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Incidence of covid-19 and associated factors in the population of Pará

Incidência da COVID-19 e fatores associados na população do Pará

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ABSTRACT
The aim of this study was to identify the incidence of COVID-19 according to the positivity of the rapid tests and the associated factors in the population of the state of Pará. This is a cross-sectional, analytical, retrospective study, developed with cases of COVID-19 in individuals notified and residing in the state of Pará. Information was collected on the State Transparency Portal. Positivity for rapid tests of the disease was considered as the outcome variable. Logistic regression analysis was applied to identify associations between variables. The incidence of COVID-19 was 46% (95% CI: 45.7-46.2). Being male, over 80 years old and waiting 22 days or more to perform the tests after the onset of symptoms increased the chances for a positive result. It can be concluded that there is a high incidence of COVID-19 in the state. Non-pharmacological measures and case tracking strategies are important alternatives to mitigate the pandemic.

Keywords: COVID-19. Diagnosis. Incidence. Pandemic.

RESUMO
O objetivo deste estudo foi identificar a incidência da COVID-19 segundo positividade dos testes rápidos e os fatores associados na população do estado do Pará. Trata-se de um estudo transversal, analítico, retrospectivo, desenvolvido com os casos da COVID-19 em indivíduos notificados e residentes no estado do Pará. As informações foram coletadas no Portal de Transparência do Estado. Considerou-se a positividade para os testes rápidos da doença como variável desfecho. Análise de regressão logística foi utilizada para identificar associação entre as variáveis. A incidência da COVID-19 foi de 46% (IC 95%: 45,7-46,2). Ser do sexo masculino, ter idade acima de 80 anos e tempo de 22 dias ou mais para realização dos testes após o início dos sintomas aumentaram as chances para o resultado positivo. Conclui-se que existe a alta incidência da COVID-19 no estado. As estratégias de medidas não farmacológicas e de rastreamento de casos são importantes alternativas para mitigar a pandemia.

Palavras-chave: COVID-19. Diagnóstico. Incidência. Pandemia.

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INTRODUCTION

The global impact of COVID-19 is immeasurable, mainly due to the negative consequences on the population health. As of November 16, 2020, 54,558,120 cases of SARS-CoV-2 infection had been confirmed worldwide, with 1,320,148 deaths recorded[1,2]. The United States leads the ranking with the highest absolute number of deaths (244,411), followed by Brazil (165,798), India (130,519), Mexico (98,542) and the United Kingdom (51,934)[3].

In Brazil, up to the date mentioned above, 5,876,464 confirmed cases and 165,798 deaths from the disease were reported. The Northern Region has one of the highest rates of incidence (3,983.1 cases/100 thousand inhabitants) and mortality (88.8 deaths/100 thousand inhabitants); in the state of Roraima, where the situation is the most serious among all states, are 1,0000.5 cases/100 thousand inhabitants and 116.5 deaths/100 thousand inhabitants. And the state of Pará accounts for the highest number of deaths (6,832) from COVID-19[2].

The COVID-19 epidemic has behaved differently in countries, and in Brazil it can be said that each state is experiencing different moments. However, regardless of the stage where each is, reducing exposure to the virus is necessary to control/delay the spread of the disease and minimize negative impacts, such as increased mortality and the crisis in the economic and social context. Thus, the tracking of cases through tests to detect the infection is essential[4].

Although the diagnosis of patients in the acute phase of the disease, carried out using RT-PCR, is efficient and specific, there needs to be serological tools to investigate antibody responses and the assessment of individual immunity and potential "herd immunity"[5]. However, in Brazil, the supply of tests is limited in many geographical areas, which causes underreporting in the actual number of cases. This means that the disease may be affecting more people than the numbers indicate.

In addition, in most confirmed cases, patients are symptomatic, have fever, dry cough and pneumonia and often atypical symptoms, such as gastrointestinal manifestations, anosmia and ageusia[4,6]. Nevertheless, SARS-CoV-2 has also been detected in asymptomatic individuals, which makes it difficult to track cases and consequently control the epidemic, due to the evidence of the occurrence of viral transmission among this group[7].

