

## Positivity rate for COVID-19 of RT-PCR tests of the first quarter of 2021 of the state of Amazonas



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### ABSTRACT

The Ministry of Health (MoH) received the first notification of a confirmed case of Covid-19 in Brazil on February 26, 2020. Based on daily data reported by the State Health Secretariats to the Ministry of Health, from February 26, 2020, to May 15, 2021, 15,586,534 cases and 434,715 deaths from covid-19 were confirmed in Brazil. The pandemic in Brazil had already completed more than a year since the first reported case, but

unfortunately, it was not possible to say that the situation was stable and that the epidemic was controlled in 2021 to opt for the relaxation of social isolation. In this sense, it is understood that testing in the population was a tool of great relevance to analyze whether cases were decreasing. The purpose of this research was to write the positivity rate for Covid-19 of the RT-PCR tests of the first quarter of 2021 in the State of Amazonas. The methodology used was a descriptive study using the e-SUS Notifica database. The results indicate that the average positivity of the State of Amazonas considering the tests carried out in the first quarter of 2021 was 36.47%, and the WHO recommendation is up to 5%, a level not reached by any Brazilian state.

**Keywords:** Covid-19, Testing, Notification.

## 1 INTRODUCTION

The Ministry of Health (MoH) received the first notification of a confirmed case of Covid-19 in Brazil on February 26, 2020. Based on daily data reported by the State Health Secretariats to the Ministry of Health, from February 26, 2020, to May 15, 2021, 15,586,534 cases and 434,715 deaths from covid-19 were confirmed in Brazil. For the country, the cumulative incidence rate was 7,360.60 cases per 100,000 inhabitants, while the cumulative mortality rate was 205.3 deaths per 100,000 inhabitants (Ministry of Health, 2021).

According to the Ministry of Health's Epidemiological Bulletin N. 36 (2021), the highest record of notifications of new cases in a single day (100,158 cases) occurred on March 25, 2021, and of new deaths (4,249 deaths) on April 8, 2021. It is noteworthy that the date of notification may not represent the day of occurrence of the events, but expresses the period to which the data were informed in the information systems of the Ministry of Health (MH). Previously, considering the period after August 2020, the day on which the lowest number of new cases (8,429 cases) was observed was October 12, 2020, and the lowest number of new deaths (128 deaths) was on November 8, 2020.

The highest tally of notifications of new cases in a single day (100,158 cases) occurred on March 25, 2021, and of new deaths (4,249 deaths) on April 8, 2021. It is noteworthy that the date of notification may not represent the day of occurrence of the events, but expresses the period to which the data were reported in the information systems of the Ministry of Health. Previously, considering

the period after August 2020, the day on which the lowest number of new cases (8,429 cases) was observed was October 12, 2020, and the lowest number of new deaths (128 deaths), was on November 8, 2020.

The pandemic in Brazil had already completed more than a year since the first case in the country, but unfortunately, it was not possible to say that the situation was stable and that the epidemic was controlled in 2021 to opt for the relaxation of social isolation. The World Health Organization emphasizes 3 criteria that guide governments to decide to relax social isolation: (1) when there is an indication that the epidemic is under control; (2) when the health system can respond to a resurgence of cases; (3) when the surveillance system can identify new cases and their contacts (WHO, 2020a).

It is in this sense that testing is an indispensable tool since the capacity to perform mass tests supports two of the three criteria pointed out by the WHO for flexibility.

Regarding epidemic control, the guidance is that the rate of positive results among the tests performed should not exceed 5% for at least 14 days. The WHO also recommends tracing everyone who has had contact with infected people so that they are advised and quarantined. This measure depends on local testing capacity and is effective in controlling the pandemic in Germany and Switzerland, which had lower death rates compared to other countries (SALATHÉ et al, 2020; ABELER et al, 2020).

In 2021 Brazil was the least-tested country in the world. According to the WHO, the percentage of positive cases among people tested also called the positivity rate, should not be higher than 5% for 14 days in a row, the benchmark of analysis adopted by the world's leading medical centers. According to a study published by John Hopkins University, Brazil has the highest percentage of positivity among countries that have been monitored, reaching the mark of 36%, a rate considered one of the highest in the world.

