4
21. Pirituba	202
22. Santa Cecília	128
23. Santana/Tucuruvi	259
24. São Mateus	226
25. São Miguel	166
26. Sé	43
27. Vila Maria/V. Guilherme	908
28. V. Prudente/ Sapopemba	249

Source: research data.

Table 1 – Number of animal cases and average monthly salary for formal employment by region

Region	Nº Cases	Average Monthly Salary for Formal Employment, in R$
Vila Maria/Vila Guilherme	908	3704,73
Itaim Paulista	596	2655,44
Jaçanã/Tremembé	471	2795,25
Itaquera	358	4369,25
Campo Limpo	322	2825,81
Cidade Ademar	312	3947,69
Penha	301	2530,38
Santana/Tucuruvi	259	3165,80
Vila Prudente/Sapopemba	249	3126,49
São Mateus	226	2907,28

Source: research data.

The correlation coefficient between the number of cases in animals and income is 0.15 (p-value=0.6872; 95% CI: [-0.53; 0.71]), considered a weak correlation, and not significant (p>0.05). This indicates that there is no direct relationship between the number of cases in a region and the average monthly family income of the region that comprises the UVIS.Tables: must have explanatory captions, be numbered in sequence, and formatted in portrait orientation. The title should be inserted as close as possible to the beginning of the table.

4 Conclusion

A positive correlation was found between the increase in human hospitalizations and a significant rise in the number of animal cases in the municipality of São Paulo. In contrast, the income factor did not show a positive correlation, which may be due to limiting factors in the design of this study or highlight the potential importance of evaluating the other indicators individually or in combination. Despite underreporting, the presence of human and animal sporotrichosis is a fact. The One Health approach may present itself as an option capable of encompassing such diversity and addressing the challenges inherent to this pathology in Brazil.

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