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Brazilian Spotted Fever Mortality Profile: 2018 to 2022

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Abstract

Background: Spotted Fever (SF) is an acute febrile zoonosis of variable severity that typically occurs in an endemic manner with worldwide distribution. Considering that SF is a disease of significant public health importance, this study aims to identify the mortality profile due to SF in Brazil from 2018 to 2022. **Methods:** Quantitative and descriptive cross-sectional approach. Data were collected from Brazilian Spotted Fever (BSF) cases registered in the Notifiable Diseases Information System (SINAN-DATASUS) across all regions of Brazil. The data collected includes information on the following variables: year of symptom, evolution, sex, race, environment of infection, region of notification, and age group. Subsequently, the data was entered into Microsoft Excel to create tables and graphs. The chi-square test was then applied to statistically analyze the associations between qualitative variables. A modified Poisson regression model with robust variance was constructed to analyze the age group data and determine which categories had different probabilities of death. The results show the estimates obtained for prevalence ratios, as well as their respective confidence intervals and p-values. The statistical software SAS version 9.4 was used to perform the analysis and a significance level of 5% was considered. **Results:** From 2018 to 2022, a total of 1126 cases of BSF were reported. Out of these cases, 59.3% (668) were cured, 32.4% (364) resulted in death, 1.1% (13) died from other causes and 7.2% (81) had no recorded outcome. Regarding the region with the highest death rate, the Southeast region led with 99.45% (362) of cases, followed by the Northeast region with 0.45% (2). As for the age group, the majority (63.7%) fell between the ages of 20 and 59 years old. In terms of race/color, 52.7% of the population identified as white. Regarding the contamination environment, 39.3% were in leisure areas. The outcome of death by BSF showed statistically significant associations

with sex (p-value = 0.03) and age group (p-value = 0.003). **Conclusion:** The profile of deaths from Brazilian Spotted Fever primarily affects individuals from the Southeast region of the country, particularly men, and whites aged 20 years or older being contaminated mainly in leisure environments. This study provides a detailed understanding of the pattern of BSP-related deaths, providing crucial information for public health authorities. These insights provide valuable support for formulating informed policies and effective BSP control and prevention strategies.

Keywords

Brazilian Spotted Fever, Mortality, Communicable Diseases, Disease Notification

1. Introduction

Spotted fever group rickettsiae are important causative agents of (re)emerging tick-borne infectious diseases in humans, and ticks play a key role in their maintenance and transmission [1]. Brazilian Spotted Fever (BSF) is an acute febrile zoonosis of variable severity, which usually develops in an endemic manner with worldwide distribution. It is caused by bacteria from the family Rickettsiaceae, with the main species responsible for the disease being Rickettsia rickettsii, Rickettsia sp. Mata Atlântica strain, and Rickettsia parkeri [2] [3] [4]. It is characterized by acute fever and symptoms similar to other infectious diseases, which can lead to hospitalization and, in more severe cases, death.

Brazilian Spotted Fever (BSF) is a disease transmitted by ticks and is commonly associated with the genus Amblyomma, which also infects wild and farmed animals, including capybaras and horses. Ticks are the primary natural reservoirs of disease-causing bacteria, utilizing vertebrate animals as hosts and, in certain cases, amplifying the spread of the disease. In this cycle, ticks act as vectors, transmitting the bacteria that cause Brazilian Spotted Fever (BSF) to different hosts, including humans. Ticks contaminated with the Rickettsia sp group of bacteria have been identified in metropolitan Barcelona, northern China, and Iran [4] [5] [6].

In Brazil, the disease follows a seasonal pattern, with a higher incidence during the warmer months of the year when tick activity is more intense. Rural areas and regions with a greater presence of wild animals are generally more conducive to disease transmission since ticks find suitable hosts in these environments to complete their life cycle and disseminate the bacteria that cause BSF. Furthermore, the high mortality rate of BSF is accentuated by its neglected status in the country. This is highlighted by the lack of access to parenteral doxycycline, the preferred treatment for severe BSF or Rocky Mountain Spotted Fever (RMSF) cases with symptoms like vomiting or altered mental status [3].

In the country, any suspected case of Spotted Fever must be compulsorily no-

tified to the local health authorities, and an epidemiological investigation must be initiated within 24 hours of notification. This process is crucial for controlling the disease, allowing the identification of cases, the adoption of preventive measures, and the assessment of the risk of transmission in a given area [7].

