Cogitare Enfermagem

ORIGINAL ARTICLE

MAGNITUDE AND SEVERITY OF COVID-19 AMONG NURSING PROFESSIONALS IN BRAZIL

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ABSTRACT

Objective: to evaluate the trend, magnitude and severity of COVID-19 in Nursing professionals according to the Brazilian states and macro-regions.

Methods: an ecological study of time series and with a spatial approach. Cases and deaths were surveyed from 03/20/2020 to 05/31/2020, made available by the Nursing Observatory of the Federal Nursing Council.

Results: a total of 6,149 cases and 138 deaths due to COVID-19 were reported among Nursing professionals; a trend of progressive growth of cases and deaths was observed in all macro-regions. A high risk cluster for the occurrence of the disease was identified among professionals in the Amazonas, and another for mortality in the states of Pará and Amapá. Conclusion: the study showed growing trends and areas of risk by COVID-19, observing a different profile across the regions, which is due to the measures adopted in the institutions to protect their Nursing workers.

DESCRIPTORS: COVID-19; Coronavirus; Nursing; Incidence, Death.

HOW TO REFERENCE THIS ARTICLE:

Alves LS, Ramos ACV, Crispim J de A, Martoreli Júnior JF, Santos MS dos, Berra TZ, *et al.* Magnitude and severity of covid-19 among nursing professionals in Brazil. Cogitare enferm. [Internet]. 2020 [accessed "insert day, monh and year"]; 25. Available from: http://dx.doi.org/10.5380/ce.v25i0.74537.

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dx.doi.org/10.5380/ce.v25i0.74537 Cogitare enferm. 25: e74537, 2020

MAGNITUDE E SEVERIDADE DA COVID-19 ENTRE PROFISSIONAIS DE ENFERMAGEM NO BRASIL

RESUMO
Objetivo: avaliar a tendência, magnitude e severidade da COVID-19 em profissionais de enfermagem segundo os estados brasileiros e macrorregiões.
Métodos: estudo ecológico de séries temporais e abordagem espacial. Foram levantados os casos e óbitos, no período de 20/03/2020 a 31/05/2020, disponibilizados pelo Observatório de Enfermagem do Conselho Federal de Enfermagem.
Resultados: foram notificados 6149 casos e 138 óbitos de COVID-19 entre profissionais de enfermagem; observou-se tendência de crescimento progressivo de casos e mortes em todas as macrorregiões. Foi identificado um aglomerado de alto risco para ocorrência da doença entre profissionais no Amazonas, e um para mortalidade nos estados do Pará e Amapá.
Conclusão: o estudo evidenciou tendências crescentes e áreas de risco por COVID-19, observando-se perfil diferenciado entre as regiões, o que se deve às medidas adotadas nas instituições para proteção dos seus trabalhadores.

DESCRITORES: COVID-19; Corona vírus; Enfermagem; Incidência, Morte.

MAGNITUD Y GRAVEDAD DEL COVID-19 ENTRE PROFESIONAIS DE ENFERMERÍA EN BRASIL

RESUMEN:
Objetivo: evaluar la tendencia, magnitud y gravedad del COVID-19 en profesionales de Enfermería de acuerdo con los estados y las macro-regiones de Brasil.
Métodos: estudio ecológico de series temporales y con enfoque espacial. Se relevaron los casos y los fallecimientos durante el período del 20/03/2020 al 31/05/2020, puestos a disposición por el Observatorio de Enfermería del Consejo Federal de Enfermería.
Resultados: se notificaron 6149 casos y 138 fallecimientos por COVID-19 entre profesionales de Enfermería; se observó una tendencia de aumento progresivo de casos y fallecimientos en todas las macro-regiones. Se identificó una región de concentración de alto riesgo de incidencia de la enfermedad entre los profesionales en el Amazonas, así como también de mortalidad en los estados de Pará y Amapá. Conclusión: el estudio puso en evidencia tendencias de aumento y áreas de riesgo por COVID-19, observándose un perfil diferenciado entre las regiones, lo que se debe a las medidas adoptadas en las instituciones para proteger a sus trabajadores de Enfermería.

DESCRIPTORES: COVID-19; Coronavirus; Enfermería; Incidencia, Fallecimiento.

INTRODUCTION

The World Health Organization (WHO) has published the State of the world's nursing 2020 report, in partnership with the International Council of Nurses (ICN), and the Nursing Now Campaign, highlighting the challenges and value of the Nursing workforce globally[1]. Adjacent to the appreciation of work and commemoration of the international year of the Nursing and Midwifery professionals, we face the most serious pandemic of an infectious disease caused by the new coronavirus: Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).

COVID-19 is a fatal disease and represents the most important public health problem in the past 100 years. On the world stage, authorities, surveillance agencies, and scientific and civil societies are mobilizing to face the pandemic, which clearly involves on the front line the health professionals who work in the care of critically ill patients affected by COVID-19. Nurses provide care directly to the patients in close physical proximity and, as such, they are usually exposed directly to this virus and are at high risk of developing the disease[2-4].

In the world, there are approximately 28 million Nursing professionals and a shortage of almost 6 million is estimated, with 5.3 million of this deficit concentrated in mid- and low-income countries[5-7]. With the advance of the pandemic, the contamination and illness of health professionals has been a reality and a concern for all countries.

In Italy, nearly 20% of the health professionals were infected, with 26 deaths among nurses[8]; in Spain, 13% of the cases were confirmed in health professionals, with reports of deaths among nurses[9]; in China, 3,000 professionals were infected and 22 deaths were reported[10]. Brazil has been listed as one of the countries with the highest number of health professionals affected by the disease.