## **2 GENERAL CHARACTERISTICS OF HUMAN INFECTION WITH THE NOVEL CORONAVIRUS (COVID-19)**

### **2.1 ETIOLOGIC AGENT**

They are RNA viruses of the order Nidovirales of the family Coronaviridae. The SARS-CoV, MERS-CoV, and COVID-19 viruses are Betacoronaviruses and highly pathogenic and responsible for causing respiratory and gastrointestinal syndrome. In addition to these three, four other types of coronavirus can cause mild respiratory syndromes in the general population, rarely leading to severe conditions.

## 2.2 RESERVOIR AND TRANSMISSION MODE

Coronaviruses are a large family of viruses common in many different species of animals, including camels, cattle, cats, and bats. Rarely, animal coronaviruses can infect people and then spread between people with MERS-CoV and SARS-CoV. As recently as December 2019, there was the transmission of a novel coronavirus (SARS-CoV-2), which was identified in Wuhan in China and caused Covid-19, and then spread and transmitted from person to person.

## 3 CLINICAL MANIFESTATIONS

The clinical spectrum of coronavirus infection is very broad, ranging from a simple cold to severe pneumonia. However, for the novel coronavirus the spectrum is not fully established, requiring further investigation and time for the characterization of the disease.

The case definition of Influenza-like Syndrome (OS) is when the individual with an acute respiratory condition, characterized by at least two (2) of the following signs and symptoms: fever (even if referred), chills, sore throat, headache, cough, runny nose, olfactory disorders, and taste disorders.

### *Observations:*

- In children: in addition to the previous items, nasal obstruction is also considered in the absence of another specific diagnosis.
- In the elderly: specific criteria of aggravation such as syncope, mental confusion, excessive sleepiness, irritability, and inappetence should also be considered.
- In suspected Covid-19, fever may be absent and gastrointestinal symptoms (diarrhea) may be present.

The case definition of the severe acute respiratory syndrome (SARS) is when the individual with OS presents: dyspnea/respiratory distress OR persistent pressure in the chest OR O<sub>2</sub> saturation less than 95% in room air OR bluish coloration of the lips or face.

### *Observations:*

- In children: in addition to the previous items, observe the nasal wing beats, cyanosis, intercostal draught, dehydration, and inappetence;

For notification in the Sivep-Influenza, the official notification system, hospitalized SARS cases or deaths from SARS regardless of hospitalization should be considered. According to the profile of confirmed cases in the first month of occurrence in Brazil in 2020, the most common clinical signs and symptoms in non-hospitalized patients were cough (73.7%), fever (68.8%), runny nose (37.4%), sore throat (36.2%) and dyspnea (5.6%). And among hospitalized patients, the most common symptoms were fever (81.5%), cough (79.8%), runny nose (31.1%), sore throat (26.1%), and dyspnea

(26.1%). The most prevalent comorbidities, in general, were cardiovascular disease (7.4%), diabetes (2.9%), chronic lung disease (2.1%), and neoplasia (1.0%).

## 4 DIAGNOSIS

### 4.1 CLINICAL DIAGNOSIS

The initial clinical picture of the disease is characterized as a flu-like syndrome. Diagnosis depends on clinical-epidemiological investigation and physical examination. It is recommended that in all cases of flu-like syndrome, the history of displacement and contact be questioned. This information should be recorded in the patient's medical record for eventual epidemiological investigation.

### 4.2 LABORATORY DIAGNOSIS

Since the beginning of the pandemic, the types of tests performed for diagnosis and screening of COVID-19 are (1) RT-PCR (reverse-transcriptase polymerase chain reaction) test; (2) serological test (detection of antibodies – IgA, IgM and IgG); and, (3) rapid antigen and antibody tests (IgM and IgG). The RT-PCR test is considered the gold standard in the diagnosis of Covid-19, while rapid and serological tests are used in the screening and spread of the virus, as summarized in Table 1.

### 4.3 DIFFERENTIAL DIAGNOSIS

The clinical features are not specific and may be similar to those caused by other respiratory viruses, which also occur in the form of outbreaks and eventually circulate at the same time, such as influenza, parainfluenza, rhinovirus, respiratory syncytial virus, adenovirus, other coronaviruses, among others.

TABLE 1. General characteristics of the existing RT-PCR test and IGM/IGG Rapid Serological Test for Covid-19.