Considering that BSF is a disease of public health importance, this study aims to identify the mortality profile due to SF in Brazil from 2018 to 2022.

2. Methods

This is a quantitative and descriptive cross-sectional study. Data were collected from BSF cases registered in the Notifiable Diseases Information System (SINAN-DATASUS) in all regions of Brazil, from 2018 to 2022 (data extracted on July 26, 2023).

The data collected includes information on the following variables: year of symptom, evolution, sex, race, environment of infection, region of notification, and age group. Subsequently, the data was entered into Microsoft Excel to create tables and graphs, and then statistically analyzed the chi-square test was applied to assess associations between qualitative variables. A modified Poisson regression model with robust variance was constructed for the age group data to verify which categories differed about the probability of death. The results show the estimates obtained for prevalence ratios, as well as their respective confidence intervals and their respective confidence intervals and p-values. The statistical software SAS version 9.4 was used to perform the analysis and a 5% significance level was considered.

Since the data is secondary, publicly accessible, unrestricted, and without identifying the study participants, the research was exempt from evaluation by the Research Ethics Committee, following the Resolution of the National Health Council No. 510 of April 7, 2016 [8].

3. Results

From 2018 to 2022, 1126 people were reported with BSF, of which 59.3% (668) were cured, 32.4% (364) people died, 1.1% (13) died from other causes and 7.2% (81) had no outcome in the evaluated records. The cases considered in this study were those in which the completion of the evolution was death due to injury or cure.

Regarding the region with the highest death rate, the Southeast region led with 99.45% (362) of cases and the Northeast region 0.45% (2). The two deaths in the Northeast region were female, aged between 20 and 59 years, one was of brown and the other was blank/ignored and the contamination environment was ignored, thus the analytical statistical analysis was performed only with the deaths in the Southeast region. In the other South, North and Midwest regions, no deaths were reported during this period (Table 1).

As for the age group, most were between 20 and 59 years old (63.7%), followed by up to 19 years old (19.6%) and 19% were 60 years old or older. Regarding the race/color variable, 52.7% were white, 27.4% were brown, 11.7% indigenous and

8.2% black. In the statistical analysis, one case of yellow color was excluded, and the items that were as white/ignored in the variables were analyzed.

Regarding the contamination environment, 39.3% were in leisure areas, 31.95% at home, 13.42% at work and 7.02% in others.

The outcome of death by BSF showed statistically significant associations with sex (p-value = 0.03) and age group (p-value = 0.003), but it was not directly associated with race/color (Table 2). Ages between 20 and 59 years and 60 years or more, in addition to males, had a higher proportion of deaths.

Table 1. Brazilian spotted fever deaths according to sociodemographic variables and contamination environment from 2018 to 2022.

Variable	Death from Brazilian Spotted Fever	
	n	%
Sex		
Male	279	76.65
Female	85	23.35
Race/Color		
Yellow	0	0.00
Caucasian	173	47.53
Black	27	7.42
Brown	130	35.71
Indigenous	0	0.00
Ignored	34	9.34
Age group		
Up to 19	69	18.96
20 to 59	229	62.91
60 or more	66	18.13
Contamination environment*		
Home	100	31.95
Work	42	13.42
Leisure	123	39.30
Ignored	26	8.31
Other	22	7.02
Brazil's regions		
West center	0	0.00
Northeast	2	0.55
North	0	0.00
Southwest	362	99.45
South	0	0.00

*Non-Brazilian resident cases excluded.

Table 2. Association between sociodemographic variables and the occurrence of deaths from Brazilian Spotted Fever in the Southeast Region, Brazil from 2018 to 2022.

Variable	Evolution				p-value*	Prevalence ratio**	I.C. 95%		p-value
	Cure		Death due to the reported injury						
	n	%	n	%			L.I.	L.S.	
Sex					0.0300				
Male	246	47.95	267	52.05					
Female	107	57.22	80	42.78					
Race/color					0.3972				
Caucasian	171	50.59	167	49.41					
Black	20	43.48	26	56.52					
Brown	94	51.93	87	48.07					
Indigenous	26	41.27	37	58.73					
Age group					0.0029				
Up to 19	106	61.27	67	38.73		1.00 (ref)			
20 to 59	198	47.94	215	52.06		1.34	1.09	1.66	**0.0055**
60 or more	49	42.98	65	57.02		1.47	1.15	1.88	**0.0021**

*p-value obtained through the Chi-square test; **The probability of presenting the result "death due to the reported injury" was estimated.

