Spatial analysis and epidemiological profile of deaths by covid-19 in the paraíba valley

Análise espacial e perfil epidemiológico de ocorrências de óbitos por covid-19 no vale do paraíba

Análisis espacial y perfil epidemiológico de muertes por covid-19 en el valle del paraíba

RESUMO
Objetivo: Analisar e descrever o perfil epidemiológico e a tendência da distribuição espacial de ocorrência de óbitos por COVID-19, nos primeiros 18 meses de pandemia na região do Vale do Paraíba – São Paulo/ Brasil. Método: Trata-se de um estudo epidemiológico, descritivo do tipo ecológico e de base populacional, cujo grupo de variáveis elencadas incluem dados secundários sobre a ocorrência de óbitos por COVID-19. Os dados são provenientes da plataforma Fundação Sistema Estadual de Análise dos Dados, que alimenta as fichas de notificação de Síndrome Respiratória Aguda Grave, cujos casos evoluíram para óbito. Resultado: A taxa de óbitos por população nos mostrou aproximadamente o percentual da população que faleceu por COVID-19 nos últimos 3 semestres. Conclusão: De forma similar ao cenário mundial, a infecção por COVID-19 configura-se como um problema de saúde pública, sendo necessária atenção à circulação do vírus no interior paulista, alerta aos grupos de risco e intervenções sanitárias efetivas.
DESCRITORES: Distribuição Espacial; Óbitos; Infecções por Coronavírus; Estudos Ecológicos; Epidemiologia descritiva.

ABSTRACT
Objective: To analyze and describe the epidemiological profile and trend of the spatial distribution of deaths from COVID-19 in the first 18 months of the pandemic in the region of Vale do Paraíba – São Paulo/Brazil. Method: This is an epidemiological, descriptive, population-based, ecological study, whose group of variables listed include secondary data on the occurrence of deaths from COVID-19. The data come from the Foundation State System for Data Analysis platform, which feeds the notification forms for Severe Acute Respiratory Syndrome, whose cases progressed to death. Result: The death rate per population showed us approximately the percentage of the population that died from COVID-19 in the last 3 semesters. Conclusion: Similar to the world scenario, infection by COVID-19 is a public health problem, requiring attention to the circulation of the virus in the interior of São Paulo, alerting risk groups and effective health interventions.
DESCRIPTORS: Spatial Distribution; Deaths; Coronavirus Infections; Ecological Studies; Descriptive epidemiology

RESUMEN
Objetivo: Analizar y describir el perfil epidemiológico y la tendencia de la distribución espacial de las muertes por COVID-19 en los primeros 18 meses de la pandemia en la región de Vale do Paraíba - São Paulo / Brasil. Método: Se trata de un estudio epidemiológico, descriptivo, poblacional, ecológico, cuyo grupo de variables enumeradas incluye datos secundarios sobre la ocurrencia de muertes por COVID-19. Los datos provienen de la plataforma Foundation State System for Data Analysis, que alimenta los formularios de notificación del Síndrome Respiratorio Agudo Severo, cuyos casos progresaron hasta la muerte. Resultado: La tasa de mortalidad por población nos mostró aproximadamente el porcentaje de la población que murió por COVID-19 en los últimos 3 semestres. Conclusión: Similar al escenario mundial, la infección por COVID-19 es un problema de salud pública, que requiere atención a la circulación del virus en el interior de São Paulo, alertando a los grupos de riesgo e intervenciones de salud efectivas.
DESCRIPTORES: Distribución espacial; Fallecidos; Infecciones por coronavirus; Estudios ecológicos; Epidemiología descriptiva.

Amanda Medeiros Ribeiro
Nurse, graduated from Escola Superior de Cruzeiro - ESC. Cruise - Sao Paulo. Brazil.
ORCID: https://orcid.org/0000-0002-7582-2645

Elaine Viana Cabral
Master in Health Sciences and Environment Teaching - Volta Redonda University Center - UniFOA - Volta Redonda - Rio de Janeiro. Professor of the Undergraduate Nursing Course at Escola Superior de Cruzeiro - ESC - Cruzeiro - São Paulo. Brazil.
ORCID:0000-0003-3088-4831

artigo

Ribeiro, A. M., Cabral, E. V., Moura, K. M. B., Carmo, H. O., Oliveira, F. F.
Spatial analysis and epidemiological profile of deaths by covid-19 in the paraíba valley