In the meantime, from an epidemiological point of view, knowledge about the incidence according to the positivity of the tests, the sociodemographic and clinical characteristics of the infected individuals and other variables that permeate the tracking of COVID-19 cases is essential to define pandemic control and post-pandemic strategies[8].

In this context, the present study aimed to identify the incidence of COVID-19 according to the positivity of rapid tests and the associated factors in the population of the state of Pará.

METHODOLOGY

This is a cross-sectional, analytical and retrospective study developed with the cases of COVID-19 in individuals notified and residing in the state of Pará from January 3 to June 15, 2020. Information from the public transparency portal of the state about the evolution of the disease. Information was collected in July 2020.

Variables with incomplete information (ignored or blank data) above 20% were excluded. It is considered excellent when there is less than 5% incomplete information, good (from 5% to 10%), regular (from 10% to 20%), bad (from 20% to 50%) and very bad (above 50 %). From the exclusion of incomplete data, we obtained a sample of 114,578 individuals.

For the analysis of organized and tabulated data, positivity for the rapid tests of COVID-19 was considered as an outcome variable, as it represents an important screening measure. Independent variables were sex, age group, time elapsed between symptom onset and testing and clinical signs and symptoms. For that, a bivariate logistic regression analysis was applied, generating the odds ratio (OR) with a 95%

confidence interval. Then, the statistically significant variables, which have a $p < 0.05$, were simultaneously included in the logistic regression model and each category in relation to the outcome variable was adjusted using the Lemeshow test to analyze how these factors behave when associated.

The research was not submitted to the Research Ethics Committee of the National Health Council, because it used secondary data from a public domain platform with free access, as recommended by Resolution 510, of April 7, 2016, of National Health Council of the Ministry of Health.

RESULTS

As for the incidence of COVID-19 according to positivity for the antigen and antibody test, out of the total of 114,578 individuals tested, 52,805 had reagent results. This represents an incidence of 46% (95% CI: 45.7-46.2) or approximately 46 people for every 100 tested.

There was a predominance of 52,948 male individuals (46.2%), aged 20 to 39 years, 52,244 (45.6%). As for clinical signs and symptoms, the majority had fever, 72,707 (63.5%) and cough 67,585 (59.0%). Dyspnea was the least frequent clinical symptom, 34,747 (30.3%).

With regard to the time elapsed between the onset of clinical signs and symptoms and the test, it was noticed that the majority of individuals who took the tests within nine days of symptom onset had a negative result, 37,960 (32.9 %).

Data related to sex, age group, clinical symptoms and screening of individuals undergoing a test for the diagnosis of COVID-19 in the state of Pará are listed in Table 1.

Table 1. Sociodemographic, clinical and tracking characteristics of individuals submitted to the COVID-19 diagnostic test in the state of Pará. 2020

Variable	N	%
Sex		
Male	52,948	46.2
Female	61,630	53.8
Age group (years)		
Up to 19 years	8,217	7.2
20 to 39 years	52,244	45.6
40 to 59 years	40,833	35.6
60 to 79 years	11,554	10.1
Time between symptom onset and diagnosis		
No symptoms before diagnosis	22	0.0
Up to 9 days	37,690	32.9
10 to 14 days	33,780	29.5
15 to 21 days	20,219	17.6
22 or more days	21,523	18.8
No information	1,344	1.2
Presente symptoms [1]		
Dyspnea	34,747	30.3
Fever	72,707	63.5
Cough	67,585	59.0
Sore throat	51,122	45.5
Other symptoms	60,009	52.4
Asymptomatic patient	119	0.1
No information about symptoms	1,237	1.1
Type of rapid test used		
Antibodies.	105,536	92.1
Antigen	9,042	7.9
Test result		
Positive	52,805	46.1
Negative	61,773	53.9
Total	**114,578**	**100.0**

Chances for positive results in the rapid test for COVID-19 are greater in individuals performing the rapid test after 22 days of symptom onset (OR 1.77; 95% CI: 1.71-.83), as listed in Table 2.