The understanding of perceived risk to the health of the professionals during pandemics has been explored in the literature[11]; concerned with the issue and considering that Nursing makes up the largest workforce in Brazil [12], the Federal Nursing Council (*Conselho Federal de Enfermagem*, Cofen) created a Nursing Observatory, with the prerogative of keeping society informed about the health situation of Nursing professionals affected by COVID-19.

In the scientific literature, there was no study that proposed to analyze the situation of COVID-19 among health professionals with the application of spatial analysis techniques and time series, which is relevant to give consistency and amplitude to the object under study.

From the above, the article aimed to assess the trend, magnitude and severity of COVID-19 among Nursing professionals in Brazil, showing disparities between the macro-regions and areas at risk for incidence and deaths from this disease.

METHOD

An ecological study[13], with application of time series and spatial analysis, with cluster diagnosis, carried out in Brazil, considering as units of ecological analysis the five macro-regions (North, Northeast, Midwest, South, and Southeast), the 26 states, and the Federal District.

Brazil has a total of 2,321,509 Nursing professionals, of which 421,581 are nursing assistants, 1,330,447 nursing technicians, 569,189 nurses and 292 midwives[14].

The new cases and deaths due to COVID-19 in Nursing professionals selected were

those registered at the Nursing Observatory, an electronic portal developed by the Crisis Management Committee of the Federal Nursing Council (Cofen). The objective of this Observatory is to put society in contact with the epidemiological reality experienced by Nursing professionals. For data collection, the period from March 20th to May 31st, 2020 was considered, with collection carried out on June 2nd and 3rd, 2020.

The data from the Nursing Observatory is filled daily with information regarding the states, age group, gender and case situation (quarantine, hospitalization, death) by the Information and Communication Technology Directorate (*Diretoria de Tecnologia da Informação e Comunicação*, DTIC) following the WHO recommendations. The population data of the Nursing professionals in the country were collected on the *Enfermagem em Números* (Nursing in Numbers) electronic portal of the Cofen.

In the collection process, diagnosed cases were considered those that were in the following categories: confirmation of COVID-19 in quarantined, hospitalized, deceased and discharged individuals. For the deaths, the confirmed diagnosis category of deceased COVID-19 was adopted.

An exploratory analysis of the incidence and mortality rates due to COVID-19 among Nursing professionals in the time series and spatial analysis was performed using the Gi* statistical technique.

Time series is the set of observations on a variable of interest, ordered in time, and recorded in regular periods. The basic assumption that guides the time series analysis is that there is a more or less constant causal system, related to time, that has influenced the data in the past and can continue to do so in the future[15].

For time series analyses, the daily incidence and mortality rates due to COVID-19 were considered according to Brazil as a country and to the five macro-regions. To calculate the incidence, the number of Nursing professionals diagnosed with COVID-19 per day was considered as numerator and, as denominator, the total number of Nursing professionals (according to Brazil as a country and to the macro-regions) with a multiplication factor per 100,000 inhabitants. For the calculation of mortality, the numerator was the number of daily deaths due to COVID-19, with the total number of Nursing professionals in the denominator, with a multiplication factor per 100,000 inhabitants.

Time series of incidence and mortality due to COVID-19 were constructed for Brazil as a country and for the macro-regions for weeks (seven full days), considering the cases and deaths records from April to May 2020 and, subsequently, the method of Seasonal decomposition of time series by Loess (STL) was used. This method of decomposition (breaking) is based on a locally weighted regression (Loess), a method used to estimate non-linear relationships, decomposing (breaking) a time series into three parts: trend, seasonality, and noise[15–17].

From the components of the time series, the trend to characterize the behavior of the incidence and mortality of COVID-19 over time was selected, and graphs were constructed according to the macro-regions.

The time series analysis and the construction of trend graphs were performed using the R Studio® statistical software, version 3.5.2.

For the spatial analyses, proportional maps with five categories were constructed, in which the larger the circle represented, the greater the incidence or mortality in the state. In order to measure the distance radius for Gi* application, the tool provided by the Arcgis® (10.5) software called Incremental Spatial Autocorrelation (ISA) was used, tested for 30 distances[18,19].

The analysis of Getis-Ord General G - G (d) consists of a global index to evaluate the spatial association of an attribute based on statistical distances and calculated from a sum of values for a given distance, according to the formula below[20]:

$$G(d) = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}(d)x_i x_j}{\sum_{i=1}^{n}\sum_{j=1}^{n} x_i x_j} \text{ , } j \text{ not equal to } i$$

Where n corresponds to the number of areas; W_{ij} to the value in the proximity matrix for region i with region j as a function of distance (d); and x_i and x_j are the values of the attributes considered in areas i and j.

The value of G(d) is provided by a Z score ranging from +3 to -3 determining whether the attributes with high or low values are spatially grouped, the higher the value of the Z score, the more extreme the grouping of the region called Hostspot (hot areas), while a lower Z score value predicts the grouping of low values, called Coldspots (cold or protection areas) and values equal to 0 indicate no grouping.

In addition, the Z score reflects statistical significance, where +/- 3 has a 99% confidence level[21,22].

For all the tests, the type I error was set at 5% as statistically significant ($p<0.05$).

According to Resolution No. 510, of April 7th, 2016, approved by the National Health Council, as the research used public access or public domain information, with aggregated data, without individual identification, it was not registered or evaluated by the Research Ethics Committee system of the National Council for Research Ethics (*Conselho Nacional de Ética em Pesquisa*, CONEP).