Katia Margareth Bitton de Moura
Mestre em Engenharia Biomédica - Universidade do Vale do Paraíba – UNIVAP - São José dos Campos - São Paulo. Docente do Curso de Graduação em Enfermagem da Escola Superior de Cruzeiro - ESC - Cruzeiro - São Paulo. Brasil.
ORCID:0000-0002-6222-8786

Hércules de Oliveira Carmo
Mestre em Saúde e Tecnologia Hospitalar - Universidade Federal do Estado do Rio de Janeiro - UNIRIO - Rio de Janeiro. Docente do Curso de Graduação em Enfermagem da Escola Superior de Cruzeiro - ESC - Cruzeiro - São Paulo. Brasil.
ORCID: 0000-0002-6996-4233

Fabiano Fernandes de Oliveira
Mestre em Enfermagem – Universidade Estadual Paulista "Júlio de Mesquita Filho". UNESP - Botucatu - São Paulo. Docente do Curso de Graduação em Enfermagem da Escola Superior de Cruzeiro - ESC - Cruzeiro - São Paulo. Brasil.
ORCID:0000-0001-6768-4257

INTRODUCTION

Currently, we are experiencing a situation of health complexity, caused by the emergence of a variable determined by the SARS-CoV-2 coronavirus, in the same subgenus as the Severe Acute Respiratory Syndrome (SARS) virus. The SARS-Cov-2 variable was identified on December 1, 2019, through bronchial lavage samples performed in patients with pneumonia of unknown origin, in Wuhan, Hubei Province, People's Republic of China. From there, the disease spread worldwide, and on March 11, 2020, the World Health Organization (WHO) declared the outbreak a pandemic. [1]

As of February 2, 2021, according to the World Health Organization, there were 102.1 million reported cases of the new coronavirus and more than 2.2 million deaths since the beginning of the pandemic. [2]

The International Committee on Taxonomy of Viruses (ICTV) designated this virus as SARS-CoV-2 and the disease as COVID-19. [3]

We know that the period in which the individual with COVID-19 can transmit the disease is still unclear. [4] However, it has already been observed that the highest viral loads were presented in the first days of infection. In addition, they were also identified in greater numbers in the nasal cavity than in the oral cavity. The viral potential in asymptomatic patients was also found to be very similar to symptomatic patients, indicating that potential transmission may occur from both asymptomatic and minimally symptomatic patients. [5,6]

It was also noted that the vast majority of patients present symptoms of a mild flu-like syndrome, such as sudden-onset fever, even if referred, accompanied by cough or sore throat or respiratory difficulty, in addition to at least one of the following factors: headache , myalgia or arthralgia. [7]

In this sense, we understand that the incidence of this virus revealed the complexity of the epidemiological picture of the health of the Brazilian population and brought together problems of great diversity at the level of determinants and at the level of intervention, imposing enormous challenges for the health system. [8]

Furthermore, in Brazil, the planning of health actions is often not based on the health-disease profile of the population, which opens space for the action of Epidemiology. [9]

As for the space chosen for data analysis, it is worth noting that, according to history, the lands of Vale do Paraíba were cleared at the time of discovery, encouraged by the gold route, the creation of sugar cane mills and the introduction of coffee culture, passing to the predominance of extensive pastures and culminating in the current scenario of forest expansion (eucalyptus) and urban-industrial consolidation. [10]

In this context, it is justified to carry out the research presented here, whose focus is on spatial analysis to identify the epidemiological profile of occurrences of deaths by COVID-19, in Vale do Paraíba - SP. This study seeks to understand comorbidities, gender, age group and number of deaths, in order to guide the population and frontline health professionals in the fight against the disease.

In this perspective, with the present study, the objective was to analyze and describe the epidemiological profile and the trend of the spatial distribution of deaths by COVID-19, in the first 18 months of the pandemic, in the region of Vale do Paraíba - SP/Brazil. In addition to identifying the areas with the highest frequency of notification of deaths by municipality.

METHOD

This is an epidemiological, descriptive, ecological and population-based study [11], whose groups of variables listed include the occurrence of reported deaths from coronavirus.