4. Discussion

A systematic review that analyzed the etioepidemiological aspects of BSF from 2003 to 2018 showed that mortality rates from the disease are around 40%, similar to data found between 2018 and 2022. This fact may be associated with several factors, including such as the difficulty of diagnosing and establishing appropriate therapy, due to the fact that it is a disease with non-specific symptoms and lack of knowledge of the population about the disease [9].

Furthermore, the quality of filling in information on notifiable diseases needs to be analyzed in greater depth. A study carried out in the state of São Paulo, Brazil, analyzed the quality of the BSF data and identified some weaknesses in filling out the Information System, highlighting the need to improve information collection, better distribution of resources for surveillance, training and health professionals and formulation of health policies [10], a fact also identified in this study in all regions of the country, in which several variables were blank/ignored, making it difficult to reliably analyze reported cases.

A study carried out from 2014 to 2019 in Mexico with 129 patients who died due to Rocky Mountain Spotted Fever (RMSF) did not identify a difference between genders, diverging from the research, which identified a higher proportion of deaths in males [11]. In Brazil, other studies that evaluated the epidemi-

ological profile of RMSF identified a higher incidence of involvement in males [12]. This data may be related to the greater contact of this public with the vector, as work activities in peri-urban and rural regions are predominantly occupied by male workers, a reason corroborated by a study carried out in the United States [13]. In addition, studies show that men tend to postpone the search for health services, mainly due to gender issues that involve masculinity, as well as the restricted hours of Primary Care services that overlap with work hours, leading to the search for care only when the disease is already advanced [14] [15].

The higher proportion of reported cases among white people is predominant in other reviews on the subject, but the reason still needs to be deepened, since the white population is not predominant in Brazil [16]. One of the possible reasons raised by Oliveira *et al.* [17] was the difficulty in identifying maculopapular rash in people with black skin, but considering that this clinical manifestation primarily occurs mainly in the palmar and plantar regions, generally lighter in black people, this hypothesis still needs proof. Another reason to be considered, already been studied by other authors [18], is related to the completion of race/color data in health questionnaires, when professionals define the answer to this question by hetero-identification, that is, not considering or not asking for the patient's self-declaration [19], evidencing institutional racism in health services [20].

It's necessary to draw attention to the particulars of the data referring to the black population and the indigenous population, in addition to the statistics referring to the white population. The black population is currently considered black and brown, therefore, when evaluating the combined data, the black population also represents a high rate of involvement by BSF. Several authors have studied racial inequalities in health, and it has been proven that institutional racism is a social determinant that exposes the black population to more vulnerable situations, such as illness and death. Thus, data from the black population should also be evaluated from the point of view of access to health equipment and geographic distribution, as the mortality rate in this population was high in the analyzed period [21] [22] [23]. Furthermore, this lens is also important to be applied in the analysis of data from indigenous population, since it is a population in social vulnerability in terms of access to health equipment, in addition to inhabiting, for the most part, rural, forested and peri-urban areas, being more susceptible to contamination by BSF [24].

A study carried out from 2014 to 2019 in Mexico with 129 patients who died due to RMSF identified that patients over 20 years of age had a higher mortality rate than those under 20 years [11], a fact also found in this study. Other studies have also shown that the number of deaths is higher in the age group of 40 years or older in the case of the RMSF, also described in the BSF data evaluated in the study. In addition to age, other risk factors are associated with deaths from the disease, such as glucose-6-dehydrogenase deficiency, diabetes and alcoholism

which are generally more prevalent in the elderly population [25] [26] [27].

Regarding the environments of contamination, it is worth highlighting the urbanization of the BSF, which can be explained by the proximity of residences to forest areas due to the disorderly growth of urban areas, directly affecting the natural habitat of wild animals and increasing the risk of contact with ticks [12]. In addition, there is a greater demand for the practice of ecotourism, exploration of forest areas and construction of houses in risk areas [28]. The COVID-19 pandemic has changed people's interests and activities, with outdoor settings, gatherings, restaurants, and natural areas becoming increasingly popular in Brazil. Following times of solitude, there is a need for social connections, outdoor activities, and outdoor meals, as well as increased engagement with nature through visits to parks and trails. Health safety awareness is still critical in this recovery setting, reflecting a culture that values relationships, well-being, and harmony.