RESULTS

A total of 6,149 cases and 138 deaths due to COVID-19 were notified among Nursing professionals in the period under study. Table 1 shows the descriptive statistics of the cases according to the professional category.

Table 1 – Number of professionals diagnosed with COVID-19 by professional category, and their respective incidence rates, Brazil, 2020 (continues)

State	NURSE		TECHNICIAN		ASSISTANT		MIDWIFE		NOT INFORMED
	NO.*	INC.**	NO.*	INC.**	NO.*	INC.**	NO.*	INC.**	NO.*
AC	11	455.86	23	444.02	11	1848.74	0	0.00	0
AL	16	209.21	28	187.15	2	39.61	0	0.00	0
AM	10	87.75	38	113.14	1	30.98	0	0.00	0
AP	22	886.38	72	707.96	8	870.51	0	0.00	0
BA	239	621.73	592	718.59	41	315.31	2	66666.67	6
EC	81	352.30	180	420.28	8	63.86	0	0.00	0
FD	17	108.83	41	114.99	5	164.37	0	0.00	0
ES	47	504.35	186	626.26	17	442.82	0	0.00	0
GO	26	160.16	42	106.15	2	41.34	0	0.00	0

MA	45	315.75	69	180.74	6	149.37	0	0.00	0
MG	49	96.60	21	17.40	11	55.15	0	0.00	1
MS	2	29.97	2	14.50	1	32.19	0	0.00	0
MT	18	188.17	14	76.90	10	403.06	0	0.00	1
PA	69	502.11	102	188.01	12	148.44	0	0.00	0
PB	55	398.46	76	314.95	8	230.68	0	0.00	0
PE	146	557.70	216	308.58	17	128.65	3	***	0
PI	44	400.00	60	283.21	40	676.93	0	0.00	0
PR	0	0.00	0	0.00	0	0.00	0	0.00	0
RJ	324	576.50	613	333.94	81	167.00	0	0.00	409
RN	7	74.52	44	195.84	1	17.80	0	0.00	98
RO	3	69.64	12	112.94	9	324.68	0	0.00	52
RR	6	359.71	34	599.12	21	1561.34	0	0.00	64
RS	26	96.69	53	58.47	51	442.59	0	0.00	68
SC	25	160.57	29	69.69	0	0.00	1	100000.00	124
SE	7	113.03	20	167.45	0	0.00	0	0.00	64
SP	280	199.85	481	209.31	0	0.00	2	716.85	258
TO	7	128.87	3	25.04	0	0.00	0	0.00	0

Source: Cofen's Nursing Observatory, 2020.
* Number of cases diagnosed by professional category from March 20th, 2020, to May 31st, 2020.
** Incidence.
*** On the Cofen website, it is stated that the state of Pernambuco does not have a registered obstetric nurse, so the calculation was impossible.

Table 2 shows the COVID-19 cases that evolved to death by professional category according to the Brazilian states.

Table 2 – COVID-19 cases that evolved to death according to the professional category and its respective mortality rate, Brazil, 2020 (continues)

State	NURSES	TECHNICIANS	ASSISTANTS	TOTAL MORTALITY RATE
	MORT. RATE	MORT. RATE	MORT. RATE	
AC	41.44	1.93	0.00	24.43
AL	0.00	0.00	19.81	3.62
AM	8.78	1.49	123.92	20.74
AP	241.74	5.90	108.81	95.79
BA	2.60	0.12	7.69	2.24
EC	8.70	0.93	15.96	10.21

FD	12.80	0.00	0.00	3.68
ES	0.00	0.00	0.00	0.00
GO	0.00	0.25	0.00	1.65
MA	7.02	0.26	24.89	5.31
MG	0.00	0.17	0.00	1.05
MS	0.00	0.00	0.00	0.00
MT	10.45	0.00	40.31	6.61
PA	36.38	0.37	0.00	9.20
PB	7.24	1.24	0.00	9.66
PE	11.46	0.86	22.70	10.97
PI	0.00	0.00	0.00	0.00
PR	0.00	0.17	0.00	0.94
RJ	14.23	1.09	6.19	10.75
RN	0.00	0.45	0.00	2.67
RO	0.00	1.88	36.08	16.94
RR	0.00	0.00	0.00	0.00
RS	0.00	0.11	0.00	0.77
SC	0.00	0.72	0.00	4.78
SE	0.00	0.00	0.00	0.00
SP	5.00	0.57	3.37	4.67
TO	0.00	0.00	0.00	0.00

Source: Cofen's Nursing Observatory, 2020.

Figure 1 shows the time trend of the COVID-19 incidence rates of among Nursing professionals in Brazil and in the five macro-regions. In the country, the time trend of the incidence showed an increasing behavior between the second and eighth week (03/20/2020 to 05/14/2020) and, later, it presented a decreasing behavior at the end of the series (end of May).