<b>RT-PCR</b>	<b>RAPID SEROLOGICAL TEST (IGM/IGG)</b>
It detects the genetic material of the virus, RNA.	It detects the antibodies produced against the virus. There are two types of antibodies: IgM, when the infection was recent, and IgG, when the person is no longer infected and has antibodies.
Collection of material in the upper airways, preferably nasopharynx and oropharynx.	Capillary blood collection.
The collection should be performed from the 3rd day of symptom onset until day 10, when the amount of RNA tends to decrease.	At the end or shortly after the infectious period, with possible detection of two antibodies: – IgM, produced, in general, after 10 days from the onset of symptoms and allows detection of recent infection – IgG, produced after the end of the infectious period and allows detection of previous contact with the virus.

<p>It identifies the virus in the period of activity in the body, making possible appropriate medical conduct, hospitalization, social isolation and tracing of people who have maintained contact with the infected individual.</p>	<p>It identifies the presence of antibodies in people who have had previous contact with the virus, allowing to measure the contamination and susceptibility of the population to the virus.</p>
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## 5 CARE AND TREATMENT

Proper management of suspected or confirmed cases of Covid-19 depends on early recognition of warning signs and continuous monitoring. Considering the general characteristics of the infection, clinical manifestations and possible complications.

## 6 AREAS OF STUDY

Amazonas is the largest Brazilian state in territorial extension, with an area of 1,559,167.878 km<sup>2</sup>, part of the territory is in the northern hemisphere, being crossed by the equator.

The state of Amazonas borders 05 federative units: Roraima to the northeast, Pará to the east, Mato Grosso to the southeast, Rondônia to the south, and Acre to the southwest. The state's international borders are to the west with Peru, and the northwest with Colombia and Venezuela.

The predominant climate in the state is the Equatorial, characterized by high air humidity (80% on average) and high temperatures that last throughout the year.

The rainfall rates recorded for the state are the highest in the national territory, with averages between 1500 mm and 2500 mm per year, exceeding 3500 mm in some areas.

The most active climatic factors that define the conditions observed in the Amazon are the low latitude and continentality. The proximity of the dense forest also contributes to the control of the elements of the local climate.

The Amazon has 4,207,714 inhabitants, being the 13th state in the population of Brazil and the 2nd in the North region. In relative terms, the Amazonian population is equivalent to 22.5% of all inhabitants of the region. With a large land area, the demographic density of the state is one of the lowest in the country. Data from the 2010 Census indicate a value of only 2.23 inhabitants/km<sup>2</sup>. Currently, this figure is 2.69 inhabitants/km<sup>2</sup>.

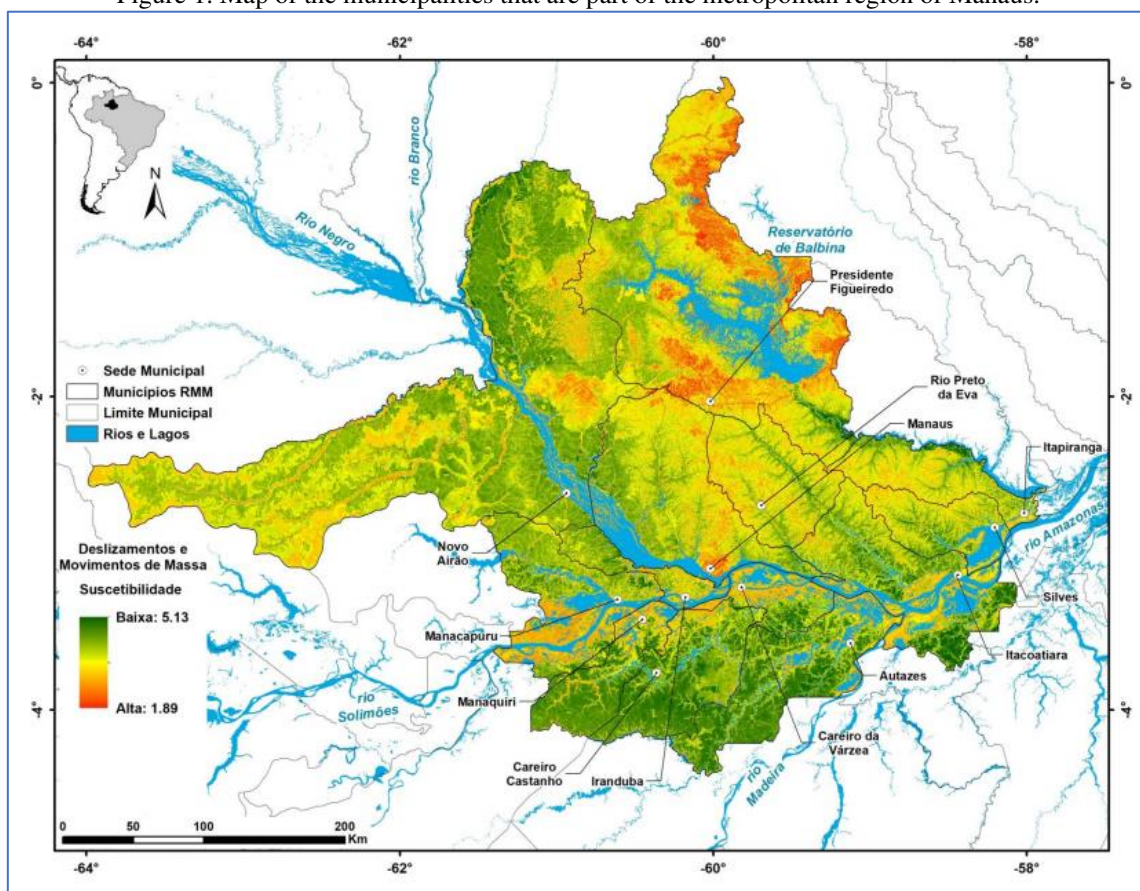
With an urbanization rate of 79,09%, we have that the largest portion of Amazonians live in cities. The capital, Manaus, is the municipality with the largest number of inhabitants in the state and the 7th most populous in Brazil, with 2,219,580 inhabitants. Next is Parintins, with 115,363 inhabitants.