Table 2. Association between the time elapsed since the onset of symptoms and the performance of the test for COVID-19 of the population of the State of Pará. 2020

	Apid test result							
Time range	**Positive**		**Negative**		**Total**		**OR (95%CI)**	***p-value***
	n	%	**n**	%	**n**	%		
Up to 9 days	14,589	38.7	23,101	61.3	37,690	100.0	1.00	p [(1)] < 0.001*
10 to 14 days	16,035	47.5	17,745	52.5	33,780	100.0	1.43 (1.39-1.47)	
15 to 21 days	10,424	51.6	9,795	48.4	20,219	100.0	1.69 (1.63-1.75)	
22 or more	11,360	52.8	10,163	47.2	21,523	100.0	1.77 (1.71-1.83)	
Total	**52,408**	**46.3**	**60,804**	**53.7**	**113,212**	**100.0**		

CI: confidence interval. (*) Significant association at 5.0%. (1) Through Pearson's Chi-square test

As for sociodemographic and clinical characteristics and the time elapsed between the onset of symptoms, it is possible to note that all variables had a statistically significant association with the positive test for COVID-19, as listed in Table 3. Furthermore, being male, over 80 years old and waiting 22 days or more to perform the tests after the onset of symptoms increased the chances for this result.

Table 3. Association between sociodemographic and clinical characteristics, the time elapsed between the onset of symptoms and the positive test for COVID-19 of the population of the state of Pará. 2020

(To be continued)

Variable	**Bivariate**		**Adjusted**	
	OR(95%CI)	***p-value***	**OR(95%CI)**	***p-value***
Sex				
Male	1.02 (0.99-1.05)	0.053	1.05 (1.02-1.07)	< 0.001*
Female	1		1	
Age group (years)		< 0.001*		< 0.001*
Up to 19	1		1	
20 to 39	0.80 (0.76-0.84)		0.80 (0.76-0.84)	
40 to 59	0.90 (0.86-0.95)		0.87 (0.83-0.91)	
60 to 79	1.24 (1.17-1.31)		1.19 (1.12-1.26)	
80 or more	1.56 (1.40-1.73)		1.54 (1.39-1.72)	
Time range between symptoms and diagnosis		< 0.001*		< 0.001*
Up to 9 days	1		1	
10 to 14 days	1.43 (1.39-1.47)		1.43 (1.39-1.48)	
15 to 21 days	1.69 (1.63-1.75)		1.68 (1.62-1.74)	
22 or more days	1.77 (1.71-1.83)		1.76 (1.70-1.82)	

(Conclusion)

Variable	Bivariate		Adjusted	
	OR(95%CI)	*p-value*	OR(95%CI)	*p-value*
Dyspnea		< 0.001*		< 0.001*
Yes	1.46 (1.42-1.49)		1.31 (1.28-1.35)	
No	1		1	
Fever		< 0.001*		< 0.001*
Yes	2.07 (2.02-2.13)		2.03 (1.98-2.09)	
No	1		1	
Cough		< 0.001*		< 0.001*
Yes	1.51 (1.47-1.54)		1.35 (1.31-1.38)	
No	1		1	
Sore throat		< 0.001*		< 0.001*
Yes	1.09 (1.06-1.12)		0.92 (0.90-0.94)	
No	1		1	
Other symptoms		< 0.001*		< 0.001*
Yes	1.13 (1.10-1.15)		1.45 (1.41-1.49)	
No	1		1	

(*) Statistically significant at 5.0%.

DISCUSSION

This study analyzed the incidence of COVID-19 according to the positivity of rapid tests of the population of the state of Pará, in addition to the association with sociodemographic and clinical variables and the time between the onset of symptoms and the diagnosis of COVID-19.