Due to this historical context, it is understood that spatial analysis is considered a methodology used in the field of public health, especially to assist in monitoring the environment and in strategies for health services. Recently, with the pandemic situation, the spatial analysis tool allows identifying areas of greater spread of the disease, to adapt public health policies to be adopted. [11]

The data collected and the sample were obtained from the cases of deaths confirmed by coronavirus, notified and released on the Fundação Sistema Estadual de Análise dos Dados – SEADE platform, which

artigo

Ribeiro, A. M., Cabral, E. V., Moura, K. M. B., Carmo, H. O., Oliveira, F. F.
Spatial analysis and epidemiological profile of deaths by covid-19 in the paraíba valley

has as its power source the Severe Acute Respiratory Syndrome notification forms, which evolved to death, as well as the notifications of Influenza Syndrome positive for COVID-19, being, the unit of analysis, the region of Vale do Paraíba, in the interior of the state of São Paulo/ Brazil. [12]

The population object of the study consisted of individuals residing in that region, considering its distribution among the 36 municipalities in the Vale do Paraíba that had positive diagnoses of COVID-19 and died. The cases reported in the period from January 2020 to June 2021 were primarily observed, for a total of 18 months.

As for the number of inhabitants per municipality, the website of the Brazilian Institute of Geography and Statistics (IBGE) was consulted to obtain the epidemiological profile of the cases of reported deaths. [13]

The variables from the notification/conclusion sheet (age, sex, race/color, city of residence, final classification (confirmed) and comorbidities) and pre-existing diseases were also added and included. Notifications with incomplete data, not finalized and with duplicate data in more than one municipality were excluded from the study.

Data were summarized in electronic spreadsheets, analyzed and later arranged in tables, according to descriptive statistical analysis with the aid of Microsoft Office Excel 2016 software. Then, the georeferencing technique of specific cases by reference municipality was applied.

This study was approved by the Research Ethics Committee (CEP) of Centro Universitário Teresa D'Ávila – UNIFATEA – through Plataforma Brasil. It obtained opinion number 4,752,457 and the Certificate of Presentation of Ethical Assessment (CAAE) 45546221.6.0000.5431, respecting the principles of resolution 510/2016 of the National Commission on Ethics and Research involving human beings. It is worth mentioning that the Free and Informed Consent Term (ICF) was waived, as it is a research with secondary sources.

RESULTS

In order to elucidate the results of our study, it is worth pointing out the municipalities that make up part of the first sub-region: São José dos Campos, Caçapava, Igaratá, Jacareí, Jambeiro, Monteiro Lobato, Paraibuna and Santa Branca; the municipalities that are part of the second sub-region are: Campos do Jordão, Lagoinha, Natividade da Serra, Pindamonhangaba, Santo Antônio do Pinhal, São Bento do Sapucaí, São Luiz do Paraitinga, Taubaté, Tremembé and Redenção da Serra. As for the third sub-region, there are the municipalities of Aparecida, Cachoeira Paulista, Canas, Cunha, Guaratinguetá, Lorena, Piquete, Potim and Roseira. To the fourth sub-region belong the cities of Arapeí, Areias, Bananal, Cruzeiro, Lavrinhas, São José do Barreiro and Silveiras. The fifth region, which was not included in this study, is composed of the municipalities on the North Coast: Caraguatatuba, Ilhabela, São Sebastião and Ubatuba.

The epidemiological surveillance group (ESG) of São José dos Campos is responsible for the municipalities of sub-region 1, while the ESG of Taubaté is responsible for the municipalities of sub-regions 2, 3 and 4. There is also a subgroup (ESSG) in Guaratinguetá in charge of coordinating the Epidemiological Surveillance of the municipalities of the Historic Valley, as shown in Figure 1 below:

In the Vale do Paraíba region, the regional headquarters affected in greater proportion with cases of COVID-19 were one and four, represented by the São José dos Campos and Taubaté Region, a sub-region of the Historic Valley. The most affected city in the region was the municipality of Igaratá, a small town with a population of 9,583 inhabitants. It is a tourist city rich in resorts that receives tourists throughout the year.

In order to calculate the standard deviation of the death rate per case, the value of the municipality of São Luís do Paraitinga was excluded, since it is estimated that this

Figure 1: Geographical and spatial distribution of the Epidemiological Surveillance Groups in the Vale do Paraíba region – São Paulo - Brazil. 2021.