The last Demographic Census, which dates from 2010, showed that Amazonas is the state that has the largest indigenous population in Brazil, with 183,514 people. The Amazonian Indians correspond to 20.46% of the Brazilian indigenous population, and 53.52% of the North region.

The Metropolitan Region of Manaus, which is also known as Greater Manaus, is the most populous, urbanized and wealthy in the state of Amazonas. It was formed through a conurbation process, which began in the early 1970s. It is the 10th most populous metropolitan region in Brazil and the most populated in the North region. Cities that are part of the Metropolitan Region: Manaus (host city), Autazes, Careiro, Careiro da Várzea, Iranduba, Itacoatiara, Itapiranga, Manacapuru, Manaquiri, Novo Airão, Presidente Figueiredo, Rio Preto da Eva and Silves (Figure 1).

The Government of Amazonas confirmed the first case of Covid-19 (novel coronavirus) in the state on March 13, 2020. The patient is a 39-year-old woman with a recent travel history to London.

Figure 1. Map of the municipalities that are part of the metropolitan region of Manaus.



## 7 JUSTIFICATION

This report is the first product, containing the positivity rate for Covid-19 of the RT-PCR tests of the first quarter of 2021 of the State of Amazonas to obtain the remuneration agreed in the contract.

## **8 OBJECTIVES**

### **8.1 GENERAL**

Describe the positivity rate for Covid-19 of the RT-PCR tests of the first quarter of 2021 of the State of Amazonas.

### **8.2 SPECIFIC**

- Stratify the Covid-19 positivity rate of RT-PCR tests in the first quarter of 2021 by race/color, age group, and sex;
- Analyze the positivity rate for Covid-19 of RT-PCR tests of the first quarter of 2020 in the municipalities of Amazonas;
- Analyze the rate of RT-PCR tests with negative and positive results in the first quarter of 2021 of the State of Amazonas.

## **9 STUDY METHOD**

This is a descriptive study to analyze the positivity rate for Covid-19 of the RT-PCR tests of the first quarter of 2021 in the State of Amazonas.

The database used for the analyses was e-SUS Notifica. The data extracted were those of positive cases of RT-PCR that were in the database, and the variables of race/color, age group, and sex were selected for the analysis.

### **9.1 SOURCE OF DATA COLLECTION**

The Department of Informatics of SUS – DATASUS has made available the e-SUS Notifica, a new tool for recording the notification of suspected and confirmed cases of the Novel Coronavirus – Covid-19. The notifier has an intuitive design and high-performance infrastructure that provides agility in the notification process. The e-SUS Notifica was developed by DATASUS exclusively to meet the high demand for notifications due to Covid-19 in the country for non-hospitalized patients.

## **10 RESULTS**

In Amazonas, in the 1st quarter of 2021, 38,734 RT-PCR tests were performed according to e-SUS data.

The results obtained show that the capital Manaus presented several tests much higher than the sum of the other 61 municipalities of Amazonas, however, the positivity rate was higher in the interior of the state which is equivalent to 41.94% (Table 2).