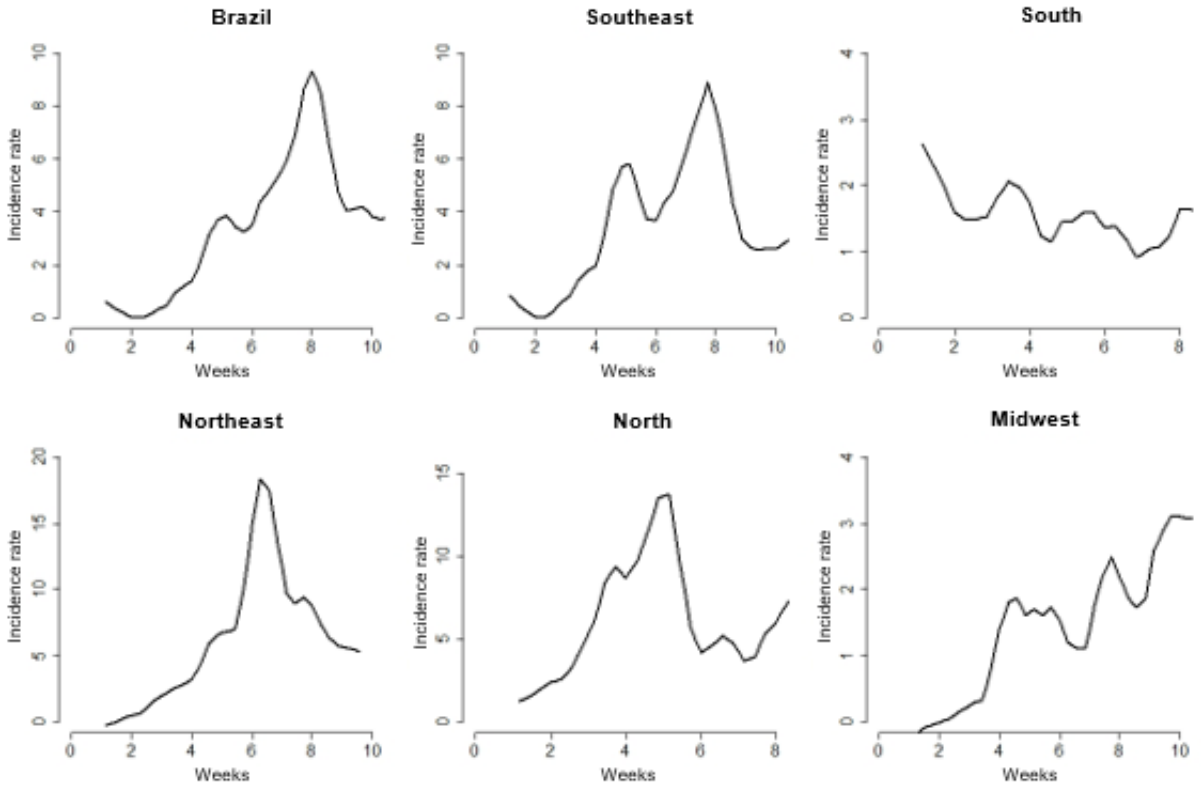

Figure 1 – Trend of the COVID-19 incidence among Nursing professionals according to the Brazilian macro-regions, Brazil, 2020

The Southeast region showed an increasing trend from the second week to the end of the seventh week (03/20/2020 to 05/07/2020) and, around the eighth week, it presents a decreasing behavior of the incidence, with a slight growth at the end of the period (05/25/2020 to 05/31/2020).

The South and Midwest regions show an increasing trend in the incidence of COVID-19 at the end of the time series, with emphasis on the Midwest region, which showed an increasing trend throughout the period.

The Northeast region showed an increasing trend from the first week to approximately the sixth week (04/02/2020 to 05/11/2020) ending the series with a decreasing trend. The North region presented the highest incidence values between the first and fifth weeks of the time series (04/09/2020 to 05/07/2020), ending the series with an increasing behavior.

Regarding deaths by COVID-19 among nursing professionals (Figure 2), Brazil and all the macro-regions showed an increasing behavior of the mortality rate due to the disease in the last weeks of the study period.