Source: EMPLASA, 2018. Elaboração: Geo Brasilis, 2018.

artigo

Ribeiro, A. M., Cabral, E. V., Moura, K. M. B., Carmo, H. O., Oliveira, F. F.
Spatial analysis and epidemiological profile of deaths by covid-19 in the paraíba valley

value was three times above the calculated standard deviation, when it was included in the analysis.

The overall mean of cases per population of the municipalities was 5.09% (8.13% ~2.05%). The municipalities with the highest rate of cases per population were: Igaratá with 18%, Roseira with 10.8%, São José dos Campos with 9.3% and Bananal with 8.2%. The cities with the lowest number of cases per population were the municipalities of São Luiz do Paraitinga with 0.4% and, at the lower limit, Natividade da Serra with 0.2%.

Regarding the percentages of deaths per case, the general average obtained was 2.48% (1.53%~3.40%). The municipalities that had the highest rate of deaths from causes were: São Luiz do Paraitinga with 26.53%, Igaratá with 14.05%, Piquete with 3.74%, Paraibuna with 3.46% and Aparecida with 3.44%. On the other hand, the municipalities that had the lowest rate of deaths per case were: Bananal with 0.22%, Areias with 0.42%, Tremembé with 0.59%, Cunha with 1.04%, Roseira with 0.85% , Redenção da Serra with 1.13%, Lagoinha with 1.18%, Cruzeiro with 1.5%, Cachoeira Paulista with 1.53% and, at the limit of our standard deviation, the municipality of São José do Barreiro with 1.57%.

Evaluating the death rate per population, in which the general average obtained was 0.09% (0.03%~0.15%), we observed that the municipalities that presented the highest rates were: Guaratinguetá with 0.15%, Santa Branca and Campos do Jordão with 0.16%, São José dos Campos and Roseira with 0.18%, Caçapava with 0.19%, Paraibuna and Aparecida with 0.20%, Jacareí with 0.21% and Igaratá with 0 .27%. Conversely, the municipalities that had the lowest death rate per population were the municipalities of: Tremembé, Areias and Bananal with 0.02% and Redenção da Serra and Cunha with 0.03%. What appears to be common among these municipalities is that, in all cases, the prevalence of deaths was among male individuals.

In the criterion of deaths per 100,000 inhabitants, our average was 110.36 deaths/100,000 inhabitants (46.59~174.14).

The municipalities that had the highest rate of deaths per 100,000 inhabitants were: Aparecida with 201.74 and Roseira with 185.17 deaths/100,000 inhabitants.

It is worth emphasizing the importance of endorsing non-pharmacological measures, in order to reduce the number of people with the disease. It is important to emphasize that a good part of the infected population was in the economically active range, [19]**which reinforces the adoption of socioeconomic measures against the new coronavirus (SARS-CoV-2).**

Obtaining the lowest rates were the municipalities of: Tremembé with 25.15, Areias with 25.67, Bananal with 18.4, Redenção da Serra with 26.05, Cunha with 32.00, La-

goinha with 40.91 and Natividade da Serra with 45.17 deaths/100,000 inhabitants.

The municipalities of Cunha, Areias, Tremembé, Redenção da Serra and Bananal drew attention for being outside our standard deviation in three criteria: deaths per case, deaths/population and deaths per 100,000 inhabitants. These values below the average showed the low rate of notification in these municipalities.

The municipality of Igaratá is above the rates in all criteria, with a rate of 18% cases/population, as it presented: 18971.09 cases/100,000 h, 14.05% deaths/cases, 0.27% deaths/population and 271.31 deaths/100,000 h. These high values showed us that the public health measures adopted in the municipality have not yet reflected in the number of cases and deaths. A similar situation occurred in the municipalities of São José dos Campos and Roseira, where only the percentage of deaths per case is not above average.

In the municipality of São Luiz do Paraitinga, the death rate per case is 26.5%, the highest until May 2021, which led us to think about the possibility that the rate is high due to underreporting of cases of flu syndrome . In that municipality, the number of cases in the second quarter of 2021 was equivalent to the number of cases in all pandemic quarters.