A 46% incidence of COVID-19 was found (95% CI: 45.7-46.2). The North Region was among the first with the highest incidence of COVID-19. As it has geographical, social and economic particularities, it can present a characteristic pattern of spread of the infection. Pará currently occupies the first position in the number of confirmed cases (261,899) among the states in this region[2].

In this study, sex, age and onset of symptoms were statistically significant when associated with the positivity of the rapid test for COVID-19. This means that being male, over 80 years old and taking the test after 22 days or more of the onset of symptoms increase the chances of the individual presenting a positive result.

As for the gender variable, the results corroborate studies that showed a higher incidence of respiratory diseases in the male population[9,10]. Disproportionate numbers between men and women related to the prevalence, morbidity and mortality from SARS-CoV-2 infection have been reported worldwide[11]. Severity and lethality rates are significantly higher among men than among women[12,13].

The difference may involve socio-cultural and gender factors. A study found that ethnic/racial minority groups were disproportionately more affected by COVID-19[14]. Therefore, in addition to sex, other factors such as age and socioeconomic status have to be examined and disseminated in order to have a clearer representation of this pandemic.

In relation to age, it is observed in the present study that the more advanced it is, the greater the chances of testing positive for COVID-19. Among the risk factors established for the development of the most severe forms of the disease are age over 65 years and the presence of comorbidities, such as diabetes mellitus and hypertension[15]. It should be clarified that, although old age is identified as a risk factor,

people of any age can present severe infection. In other population contexts, such as in the United States, more than 60% confirmed patients were over 45 years of age[16].

As for clinical signs and symptoms in the population studied, fever and cough were the most prevalent in COVID-19. Research shows that fever, cough and fatigue are the most frequent symptoms[17,18,19], others, less characteristic, include headache, diarrhea, abdominal pain, vomiting, chest pain, rhinorrhea or pharyngalgia[20,21,22]. Approximately 90% infected patients have more than one symptom[23,24], which reinforces the result presented in this study.

A study carried out in China with 136 individuals affected by COVID-1917 showed that they had the same signs and symptoms as the present study. Nevertheless, the absence of fever in COVID-19 can happen and has been more frequent than in Severe Acute Respiratory Syndrome (SARS) (1%) and Middle East Respiratory Syndrome (MERS) (2%)[25]. Therefore, afebrile patients can be lost if the surveillance case definition focuses on the detection of fever[26].

A finding that draws attention and that requires consideration concerns the time taken to perform the tests after the onset of symptoms. The study showed that the chances of the result being positive are greater in individuals who performed the rapid test 22 days after the onset of symptoms. Research that evaluated these tests concluded that the average seroconversion times were 11, 12 and 14 days[27]. Until the seventh day after symptoms start, the sensitivity of the tests is less than 70%; it increases between the eighth and twelfth days. Among samples from patients in the later phase (days 15-39 after onset), the sensitivity of rapid tests for antibodies was over 90%, reaching 100% for IgM[28]. Tests should be interpreted with caution, and epidemiology through the screening of rapid tests should not be considered as the main pandemic control strategy.

The limitations of this refers to information about the cases, as there was incomplete information in the transparency portal. This is a common limitation among retrospective observational studies. A second limitation is the lack of data among asymptomatic individuals who probably did not perform the COVID-19 rapid test for investigation.

CONCLUSION

The state of Pará had a 46% incidence of COVID-19 among individuals who underwent rapid testing as a means of investigating the infection. Being male, over 80 years old and waiting 22 days or more to perform the tests after the onset of symptoms increased the chances of the individual being positive for the disease.

The results presented herein can be considered relevant for this region of the country due to investigating the behavior of the pandemic in the state. Since, by providing sociodemographic and epidemiological data on patients, it allows the planning of public health strategies.

In addition, non-pharmacological measures should be prioritized when confronting COVID-19. Inappropriate conduct, absence of behavioral changes, lack of clarity in the guidelines given to the population and impasse between government entities can lead to an increase in the number of cases and difficult control of the disease.

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