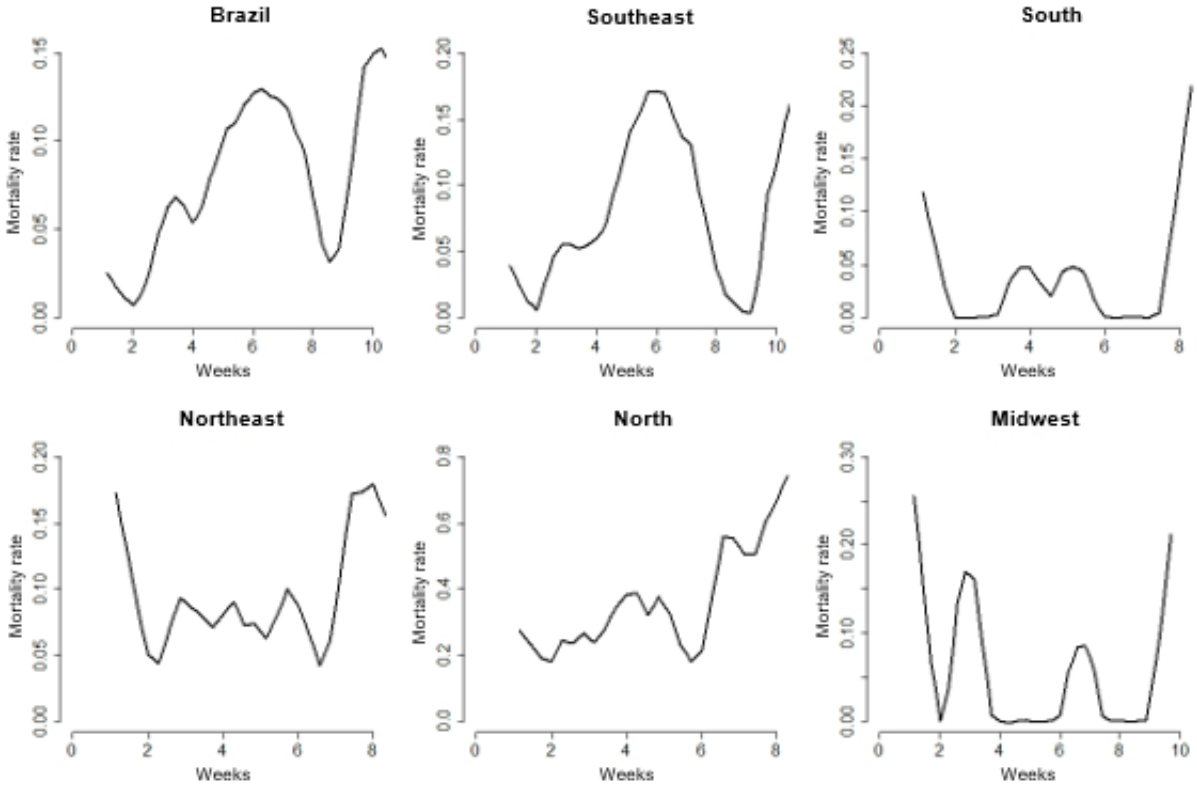

Figure 2 – Trend of the COVID-19 mortality rates among Nursing professionals according to the Brazilian macro-regions, Brazil, 2020

In Brazil and in the Southeast region, the time series between the first and approximately the sixth weeks (03/20/2020 to 04/28/2020) presented an increasing behavior, decreasing until the end of the eighth and ninth weeks, and ending the series with an increasing behavior, with the highest mortality rates seen at the end of the period (end of May).

The North and Northeast regions showed some fluctuations in the trend during the time series; however, they ended the last weeks with an increasing behavior, with the highest mortality rates at the end of the series. The South and Midwest regions also showed fluctuations in the trend during the time series, but ended the period with an increasing behavior of mortality.

Figure 3 shows the proportional spatial distribution of the incidence and mortality of the Nursing professionals by state. Roraima presented the highest national incidence for COVID-19 with 1,197 cases/100,000 inhabitants, Followed by the state of Amapá with 751 cases/100,000 inhabitants and by Bahia in third place, with 657 cases/100,000 inhabitants.

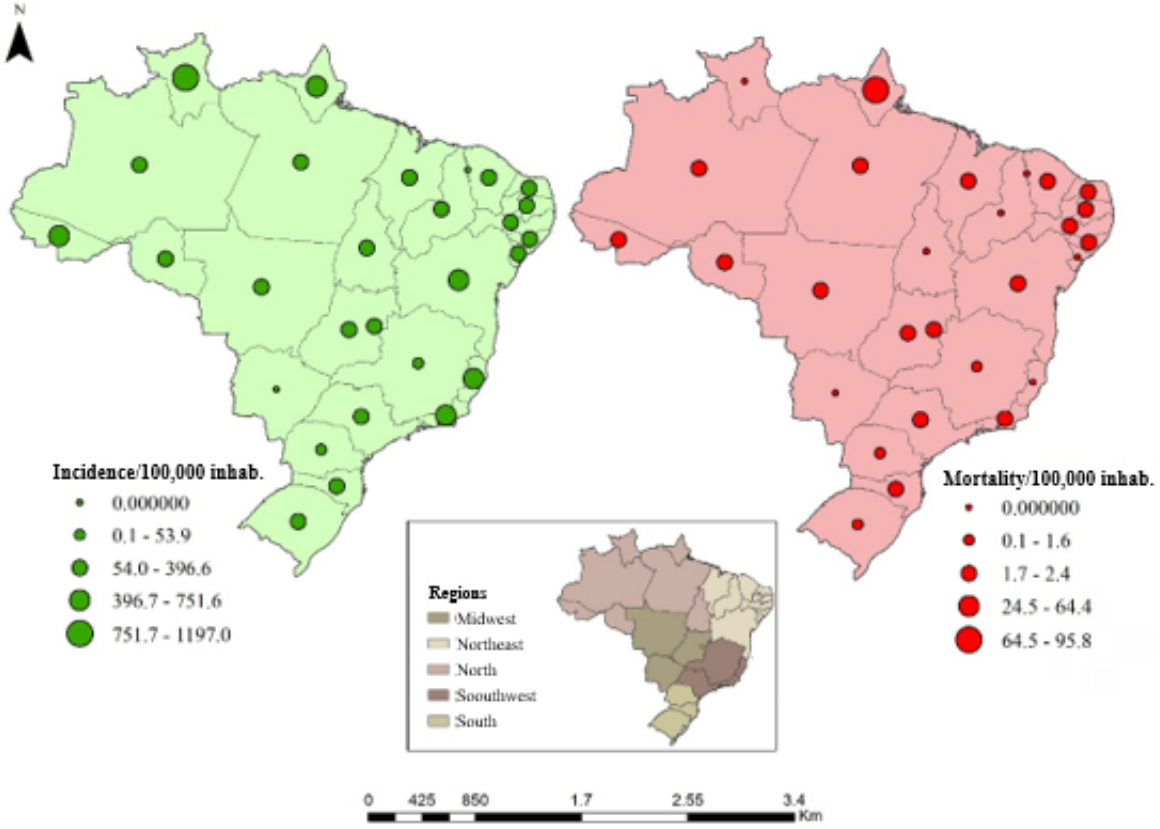

Figure 3 – Proportional spatial distribution of incidence and mortality due to COVID-19 among Nursing professionals according to the states, Brazil, 2020

Regarding the mortality rate due to COVID-19 among Nursing professionals, Amapá presented a rate of 95.7 deaths/100,000 inhabitants; Acre had 24.4 deaths/100,000 inhabitants; and Amazonas 20.7 deaths/100,000 inhabitants. It is observed that both rates, incidence and mortality, are higher in the states of the North region of the country.