In the municipality of Tremembé, the death rate per case is 0.59%, which is far below the general average. This allowed us to think about the underreporting of deaths and the failure to close the notification of severe acute respiratory syndrome in the system. This failure can be circumvented through adequate training of the employees who supply the system. The same occurred in the municipality of Cunha.

In the municipality of Arapeí, there were two notifications in the age group from 70 to 79 years, however, there was no information about the comorbidities, which leads us to think that perhaps they were not filled in correctly. This intercurrence showed us once again the need to reinforce training in filling out the forms in hospital care and in feeding the system.

Regarding the second wave of the virus,

the increase in case notifications in the first quarter of 2021 was evident. This increase was not seen in the municipalities of São Bento do Sapucaí, São Luiz do Paraitinga and Redenção da Serra, as shown below.

Analyzing the graph above, we can see the curve of the increase in cases over the third quarter of 2020. This curve shows the first wave of cases, followed by a decrease, in the fourth half of the same year, and a new rise in the first quarter of 2021, characterizing the second wave of COVID-19 in Vale do Paraíba – São Paulo/Brazil.

DISCUSSION

With regard to the high incidence of cases in the Vale Histórico sub-region, such facts may be related to the ease of transmissibility of the disease in the regional headquarters due to the large flow of individuals in places of agglomeration, such as bus terminals, which offer mobility to nearby regions, such as surrounding cities, and also connection with other states.

This region is known as Fundo do Vale and is responsible for converging three large states of the Southeast region: São Paulo, Minas Gerais and Rio de Janeiro. Due to this strategic location, transfers in nearby cities are very large, which means that contact between potentially contaminated individuals can occur indiscriminately.
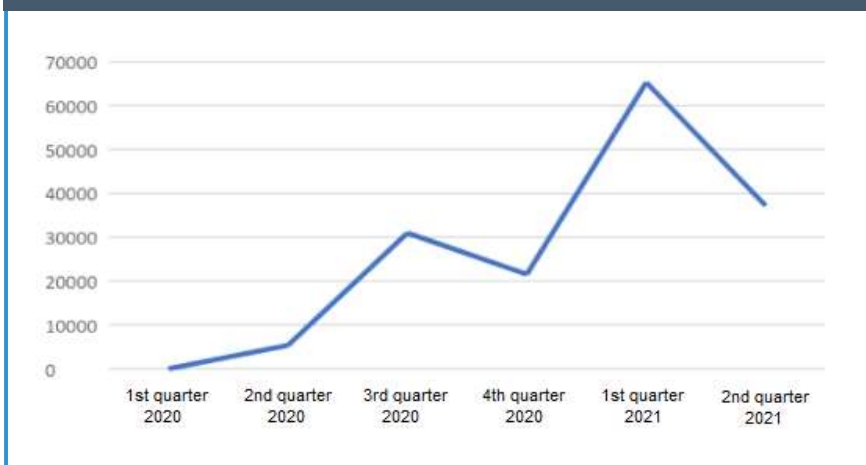
Considering the outcomes of COVID-19 cases and the increasing number of cases of the disease, which causes greater demand for health services in all regions, it is clear that there was an increase in the number of beds. In particular, the number of beds for intensive care exclusively for the treatment of COVID-19 was significant, according to Ordinance No. 568 of the Ministry of Health, of March 26, 2020, (14) through which vacancies for hospitalizations have already been made available throughout the Vale do Paraíba region. At times when the bed occupancy rate was close to 100%, the municipality of Cruzeiro, for example, expanded its number of beds from 10 to 16 and then to 28 beds. In addition, field hospitals were opened across the country, including the Vale do Paraíba