The prevention of BSF mainly consists of avoiding contact with the tick, being essential to guide the population through educational activities that address the clinical characteristics, seasonality of the disease, vector cycle, search for immediate care and forms of prevention when exposing oneself in areas with the possibility of the presence of ticks [29]. In addition, the training of health professionals, especially in the health services in Primary Care, in the context of the Unified Health System (SUS), is essential for the identification of suspected cases and the immediate and early treatment of these cases, without the need to wait for laboratory results to confirm the disease.

As limitations of the study, the use of a national database in the public domain has several variables that were not filled in and were considered ignored and/or blank, and the data from 2020 to 2022 from Espírito Santo State, located in the Southeast region of Brazil, were not available in this system, as they come from another e-SUS VS Information System, which can impact the statistical analysis. Overcoming these difficulties requires a joint effort that involves continuous training, standardization, simplification of the systems' interface, awareness of the importance of accurate data, and commitment to invest time for proper completion. These actions are essential for health information systems to fulfill their crucial role in improving the quality of care and evidence-based decision-making.

5. Conclusion

The profile of deaths from BSF affects mostly people from the Southeast region of the country, primarily white men aged 20 years or older being contaminated mainly in leisure environments. This study provides a detailed understanding of the pattern of BSP-related deaths, providing crucial information for public health authorities. These insights provide valuable support for formulating informed policies and effective BSP control and prevention strategies.

Compulsory notification of suspected cases of BSF and conducting epidemiological investigations are crucial measures for controlling the disease and main-

taining epidemiological surveillance in the country. Early identification by health professionals will enable the proper administration of treatment, helping to minimize the impact on patient's health and reduce both morbidity and mortality associated with the disease.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Guo, W.P., Wang, Y.H., Lu, Q., Xu, G., Luo, Y., Ni, X. and Zhou, E.M. (2019) Molecular Detection of Spotted Fever Group Rickettsiae in Hard Ticks, Northern China. *Transboundary and Emerging Diseases*, **66**, 1587-1596. https://doi.org/10.1111/tbed.13184

[2] Ribeiro, C.M., da Costa, V.M., de Carvalho, J.L.B., Mendes, R.G., Bastos, P.A.S., Katagiri, S. and Amaku, M. (2020) Brazilian Spotted Fever: A Spatial Analysis of Human Cases and Vectors in the State of São Paulo, Brazil. *Zoonoses and Public Health*, **67**, 629-636. https://doi.org/10.1111/zph.12742

[3] de Oliveira, S.V., Willemann, M.C.A., Gazeta, G.S., Angerami, R.N. and Gurgel-Gonçalves, R. (2017) Predictive Factors for Fatal Tick-Borne Spotted Fever in Brazil. *Zoonoses and Public Health*, **64**, e44-e50. https://doi.org/10.1111/zph.12345

[4] Costa, F.B., Gerardi, M., Binder, L.C., Benatti, H.R., Serpa, M.C.A., Lopes, B., Luz, H.R., Ferraz, K.M.P.M.B. and Labruna, M.B. (2020) *Rickettsia rickettsii* (Rickettsiales: Rickettsiaceae) Infecting *Amblyomma sculptum* (Acari: Ixodidae) Ticks and Capybaras in a Brazilian Spotted Fever-Endemic Area of Brazil. *Journal of Medical Entomology*, **57**, 308-311. https://doi.org/10.1093/jme/tjz141

[5] Castillo-Contreras, R., Magen, L., Birtles, R., Varela-Castro, L., Hall, J.L., Conejero, C., Aguilar, X.F., Colom-Cadena, A., Lavín, S., Mentaberre, G. and López-Olvera, J.R. (2022) Ticks on Wild Boar in the Metropolitan Area of Barcelona (Spain) Are Infected with Spotted Fever Group Rickettsiae. *Transboundary and Emerging Diseases*, **69**, e82-e95. https://doi.org/10.1111/tbed.14268

[6] Hosseini-Chegeni, A., Tavakoli, M., Telmadarraiy, Z. and Faghihi, F. (2020) Molecular Detection of Spotted Fever Group Rickettsia (Rickettsiales: Rickettsiaceae) in Ticks of Iran. *Archives of Razi Institute*, **75**, 317-325.