In the GI* analysis, the most pronounced value of the distance radius in the ISA tool was 8,500 km and $p<0.05$, with a cluster of spatial risk for incidence in the state of Amazonas, with a 95% confidence level, and the protection cluster in Mato Grosso do Sul, where there was no notification of COVID-19 cases among Nursing professionals. As for the risk cluster for mortality, occurrence is verified in the states of Pará and Amapá, with a 99% confidence level (Figure 4).

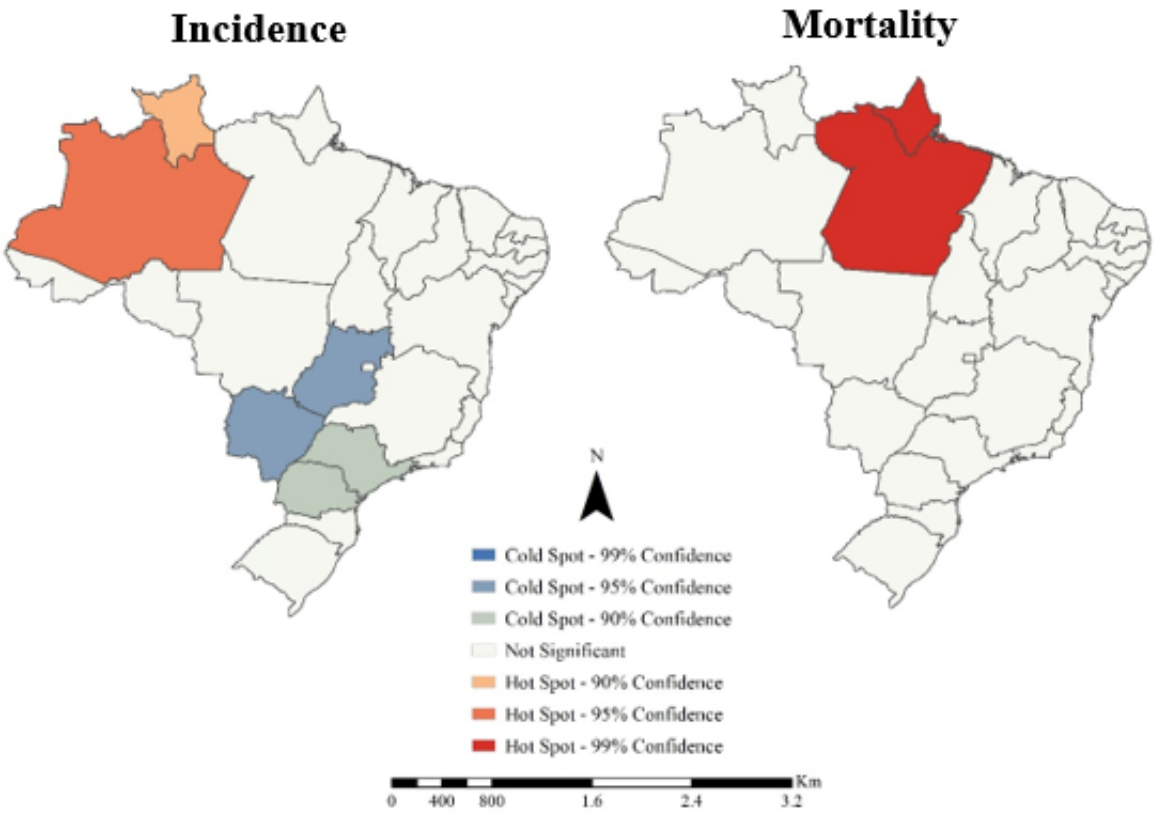

Figure 4 – Spatial risk clusters of the incidence and mortality of COVID-19 among Nursing professionals according to the states, Brazil, 2020

DISCUSSION

The study aimed to evaluate the trend, magnitude and severity of the disease among Nursing professionals. There was a growing trend in the incidence of COVID-19 in most of the Brazilian states, and also in severity, expressed by mortality.

It is noteworthy that this disease has had a greater impact on the Nursing professionals in the North region, notably in the Amazonas, with a high risk of illness, when compared to other Brazilian states, identifying a risk cluster in that state, with an accuracy of 95% confidence level (Figure 4).

However, when severity is observed, a new configuration is noticed, now in the states of Pará and Amapá, with a high risk of deaths, at a 99% confidence level. The states of Goiás and Mato Grosso do Sul proved to be areas of protection for the occurrence of COVID-19, perhaps due to the containment policies adopted in these states (Figure 4), which should be investigated in future studies. In terms of severity, no state was observed that would be considered as a potential protection region.

The number of health professionals who fell ill and are ill during the pandemic has been steadily increasing[23]. In this scenario, we have to acknowledge that the Nursing professionals are at the forefront in the fight against COVID-19 in several countries[5,24].

In the descriptive analysis of cases and deaths due to COVID-19 among the Nursing professionals investigated in this study, it can be seen that this corroborates the composition of the national Nursing team, where 77% are nursing technicians and assistants and 23% are nurses[25].

The state of Rio de Janeiro, which had the highest number of cases and deaths among the professional categories analyzed, demands further research studies to clarify its impacts. In Brazil, cases of infection in the health professionals have been reported, being especially attributed to the lack of PPE as a critical aspect[26].

A behavior verified in Brazil and in the Southeast, North and Northeast regions is the rapid growth of the trend in the first weeks of study, reaching a peak (maximum values) of incidence in the middle of the time series.