Figure 2: Spatial Distribution of New COVID-19 Cases for every 100,000,000 Inhabitants. Vale do Paraíba – São Paulo – Brazil, from January 2020 to June 2021.
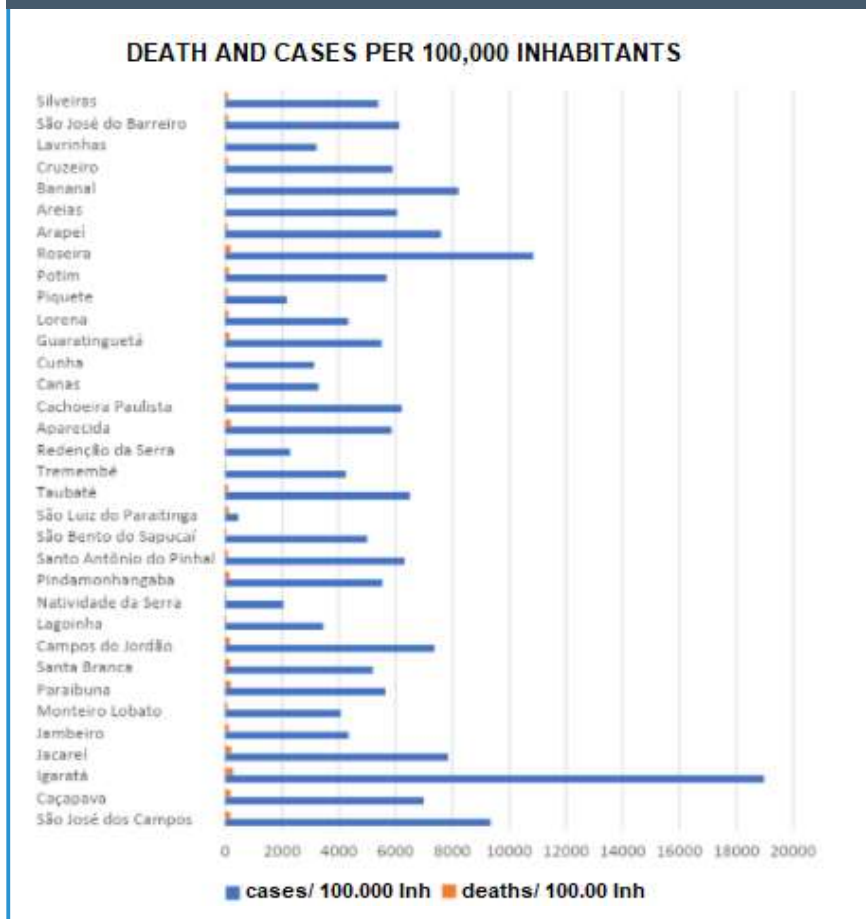
Source: SEADE,2021

Figure 3: Distribution of the number of confirmed cases of COVID-19 deaths in the Vale do Paraíba region- São Paulo- Brazil, 2020/2021.

Source: SEADE,2021

artigo

Ribeiro, A. M., Cabral, E. V., Moura, K. M. B., Carmo, H. O., Oliveira, F. F.
Spatial analysis and epidemiological profile of deaths by covid-19 in the paraíba valley

region.

Regarding the analysis of the sex of individuals diagnosed with the disease, there is a predominance of male cases. This finding was also observed in a study carried out in the state of Mato Grosso, [15] in which 56% of the cases were male.

In this scenario, it is assumed that women seek health services more frequently than men. Possibly, due to this, there may be underreporting of cases in the male population, since, historically, men seek health services less, which can lead to aggravation of the disease, late treatment and evolution to death.

Regarding the age group, there was a predominance of cases of patients between 70 and 79 years of age. These findings are similar to those found in a study [16] carried out in Wenzhou, China, which presented 58.9% of confirmed cases in individuals in this age group. With regard to deaths, the predominant age group of patients was 60 years or older.

Historically, data on general mortality in the Vale do Paraíba region show a predominance of cases of patients in the age group from 9 to 19 years of age and of deaths related to diseases of the circulatory system. [17] These diseases can entail morbidity of vital/target organs such as kidneys, lungs and immune system. In the recent scenario of a pandemic, among these diseases, many affect people who die due to their association with the infection caused by the new coronavirus (SARS-CoV-2).

In view of this, one can infer the importance of care aimed at the elderly population. This care must occur through the application of protective public measures that reinforce the need for social and health assistance.

This fact raises concerns about the health care available, since early diagnosis is an important mechanism for detecting new cases. This diagnosis strengthens health surveillance for decision-making in the investigation, confirmation and disposal of cases.[18]

It is worth emphasizing the importance of endorsing non-pharmacological measures, in order to reduce the number of people with the disease. It is important to emphasize that a good part of the infected population was in the economically active range, [19] which reinforces the adoption of socioeconomic measures against the new coronavirus (SARS-CoV-2).