[7] Brasil Ministério da Saúde (2014) Portaria no 1.271, de 6 de junho de 2014. Define a Lista Nacional de Notificação Compulsória de doenças, agravos e eventos de saúde pública nos serviços de saúde públicos e privados em todo o território nacional, nos termos do anexo, e dá outras providências. Diário Oficial da União, Brasília (DF). https://pesquisa.in.gov.br/imprensa/jsp/visualiza/index.jsp?jornal=1&pagina=67&data=09/06/2014

[8] Brasil Ministério da Saúde (2016) Conselho Nacional de Saúde. Resolução no 510, de 7 de abril de 2016. Trata sobre as diretrizes e normas regulamentadoras de pesquisa em ciências humanas e sociais. Diário Oficial da União, Brasília, DF, 24 maio 2016.

[9] Zanchetta e Gava, M., Ribeiro Braga, F. and Langoni, H. (2022) Aspectos Etioepidemiológicos da Febre Maculosa Brasileira: Revisão Sistemática. *Veterinária E Zootecnia*, **29**, 1-20. https://doi.org/10.35172/rvz.2022.v29.652

[10] Xavier, D.R., Albuquerque, M.P., Sousa-Carmo, S.V.T. and Pinter, A. (2023) Evalu-

ation of Completeness and Timeliness of Data in the National Information System for Notifiable Diseases for Spotted Fever in the State of São Paulo, Brazil, 2007-2017. *Epidemiologia e servicos de saude*, **32**, e2022416. https://doi.org/10.1590/s2237-96222023000200011

[11] Jaramillo-Ramírez, H.J., Hernández-Ríos, J.J., Martínez-González, F.M., Gutiérrez-Bañales, L.A., García-Valenzuela, E.R., Beltrán-López, J.A., Peterson, J.L., Yocupicio, F.M. and Ruíz-Luján, R. (2020) Prognostic Factors in Patients with Rocky Mountain Spotted Fever. *International Journal of Medical Students*, **8**, 107-110. https://doi.org/10.5195/ijms.2020.459

[12] Rodrigues, C.M., Geise, L., Gazeta, G.S. and de Oliveira, S.V. (2023) Estudo descritivo de casos notificados de febre maculosa em São Paulo, Rio de Janeiro e Minas Gerais entre 2007 e 2016. *Cadernos Saúde Coletiva*, **31**, e31020104. https://doi.org/10.1590/1414-462x202331020104

[13] Dahlgren, F.S., Mandel, E.J., Krebs, J.W., Massung, R.F. and McQuiston, J.H. (2011) Increasing Incidence of *Ehrlichia chaffeensis* and *Anaplasma phagocytophilum* in the United States, 2000-2007. *The American Journal of Tropical Medicine and Hygiene*, **85**, 124-131. https://doi.org/10.4269/ajtmh.2011.10-0613

[14] da Silva, P.H.G., de Santana, V.C.L., dos Santos Pessoa, R.G. and da Silva, A.I.F. (2023) The Evaluation of Male Resistance in Seeking Health Services. *Research, Society and Development*, **12**, e19912340356. https://doi.org/10.33448/rsd-v12i3.40356

[15] Cobo, B., Cruz, C. and Dick, P.C. (2021) Desigualdades de gênero e raciais no acesso e uso dos serviços de atenção primária à saúde no Brasil. *Ciência & Saúde Coletiva*, **26**, 4021-4032. https://doi.org/10.1590/1413-81232021269.05732021

[16] Brasil Instituto Brasileiro de Geografia e Estatística (IBGE) Cor ou raça. https://educa.ibge.gov.br/jovens/conheca-o-brasil/populacao/18319-cor-ou-raca.html

[17] de Oliveira, S.V., de Caldas, E.P., Colombo, S., Gazeta, G.S., Labruna, M.B., dos Santos, F.C.P. and Angerami, R.N. (2016) A Fatal Case of Brazilian Spotted Fever in a Non-Endemic Area in Brazil: The Importance of Having Health Professionals Who Understand the Disease and Its Areas of Transmission. *Revista Da Sociedade Brasileira De Medicina Tropical*, **49**, 653-655. https://doi.org/10.1590/0037-8682-0088-2016