Another point refers to the protection cluster in the state of Mato Grosso do Sul, which so far has no cases; however, the time series analysis showed an increase in the incidence in the Midwest region, constant throughout the time series.

This rapid growth of incidence in Brazil and in the macro-regions can be related to the availability of personal protective equipment (PPE) for health professionals (especially Nursing), mainly in public hospitals; the lack of PPE is pointed out as one of the main factors related to the Nursing professionals contracting the disease[23].

Brazil and the five macro-regions showed an increasing trend towards mortality at the end of the time series. According to the COFEN and to the ICN, Brazil is the country with the most deaths of nurses due to COVID-19 in the world, surpassing countries with high incidence of the disease, such as the United States, United Kingdom, Spain, Italy, and China[25].

The formation of a risk cluster in terms of both incidence and death in the North macro-region of the country can be associated with the readjustment of the hospitals to face the pandemic[2].

This rapid hiring of health workers may not have been accompanied by an effective qualification of these professionals for the management of COVID-19, which, in addition to the scarcity of PPE, strongly contributes to the increase in incidence and deaths among Nursing professionals[26].

The results of the increase in the mortality of Nursing professionals in Brazil and in the macro-regions point to the need for actions to prevent and protect the health of these professionals. Among these actions, the implementation of management protocols for COVID-19 can be highlighted, as well as the adoption of administrative measures for a safe environment and wide availability of PPE, actions that can reduce the risks of contamination during the work activity[22].

Considering the dynamics of COVID-19 across the different regions of the country and states, and that the results are due to the period of the study, the impact and severity of the regions indicated in the study may have been changed during the current pandemic until the publication of the present manuscript. However, this is the first research study that uses the Gi* technique to diagnose the magnitude and severity of COVID-19 among Nursing professionals, revealing itself to be a very useful technique to meet this objective.

As limitations of the study, there is the use of secondary data available in a public database, which may be incomplete regarding the information filled out. Another limitation refers to the short time interval used in the construction of the time series, an interval that may have influenced the fluctuations in the trends.

CONCLUSION

The study made it possible to diagnose the epidemiological situation of COVID-19 among Nursing professionals, evidencing a more critical area in the North macro-region of

the country, and the constant increase in the incidence in the South and Midwest macro-regions, available until May 2020. A critical behavior in relation to the mortality rates is evidenced in view of their growth throughout the national scenario.

It is important to highlight the need for continuous monitoring of the data, considering the geometric progression of this disease and also of studies that expand the analysis of the relationships between the number of cases and deaths, considering that these can help in the development of policies and in the structure to be adopted in the states with fewer number of cases.

In the current context, in which the virus was recently discovered and that there are still few studies on the topic, mainly on Nursing professionals, who do not maintain close contact with patients affected by COVID-19, the study contributes to the advancement of knowledge in this area and to guide policies aimed at facing the issue and class councils.

The study showed a diagnosis with aggregated data, so that continuity of monitoring is necessary, as well as the proposal of new studies in the regions identified by the research study.

ACKNOWLEDGMENTS

This work was carried out with the support of the Coordination for the Improvement of Higher Level Personnel (*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*, CAPES) - Brazil - Funding Code 001 - and of the National Council for Scientific and Technological Development (CNPq) for granting a research productivity scholarship (Process 304483/2018-4).

REFERENCES

1. World Health Organization. State of the world's nursing 2020: investing in education, jobs and leadership investing in education, jobs and leadership. [Internet]. Geneve: WHO; 2020 [accessed 04 jun 2020]. Available from: https://apps.who.int/iris/handle/10665/331677.

2. Medeiros EAS. A luta dos profissionais de saúde no enfrentamento da COVID-19. Acta Paul. Enferm. [Internet]. 2020 [accessed 04 jun 2020]; 33. Available from: https://doi.org/10.37689/acta-ape/2020edt0003.

3. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J Autoimmun [Internet]. 2020 [accessed 04 jun 2020]; 109. Available from: https://doi.org/10.1016/j.jaut.2020.102433.

4. Hope K, Massey PD, Osbourn M, Durrheim DN, Kewley CD, Turner C. Senior clinical nurses effectively contribute to the pandemic influenza public health response. Aust J of Adv Nurs [Internet]. 2011 [accessed 04 jun 2020]; 28(3). Available from: https://www.ajan.com.au/archive/Vol28/28-3_Hope.pdf.

5. Oliveira AC. Desafios da enfermagem frente ao enfrentamento da pandemia da Covid19. REME - Rev Min Enferm. [Internet]. 2020 [accessed 04 jun 2020]; 24(e:1302). Available from: https://www.reme.org.br/artigo/detalhes/1448.

6. The Lancet. COVID-19: protecting health-care workers. Lancet [Internet]. 2020 [accessed 04 jun 2020]; 395(10228). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7138074/.

7. Cassiani SH de B, Jimenez EFM, Ferreira A,U Peduzzi M, Hernández CL. La situación de la enfermerÍa en el mundo y la Región de las Américas en tiempos de la pandemia de COVID-19. Rev Panam

Salud Publica [Internet]. 2020 [accessed 04 jun 2020]; 44. Available from: https://doi.org/10.26633/RPSP.2020.64.

8. Remuzzi A, Remuzzi G. COVID-19 and Italy: what next? The Lancet [Internet]. 2020 [accessed 04 jun 2020]; 395. Available from: https://doi.org/10.1016/S0140-6736(20)30627-9.

