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IMPORTANCE OF LABORATORY FOLLOW-UP DURING COVID-19 INFECTION

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Abstract: **Objective:** To analyze the importance of laboratory monitoring during COVID-19 infection in the public and private health network as a differential for disease progression. **Materials and methods:** Through a qualitative descriptive study, a questionnaire was applied to 467 participants, the collected data were analyzed using descriptive statistics. **Results and discussion:** Among the participants, there was a predominance of women, single, aged between 24 and 30 years, self-declared brown, studying graduation, employees of a private company, with a monthly family income of up to two minimum wages, who were infected at least once by the Coronavirus. Risk factors identified among the participants were overweight and obesity, age over 59 years and pre-existing diseases such as respiratory, endocrine and heart diseases. Despite the aggravating factors for COVID-19, it was observed that among the participants who sought medical care, a minority underwent complementary tests. **Conclusion:** From the results shown, it is possible to be aware of how the assistance provided to patients occurred during the pandemic and, this way, to outline, if necessary, new strategies for the future.
Keywords: Covid-19. Biomarkers. Exams in the laboratory. Prognosis.

INTRODUCTION

In March 2020, the beginning of the COVID-19 pandemic caused by the new coronavirus was declared (TIAGO, 2021). SARS-CoV-2 infection mainly affects the upper respiratory tract, similar to a simple cold, but it can compromise the lower respiratory tract, causing complications and leading to death (XAVIER, 2020).

On February 26, 2020, Brazil officially had the first COVID-19 patient in its territory. Since then, the pandemic has spread rapidly throughout the country (OLIVEIRA; et al, 2020). By August 2022, 34,381,295 cases and 683,472 deaths from COVID-19 had been confirmed in Brazil (MINISTRY OF HEALTH, 2022).

With the rapid spread of COVID-19 in Brazil, the challenges to contemplate all patients generated public policies with strategies to face the pandemic (SANTOS; et al, 2021). The National Contingency Plan presented such strategies against the disease: surveillance, laboratory support, infection control, medical and pharmaceutical assistance, health surveillance, risk communication and management (MINISTRY OF HEALTH, 2021).

In COVI-19, the virus not only activates the antiviral immune response, but can also cause uncontrolled inflammatory responses characterized by marked release of pro-inflammatory cytokines in more severe patients, leading to changes in blood cells (YANG, 2021).

Through laboratory tests, it is possible to visualize the organism, being able to evaluate how the organs are functioning, identify changes and even prevent or see the progression of diseases. This way, laboratory analyzes are a valuable tool helping clinical practice, being one of the most important supports at all levels of health care, which was no different during the pandemic, helping the health team so far, guaranteeing a service of higher quality health (SIMONS; CAPRARO, 2020).

Laboratory diagnosis is essential for the prognosis of any pathology, and with COVID-19, changes were observed in several biomarkers that can guide the evolution of patients (CRODA; et al, 2020). SARS-CoV-2 has a different behavior compared to other viruses, in the blood count it usually indicates, marked lymphopenia more related to the onset of the disease, reduced hemoglobin, neutrophilia that may be related

to the association of bacterial infection (DE OLIVEIRA JUNIOR; et al, 2020).

Inflammatory markers such as C-Reactive Protein (CRP), erythrocyte sedimentation rate (ESR), lactate dehydrogenase (LDH) and liver markers show an increase, in some cases hypoalbuminemia occurs, changes in D-Dimer may begin in the acute phase of the infection, among other changes (DE OLIVEIRA JUNIOR; et al, 2020).

In this scenario, laboratory monitoring is essential for diagnosis, more accurately predicting the prognosis of patients with COVID-19, in addition to being able to guide more effective government strategies, since laboratory investigations provide the basis for epidemiological studies and scientific evidence (DE OLIVEIRA JUNIOR; et al, 2020).

In view of the above, the objective of this work was to analyze the importance of laboratory monitoring during the COVID-19 infection in the public and private health network as a differential for disease progression.

METHODOLOGY

A descriptive qualitative study was carried out, approved by the Research Ethics Committee of UNIEURO, CAAE: 63427322.7.0000.5056. Data collection took place through a self-applicable sociodemographic questionnaire, adapted from a previously published questionnaire (BUSATTO GF et al, 2021), answered through the platform *Google Forms* containing 26 questions divided between sociodemographic questions, questions about health prior to COVID-19, the period of COVID-19 infection, vaccination, post-COVID-19 and current health status.

To participate in the study, the inclusion criteria were: being aged 18 or over, with internet access and agreeing to participate in the research and having had COVID-19 at least once. And the exclusion criteria used were: individuals under 18 years old, who did not have COVID-19 and those who refused to participate.

A convenience sample was used, consisting of selecting an accessible sample from the population. The questionnaire remained available for 30 days, resulting in a total of 467 participants. The participation took place voluntarily with informed consent and guaranteeing the reliability of the data and any personal information.