Among the comorbidities related to deaths recorded by COVID-19, there was a higher occurrence of chronic diseases of the cardiovascular and immune system. Chronic non-communicable diseases, such as diabetes, cardiovascular diseases and others, maximize the risks related to clinical complications, which makes affected patients more vulnerable. [20-21]

The limitations of the study are related to the constant updating of the data being processed, which shows that the transmission dynamics occurs in a mutable way.

In this sense, it is necessary to continue the epidemiological studies to assess the longitudinal age of the pandemic, as well as the constant changes in the epidemiological and social scenarios in the Vale do Paraíba region.

CONCLUSION

In a similar way to the world scenario, the infection by COVID-19, in the state of São Paulo, is configured as a public health problem, requiring attention to the circulation of the virus in the interior of São Paulo, alert to risk groups and effective health interventions. As for the reported cases, the information evaluated was consistent with the expected profile and showed the similarity of other regions of Brazil.

Regarding underreporting, it was found that it occurs in most municipalities through the analysis of the number of inhabitants and the number of notifications. These underreporting prevent a real dimension of the number of cases in the Valley, in addition to interfering in the study of the comorbidities that most lead to death in the population of the Vale do Paraíba region.

It is also concluded that the epidemiological profile of COVID-19 in Vale do Paraíba is constituted by the elderly aged between 70 and 79 years, male, carrier of circulatory system comorbidity and resident of the Vale do Paraíba sub-region, with emphasis on the higher frequency of notification of deaths by COVID-19 for the municipalities of São José dos Campos and Guaratinguetá that are part of the sub-region 1 and 4. Recognizing this profile allows us, as health agents, to take more effective measures in the care of patients with these characteristics.

In view of this, we understand that public health measures are aimed at the prevention, monitoring and control of cases, which gives rise to the need for investments in new health technologies and innovation to respond to contemporary needs.

REFERENCES

1.Peeri NC, Shrestha N, Rahman S, Zaki R, Tan Z, Bibi S, et. Al. A SARS, MERS e a nova epidemia de coronavírus (COVID-19), as novas e maiores ameaças globais: quais lições aprendemos? Int J Epidemiol [Internet]. 2020 Feb [cited 2020 Nov 3].49(3):717-26. Available from: https://doi.org/10.1093/ije/dyaa033

2.Atualização Epidemiológica Semanal da OMS – 2 fevereiro de 2021. Available from: https://www.who.int/publications/m/item/weekly-epidemiological-update---2-february-2021

3.Palú IA. A VIROLOGIA DO SARS-COV-2: Entendendo a importância da estrutura do vírus causador da nova doença por coronavírus (COVID-19). Connectionline n.25 – 2021.

4.Wu Y, Chen C, Chan Y. O surto de COVID-19: uma visão geral. J Chinese Med Assoc. 2020 Nov. 3. 217-20. [Internet]. Available from: https://doi.org/10.1097/JCMA.0000000000000270

5.McIntosh K, Hirsch M, Bloom A. Doença de coronavírus

artigo

Ribeiro, A. M., Cabral, E. V., Moura, K. M. B., Carmo, H. O., Oliveira, F. F.
Spatial analysis and epidemiological profile of deaths by covid-19 in the paraíba valley

REFERENCES

2019 (COVID-19). Fev/2020. [Internet]. Available from: http://www2.ebserh.gov.br/documents/1688403/5111980/4.pdf/49227786-d768-470e-9ea2-7e021aa96cc9

6.Pan Y, Zhang D, Yang P, et. Al. Cargas virais de SARS-CoV-2 em amostras clínicas. Lancet Infect Dis. 2020 abril/2020. 411–412. [Internet]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7128099/

7.Brasil. Protocolo de Manejo clínico do novo Coronavírus (COVID-19) na atenção primária à saúde. Secretaria de Atenção Primária à Saúde. Brasília/DF. Abril/2020. [Internet]. Available from: https://saude.rs.gov.br/upload/arquivos/202004/14140606-4-ms-protocolomanejo-aps-ver07abril.pdf

8.Silva MBB. Prioridades, conquistas e desafios na gestão de uma comissão da Associação Brasileira de Saúde Coletiva. Relato de experiência. Saúde debate 43. 13 Jul 2020. [Internet]. Available from: https://scielosp.org/article/sdeb/2019.v43nspe7/222-234/