9. Jones S. Spain: doctors struggle to cope as 514 die from coronavirus in a day. The Guardian [Internet]. 2020 [accessed 04 jun 2020]. Available from: https://www.theguardian.com/world/2020/mar/24/spain-doctors-lack-protection-coronavirus-covid-19.

10. Adams JG, Walls RM. Supporting the health care workforce during the COVID-19 global epidemic. Jama. [Internet]. 2020 [accessed 04 jun 2020]; 323(15). Available from: https://doi.org/10.1001/jama.2020.3972.

11. Koh Y, Hegney DG, Drury V. Comprehensive systematic review of healthcare workers' perceptions of risk and use of coping strategies towards emerging respiratory infectious diseases. Int J Evid Based Healthc [Internet]. 2011 [accessed 04 jun 2020]; 9(4). Available from: https://doi.org/10.1111/j.1744-1609.2011.00242.x.

12. Campoy LT, Ramos ACV, Souza LLL, Alves LS, Arcoverde MAM, Berra TZ, et al. A distribuição espacial e a tendência temporal de recursos humanos para o Sistema Único de Saúde e para a Saúde Suplementar, Brasil, 2005 a 2016. Epidemiol. Serv. Saúde [Interneet]. 2020 [accessed 04 jun 2020]; 29(2). Available from: https://doi.org/10.5123/s1679-49742020000200020.

13. Kleinbaum DG, Kupper LL, Morgenstern H. Epidemiologic research: principles and quantitative methods. New York: John Wiley & Sons; 1982.

14. Instituto Brasileiro de Geografia e Estatística (IBGE). Pesquisa Nacional de Saúde 2013 [Internet]. 2014 [accessed 04 jun 2020]. Available from: ftp://ftp.ibge.gov.br/PNS/2013/pns2013.pdf.

15. Latorre M do RD de O, Cardoso MRA. Análise de séries temporais em epidemiologia: uma introdução sobre os aspectos metodológicos. Rev. bras. epidemiol. [Internet]. 2001 [accessed 04 jun 2020]; 4(3). Available from: https://doi.org/10.1590/S1415-790X2001000300002.

16. Cleveland RB, Cleveland WS, McRae JE, Terpenning I. STL: a seasonal-trend decomposition procedure based on loess. J Off Stat [Internet]. 1990 [accessed 04 jun 2020]; 6(1). Available from: https://search.proquest.com/docview/1266805989?pq-origsite=gscholar.

17. Brockwell PJ, Davis RA. Introduction to time series and forecasting. New York: Springer-Verlag; 2002.

18. Stopka TJ, Goulart MA, Meyers DJ, Hutcheson M, Barton K, Onofrey S, et al. Identifying and characterizing hepatitis C virus hotspots in Massachusetts: a spatial epidemiological approach. BMC Infect Dis. [Internet]. 2017 [accessed 04 jun 2020]; 17(294). Available from: https://doi.org/10.1186/s12879-017-2400-2.

19. Zhang Y, Shen Z, Ma C, Jiang C, Feng C, Shankar N, et al. Cluster of human infections with avian influenza A (H7N9) cases: a temporal and spatial analysis. Int J Environ Res Public Health [Internet]. 2015 [accessed 04 jun 2020]; 12(1). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4306894/.

20. Getis A, Ord J. The analysis of spatial association by use of distance statistics. Geographical Analysis [Internet] 1992 [accessed 04 jun 2020]; 24(3). Available from: https://doi.org/10.1111/j.1538-4632.1992.tb00261.x.

21. Wang T, Xue F, Chen Y, Ma Y, Liu Y. The spatial epidemiology of tuberculosis in Linyi City, China, 2005–2010. BMC Public Health [Internet]. 2012 [accessed 04 jun 2020]; 12(885). Available from: https://bmcpublichealth.biomedcentral.com/track/pdf/10.1186/1471-2458-12-885.

22. Abedi-Astaneh F, Hajjaran H, Yaghoobi-Ershadi MR, Hanafi-Bojd AA, Mohebali M, Shirzadi MR, et al. Risk mapping and situational analysis of cutaneous leishmaniasis in an endemic area of Central Iran: a GIS-based survey. PLoS One [Internet]. 2016 [accessed 04 jun 2020];11(8). Available from: https://doi.org/10.1371/journal.pone.0161317.

23. Centers for Disease Control and Prevention. Coronavirus disease 2019: pregnant people and breastfeeding. [Internet]. 2020 [accessed 04 jun 2020]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/prepare/pregnancy-breastfeeding.html.

24. Ran L, Chen X, Wang Y, Wenwen W, Zhang L, Tan X. Risk factors of healthcare workers with corona virus disease 2019: a retrospective cohort study in a designated hospital of Wuhan in China. Clin Infect Dis [Internet]. 2020 [accessed 04 jun 2020]; Available from: https://doi.org/10.1093/cid/ciaa287.

25. Conselho Federal de Enfermagem. Brasil é o país com mais mortes de enfermeiros por Covid-19 no mundo [Internet]. 2020 [accessed 04 jun 2020]. Available from: http://www.cofen.gov.br/brasil-e-o-pais-com-mais-mortes-de-enfermeiros-por-covid-19-no-mundo-dizem-entidades_80181.html.

26. Miranda FMA, Santana L de L, Pizzolato AC, Saquis LMM. Condições de trabalho e o impacto na saúde dos profissionais de enfermagem frente a Covid-19. Cogitare enferm. [Internet]. 2020 [accessed 04 jun 2020]; 25. Available from: https://revistas.ufpr.br/cogitare/article/view/72702.

Received: 16/06/2020
Finalized: 21/09/2020

Associate editor: Luciana Puchalski Kalinke

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