For data analysis, descriptive statistics were used, showing the absolute distributions represented by the mean, standard deviation. For comparison between the variables: demand for care and age, BMI and pre-existing diseases, the chi-square test was used at 5% significance, the analyzes were carried out in SPSS 2016. The results were presented in tables and graphs created in the Microsoft Excel 2016.

RESULTS AND DISCUSSION

SOCIODEMOGRAPHIC CHARACTERISTICS

The study had a total of 467 participants, 340 women and 127 men who were infected with the Coronavirus at least once between March 2020 and October 2022. It is noted that most participants are single 53,32 % (n=249) the rest is divided between married, divorced and widowed.

As for age, the predominance was of participants aged between 24 and 30 years 27.19% (n=127), between 31 and 40 years following 24.84% (n=116), between 18 and 23 years 23, 34% (n=109), between 41 and 54 years old 21.84% (n=102) and over 55 years old 2.78% (n=13). Regarding ethnicity, whites and browns accounted for 83.94% (n=392) of the total number of participants. As for the level of education, the highest proportion

was of undergraduates 23.98% (n=112) and the lowest proportion of individuals with complete elementary education 1.28% (n=6).

It was observed that the most frequent occupations among the participants were private company employees 35.76% (n=167), followed by students 23.55% (n=110), statutory 20.34% (n=95). The monthly family income presented by 40.90% (n=191) of the participants was up to two minimum wages.

Comparing the results found with sociodemographic data from the IBGE, a similarity with the profile of the Brazilian population in general can be noted, with a predominance of women. In age groups, young adults between 20 and 40 years old are the majority of the Brazilian population (BRAZIL, 2019).

RISK FACTORS ASSOCIATED WITH COVID-19

The most significant risk factors among participants were pre-existing diseases (endocrine and cardiovascular), overweight or obesity, and being elderly.

There are several factors related to increased risk in COVID 19 patients. The three most frequent risk factors related to deaths from COVID-19 in Brazil are heart disease, diabetes mellitus and obesity (BENITO; et al, 2021). Another survey showed the following results for risk factors, chronic cardiovascular diseases – including Systemic Arterial Hypertension (52%), Diabetes Mellitus (24%), Smoking (15%) and Obesity (14%). Identifying these risk factors is important as it allows better organization of health policies, especially those with a preventive focus (KLOKNER; et al, 2021).

Among the participants, 7.28% (n=34) had endocrine diseases, such as diabetes mellitus and 6.00% (n=28) had cardiovascular diseases. The participants' BMI demonstrated overweight with the mean and standard deviation of 25.95 ±4.90 (n=464). According to the Ministry of Health, among the main risk factors for COVID-19 are obesity, cardiomyopathies of different etiologies (heart failure, ischemic cardiomyopathy, etc.), arterial hypertension, cerebrovascular disease and diabetes mellitus, according to clinical judgment (MINISTRY OF HEALTH, 2022).

When non-parametric tests were performed to assess whether any variable determined the search for medical care among COVID-19 patients, it was observed that being elderly was not a determining factor for Covid-19 patients to seek medical care *(chi-square =13,059*; *p=0,365*). Using continuous medications did not influence participants to seek medical attention (*chi-square =7,261 with p=0,064*). And having a pre-existing disease was also not a determinant for seeking medical care among participants in this study (chi-square=6.579 with p=0.087).

Other studies show that the search for medical care during the Coronavirus infection, in most cases, was driven by the symptomatology (BRAZIL; et al, 2021). Another motivation for seeking medical care was having chronic diseases (MACINKO, et al. 2020).

The results showed that 32.98% (n=154) of the patients had contact with the COVID-19 virus more than once, which means that the individuals had the opportunity to produce defenses against some antigens. In the case of vaccines, 94.86% (n=443) took at least two doses of the vaccine and with that the antigens were also presented.

Considering that the immune system is primarily responsible for fighting the Coronavirus, all exposure to antigens stimulates the body to produce an immune response. Exposure to viral antigens can occur through vaccines or the development of pathology (DE CHIARA; et al, 2020). There is a consensus in the scientific community that

vaccination campaigns help prevents millions of deaths and control the evolution of various diseases. Thus, vaccination is essential to reduce the risk of developing severe forms of the disease (SILVA, et al, 2021).

USE OF HEALTH SERVICES

Of the 467 participants, 33.50% (n=136) said they used medical insurance, 18.97% (n=77) reported using the private health service, among COVID-19 cases, 8.62% (n=35) only took the rapid test and approximately 52.71% (n= 214) had access to the public health system (FIGURE 1). This shows that the Unified Health System (SUS) was fundamental in facing the pandemic (IBGE, 2022).

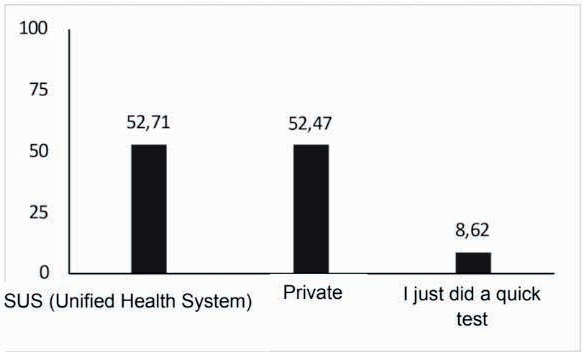

Figure 1: Percentages related to the use of health services used by research participants.