9.D'Avila, OP et al. Utilização dos Serviços de Saúde e Estratégia Saúde da Família Cobertura da População Domiciliar no Brasil. Ciência & Saúde Coletiva [online]. 2021, v. 26, n. 09 [Acessado 14 Outubro 2021] , pp. 3955-3964. Disponível em: <https://doi.org/10.1590/1413-81232021269.11782021>. Epub 27 Set 2021. ISSN 1678-4561. https://doi.org/10.1590/1413-81232021269.11782021

10.Devide ACP. História Ambiental do Vale do Paraíba. Seropédica. Universidade Federal Rural do Rio de Janeiro. Maio/2013. [Internet]. Available from: https://orgprints.org/24815/1/HISTORIA_AMBIENTAL_VALE_DO_PARAIBA.pdf

11.Merchán-Hamann, E e Tauil, PL. Proposta de classificação dos diferentes tipos de estudos epidemiológicos descritivos. Epidemiologia e Serviços de Saúde [online]. 2021, v. 30, n. 1 [Acessado 14 Outubro 2021] , e2018126. Disponível em: <https://doi.org/10.1590/s1679-49742021000100026>. Epub 28 Abr 2021. ISSN 2237-9622. https://doi.org/10.1590/s1679-49742021000100026

12.Boletim Completo. SP Contra o Coronavírus. [Acesso: 23/05/2021]. https://www.seade.gov.br/coronavirus/

13.Instituto Brasileiro de Geografia e Estatística – IBGE- 2021 Disponível em: https://cidades.ibge.gov.br/brasil/pb/panorama. Citado em 12 de out de 2021

14.Brasil. Ministério da Saúde. Diário Oficial da União. Portaria 568, de 26 de março de 2020.

15.Rezer F, Faustino WR, Maia CS. Incidence of COVID-19 in the mesoregions of the state of Mato Grosso: confirmed and notified cases. Rev Pre Infec e Saúde [Internet]. 2020 Jan [cited 2020 Mar 28]; 6(2020): 10317. Available from: http://www.ojs.ufpi.br/index.php/nupcis/article/view/10317

16.Yi H, Yi L, Liyuan Z, Enguo C, Pengyuan L, Xiaoqing P, et al. Epidemiological Assessment of Imported Coronavirus Disease 2019 (COVID-19) Cases in the Most Affected City Outside of Hubei Province, Wenzhou, China. JAMA Network Open [Internet]. 2020 Jan [cited 220 Mar 20]; 3(4):1–12. Available from: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2764905

17.Lana RM, Coelho FC, Gomes MFC, Cruz OG, Bastos LS, Villela DAM et al. The novel coronavirus (SARS-CoV-2) emergency and the role of timely and effective national health surveillance. Cad Saúde Pública [Internet]. 2020 Mar [cited 2020 Apr 23]; 36(3):1–12. Available from: https://doi.org/10.1590/0102-311x00019620

18.Vincent J, Marion K, Neeltje VD, Debby VR, Emmie W. A Novel Coronavirus Emerging in China — Key Questions for Impact Assessment. Engl J Med [Internet]. 2020 May [cited 2020 Apr 28]; 382:692–694. Available from: https://www.nejm.org/doi/full/10.1056/NEJMp2000929

19.Oliveira AL, Bastos RL, Bonfada D, et al. Vivência integrada na comunidade: Experiências de uma escola médica durante a pandemia da COVID-19. E-livro. 1ª edição. Porto Alegre.2021.

20.Ministério da Saúde (BR). Departamento de Informática do Sistema Único de Saúde. Sistema de Informação de Mortalidade. Brasília: MS; 2020. Available from: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sim/cnv/obt10ma.def

21.Felismino Chagas LK, Albuquerque Soares de Camargo LM, Brito Soares LT, Ferreira Lemos L, Carvalho Dias ME, Araújo Costa R. Distribuição espacial da COVID-19 no estado da Paraíba: uma associação com a densidade demográfica. SaudColetiv (Barueri) [Internet]. 29° de setembro de 2020 [citado 18° de dezembro de 2021];10(56):3336-51. Disponível em: http://revistas.mpmcomunicacao.com.br/index.php/saudecoletiva/article/view/916