[18] Geraldo, R.M., de Oliveira, J.C., Alexandre, L.S.C., de Aguiar, M.R.A., Vieira, A.F.S. and Germani, A.C.C.G. (2022) Preenchimento do quesito raça/cor na identificação dos pacientes: Aspectos da implementação em um hospital universitário. *Ciência & Saúde Coletiva*, **27**, 3871-3880. https://doi.org/10.1590/1413-812320222710.08822022en

[19] Grandi, J., Dias, M.T.G. and Glimm, S. (2013) Percepções daqueles que perguntam: Qual a sua cor? *Saúde Em Debate*, **37**, 588-596. https://doi.org/10.1590/S0103-11042013000400006

[20] Werneck, J. (2016) Racismo institucional e saúde da população negra. *Saúde E Sociedade*, **25**, 535-549. https://doi.org/10.1590/s0104-129020162610

[21] Goes, E.F., de Oliveira Ramos, D. and Ferreira, A.J.F. (2020) Desigualdades raciais em saúde e a pandemia da COVID-19. *Trabalho, Educação E Saúde*, **18**, e00278110. https://doi.org/10.1590/1981-7746-sol00278

[22] dos Santos, F.B. and da Silva, S.L.B. (2022) Gênero, raça e classe no Brasil: Os efeitos do racismo estrutural e institucional na vida da população negra durante a pandemia da COVID-19. *Revista Direito E Práxis*, **13**, 1847-1873. https://doi.org/10.1590/2179-8966/2022/68967

[23] de Souza Santos, D., de Souza Monezi, N., Castelaneli, I.K.M. and de Gouveia Vilela, M.F. (2021) Social Determinants and Reflections for the Nursing Practice in Times of COVID-19. *Revista Latino-Americana De Enfermagem*, **29**, e3443. https://doi.org/10.1590/1518-8345.4907.3443

[24] de Souza, G.A.S.C., de Matos Ferreira, A., Monteiro, J.C. and Orfão, N.H. (2021) Diseases, Grievances, and Public Health Notification Events: Result of Treatment among Indigenous Children. *Research, Society and Development*, **10**, e28810817501. https://doi.org/10.33448/rsd-v10i8.17501

[25] de Araújo, R.P., de Albuquerque Navarro, M.B.M. and de Oliveira Cardoso, T.A. (2016) Febre maculosa no Brasil: Estudo da mortalidade para a vigilância epidemiológica. *Cadernos Saúde Coletiva*, **24**, 339-346. https://doi.org/10.1590/1414-462x201600030094

[26] Del Fiol, F.S., Junqueira, F.M., Rocha, M.C.P., Toledo, M.I. and Barberato Filho, S. (2010) A Febre Maculosa no Brasil. *Revista Panamericana de Salud Pública*, **27**, 461-466. https://doi.org/10.1590/S1020-49892010000600008

[27] Díaz, J.S. and Cataño, J.C. (2010) Fiebre manchada de las montañas rocosas: Ni tan manchada ni tan montañosa como pensábamos. *Infectio*, **14**, 264-276. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0123-93922010000400 005&lng=en&tlng=es https://doi.org/10.1016/S0123-9392(10)70120-X

[28] Galbiati de Senzi, C., de Souza Freitas, V.C., Moraes Guimarães, N., de Oliveira, R.O., Rodrigues Frias, D.F. and Ahad das Neves, D. (2022) Febre maculosa: Uma análise epidemiológica no Brasil. *Saúde Coletiva* (*Barueri*), **12**, 11073-11084. https://doi.org/10.36489/saudecoletiva.2022v12i79p11073-11084

[29] Brasil Ministério da Saúde (2023) Secretaria de Vigilância e Ambiente. NOTA TÉCNICA No. 75/2023-CGZV/DEDT/SVSA/MS. Orientações da Vigilância Epidemiológica do Ministério da Saúde as Secretarias Estaduais de Saúde para o período de sazonalidade da febre maculosa no Brasil e dá outros encaminhamentos. Diário Oficial da União, Brasília (DF). https://www.gov.br/saude/pt-br/assuntos/saude-de-a-a-z/f/febre-maculosa/publicac oes/nota-tecnica-no-752023-cgzv-dedt-svsa-ms/view