TABLE 2. POSITIVITY RATE OF RT-PCR TESTS OF THE 1ST QUARTER OF 2021 IN THE STATE OF AMAZONAS

	POSITIVE	NEGATIVE	%
MUNICIPALITIES	N	N	TX POSITIVITY (%)
<b>CAPITAL</b>	<b>9745</b>	<b>16698</b>	36,85%
<b>INTERIOR</b>	<b>5155</b>	<b>7136</b>	41,94%

Source: e-SUS Notifies, FVS-AM. Data extracted on 05/26/2021, subject to review.

Another variable analyzed with e-SUS data was the RT-PCR positivity rate by race/color. The Brazilian racial classification is characterized by complexity, ambiguity and fluidity, being based on the appearance of individuals. There are different classification systems, and the official one of the Brazilian Institute of Geography and Statistics (IBGE) consists of five categories: black, brown, white, yellow and indigenous.

The results indicate a high positivity rate in white individuals, even considering the brown race as the most common in the Amazon, which is the second highest in positivity (Table 3). It is noteworthy that this variable is filled by the individual himself based on how he assumes himself.

Concerning the positivity rate in RT-PCR tests in the 1st quarter of 2021 in the variable age group there is an increase in the 50-year-old age group upwards, the results of the e-SUS Notifica show that there is not a very large variation between the rates, all of them somehow remain above the desired (Table 4).

In the gender variable, the positivity rate of RT-PCR tests in the 1st Quarter of 2021 remained practically the same, considering the entire state of Amazonas, according to data from e-SUS Notifica (Table 5).

TABLE 3. POSITIVITY RATE OF RT-PCR TESTS OF THE 1ST QUARTER OF 2021 IN THE STATE OF AMAZONAS CONSIDERING THE RACE/COLOR VARIABLE

	POSITIVE	NEGATIVE	%
COLOR RACE	N	N	TX POSITIVITY (%)
Yellow	114	179	38,91%
White	1193	1464	44,90%
Indigena	282	1075	20,78%
Brown	10348	14084	42,35%
Black	178	310	36,48%
Not Informed	2782	6725	29,26%

Source: e-SUS Notifies, FVS-AM. Data extracted on 05/26/2021, subject to review.

TABLE 4. THE POSITIVITY RATE OF RT-PCR TESTS CONSIDERING THE VARIABLE AGE GROUP REPORTED IN E-SUS NOTIFIES IN THE 1ST QUARTER OF 2021

	POSITIVE	NEGATIVE	%
AGE GROUP	N	N	TX POSITIVITY (%)
1 to 4 years	190	554	25,54%
5 to 9 years	113	358	23,99%
10 to 19 years	847	1862	31,27%
20 to 29 years	2723	5290	33,98%
30 to 39 years	3572	6171	36,66%
40 to 49 years	3142	4750	39,81%
50 to 59 years	2134	2601	45,07%
> 60 years	2176	2261	49,04%

Source: e-SUS Notifies, FVS-AM. Data extracted on 05/26/2021, subject to review.

TABLE 5. POSITIVITY RATE OF RT-PCR TESTS CONSIDERING THE GENDER VARIABLE REPORTED IN E-SUS NOTIFIES IN THE 1ST QUARTER OF 2021

	POSITIVE	NEGATIVE	%
SEX	N	N	TX POSITIVITY (%)
Male	6922	10986	38,65%
Female	7975	12851	38,29%

Source: e-SUS Notifies, FVS-AM. Data extracted on 05/26/2021, subject to review.

The positivity rate of RT-PCR tests in the municipalities of Amazonas in the 1st Quarter of 2021 remained high according to data from e-SUS Notifica. These values also state that the performance of the RT-PCR test, even being considered the gold test for the detection of Covid-19, is not so common, because in the Amazon the use of rapid tests predominates (Table 6). The difficulty in the use of RT-PCR is due to the logistics of transporting the samples from the municipalities to the central laboratory located in Manaus. The limiting factor for the use of this type of examination, in addition to the difficulty in transporting the sample to the laboratory, is the registration of the sample, because there is a need for internet and not always the municipalities of the interior of Amazonas have quality internet at any time, a factor that also impairs the insertion of data in the e-SUS Notifica and SICEP Gripe systems.

TABLE 5. POSITIVITY RATE OF RT-PCR TESTS IN THE MUNICIPALITIES OF AMAZONAS IN THE 1ST QUARTER OF 2021

	POSITIVE	NEGATIVE	%
MUNICIPALITIES	N	N	TX POSITIVITY (%)
Alvarães	2	0	100,00%
Amaturá	0	10	0,00%
Anamã	29	35	45,31%

Anori	242	131	64,88%
Apuí	139	146	48,77%
Atalaia do Norte	3	4	42,86%
Autazes	13	345	3,63%
Barcelos	5	9	35,71%
Barreirinha	0	2	0,00%
Benjamin Constant	2	12	14,29%
Beruri	0	1	0,00%
Boa Vista do Ramos	1	1	50,00%
Boca do Acre	3	6	33,33%
Borba	43	291	12,87%
Caapiranga	1	2	33,33%
Canutama	4	2	66,67%
Carauari	9	21	30,00%
Careiro	1547	1411	52,30%
Careiro da Várzea	2	54	3,57%
Coari	1	4	20,00%
Codajás	4	2	66,67%
Eirunepé	25	11	69,44%
Envira	109	88	55,33%
Fonte Boa	0	1	0,00%
Guajará	8	5	61,54%
Humaitá	703	1436	32,87%
Ipixuna	2	3	40,00%
Iranduba	40	69	36,70%
Itacoatiara	26	255	9,25%
Itamarati	1	0	100,00%
Itapiranga	0	1	0,00%
Japurá	0	1	0,00%
Juruá	0	1	0,00%
Jutaí	52	50	50,98%
Lábrea	2	5	28,57%
Macapa	0	1	0,00%
Manacapuru	1667	1773	48,46%
Manaquiri	53	135	28,19%
Manaus	<b>9745</b>	<b>16698</b>	<b>36,85%</b>
Manicoré	16	81	16,49%
Maraã	0	1	0,00%
Maués	1	8	11,11%
Nhamundá	1	0	100,00%
Nova Olinda do Norte	11	33	25,00%
Novo Airão	4	75	5,06%
Novo Aripuanã	2	3	40,00%
Parintins	11	9	55,00%
Pauini	2	2	50,00%
Presidente Figueiredo	32	28	53,33%

**Emerging Issues Related to the Corona**

*Positivity rate for COVID-19 of RT-PCR tests of the first quarter of 2021 of the state of Amazonas*

Rio Preto da Eva	49	77	38,89%
Santa Isabel do Rio Negro	5	6	45,45%
Santo Antônio do Içá	1	2	33,33%
São Gabriel da Cachoeira	183	340	34,99%
São Paulo de Olivença	42	40	51,22%
Silves	2	7	22,22%
Tabatinga	6	10	37,50%
Tapauá	0	3	0,00%
Tefé	13	19	40,63%
Tonantins	21	59	26,25%
Uarini	1	0	100,00%
Urucará	4	0	100,00%
Urucurituba	10	9	52,63%

RT-PCR testing allows those infected to be identified and measures to isolate the infected person, such as quarantine for their contacts, and the resulting medical procedures, are adopted. Differently, the performance of rapid tests contributes to the tracking of the disease and analysis of the evolution of the pandemic. The identification of people with antibodies also supports social isolation and relaxation decisions. Thus, an effective strategy should show the use of both tests. The results indicate that this combination does not always occur in Brazil, as well as in the State of Amazonas.

## 11 LIMITATIONS

The limitations found were due to the feeding of information into the e-SUS Notifica database, arising from the lack of filling in important fields in the form.

In addition to the lack of filling in some fields, there is also a shortage of resources such as computers and still failures in the internet connection and some places the total absence of signal, making it difficult to feed the system in real-time. Given this, it is understood that one has an inconsistent database that often does not represent reality.

## 12 FINAL CONSIDERATIONS

The average positivity of the State of Amazonas considering the tests carried out in the first quarter of 2021 was 36.47%, and the WHO recommendation is up to 5%, a level not reached by any Brazilian state.

It is understood that the testing carried out in the Amazon was insufficient to identify the proportion of individuals who have already had contact with the virus.

There is also a gap in information about the presence and circulation of the virus among the population that is at the root of the underreporting of positive cases and makes physical distancing and relaxation decisions more sensitive to business pressure, politics, or subjectivity.

Given the facts, it is necessary to expand testing in the State of Amazonas and invest in health departments so that the correct notification is made in official notification systems. The population must have access to the information that should guide both physical distancing policies and those of their relaxation.

The lack of standards in measurements, testing, and the definition of strategies favor the insecurity of the population.

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