The COVID-19 pandemic showed the importance of the SUS as a universal health system based on the principle of equity and equality and, on the other hand, pointing out the main weaknesses and strengths of the SUS both in facing the COVID-19 pandemic and in its journey towards a more effective universal health system (ASSIS; et al, 2012).

Access to health services is a multifaceted and multidimensional theme involving political, economic, social, organizational, technical and symbolic aspects, in establishing ways for the universalization of care (BONELLO, et al, 2014) Access to health involves dimensions that express the relationship between the offer and individuals: availability of services; accessibility (geographical); reception; purchasing capacity; and, acceptability (MASSUDA; et al; 2021).

In the SUS, even with systems that enable prevention, disease control and the preparation of contingency plans, there was a difficulty for the Public System due to the shortage of laboratory tests, an inevitable measure for diagnosis and anticipation of the patient's prognosis (PAVAN, et al, 2022).

The study shows that 63.60% (n=297) sought access to health services, 16.27% (n=76) were only diagnosed through tests and approximately 8.78% (n=41) sought assistance only in the first infection, while 11.35% (n=53) participants did not seek any type of medical assistance or diagnosis (TABLE 1).

Sought medical care	*f*	%
No, just diagnose	76	16,27
Yes	297	63,60
No, only on the first infection	41	8,78
No, not once	53	11,35
Total	467	100,00

Table 1: Absolute frequencies and percentages on access to health services.

The lack of accurate information about the importance of medical care and proper diagnosis may be related to the lack of seeking medical care when sick. It is important to note that adequate care was essential to avoid a greater number of fatal cases during the COVID-19 pandemic (MINISTRY OF HEALTH, 2021).

HEALTH CONDITIONS DURING COVID-19

Among the participants, 52.46% (n=245) reported that they only had the diagnosis of COVID-19 and did not undergo any type of medical follow-up during the infection

(TABLE 2). According to the Ministry of Health (MS), most patients have mild or moderate symptoms and do not require medical follow-up (MINISTRY OF HEALTH, 2021), possibly this may be the explanation for most participants reporting only a diagnosis of the disease.

The pandemic brought about changes in health systems, adaptations were necessary to provide care to all patients, the teleconference between doctors and patients is one of the adaptations carried out since the beginning of 2020 to better assist the Brazilian population (MACINKO, et al. 2020).

The person had medical follow-up	*f*	%
No, I just made the diagnosis	245	52,46
Yes, remote consultation	76	16,27
Yes, personnally	146	31,26
Total	467	100,00

TABLE 2: Absolute frequency and percentage of medical follow-up of participants during COVID-19

The results of the research showed that when added together, 85.44% (n=399) of the participants were asymptomatic, had mild or moderate symptoms, that is, data close to the estimates of the Ministry of Health (MINISTRY OF HEALTH, 2021) indicating that this group possibly, when necessary, she underwent outpatient follow-up (TABLE 3).

Complication	*f*	%
No, I was asymptomatic	48	10,28
Mild symptoms	204	43,68
Moderate symptoms	147	31,48
Severe symptoms without hospitalization	58	12,42
Severe symptoms with hospitalization	10	2,14
Total	467	100,00

TABLE 3: Absolute and percentage frequency of health complications reported by participants during COVID-19

According to the Ministry of Health (MS) the majority (80%) of patients with covid-19 will have clinical conditions with mild or moderate symptoms. Around 15% of patients may develop severe symptoms and about 5% may present the critical form of the disease and require intensive care (MINISTRY OF HEALTH, 2021).

It was observed that 70.66% (n=330) of the study participants reported that they used some medication during the COVID-19 infection, among these medications the most used classes were: Antimicrobials 43.07% (n=118), Antipyretics 28.47% (n=78) and Analgesics 21.53% (n=59). A significant number of participants, suggesting that many individuals self-medicated in search of symptom relief.

The National Health Council (CNS) informs in the Brazilian Guidelines for Outpatient Medication Treatment of Patients with Covid-19, that there are no specific medications recommended routinely for the treatment of outpatients with Covid-19. Thus, most outpatient treatments will be done only for symptomatic relief as shown in the research (LIMA; et al, 2020).

LABORATORY FOLLOW-UP

Of the respondents, 64.88% (n=303) did not monitor laboratory parameters during the COVID19 infection. Among the participants who underwent a complementary exam to the diagnosis, the predominance was: Complete Blood Count 38.54% (n=180), Inflammatory Markers (C-Reactive Protein and LDH) 12.42% (n=58), Coagulogram (Dimer- D and Prothrombin Time) 7.49% (n=35) (FIGURE 2).

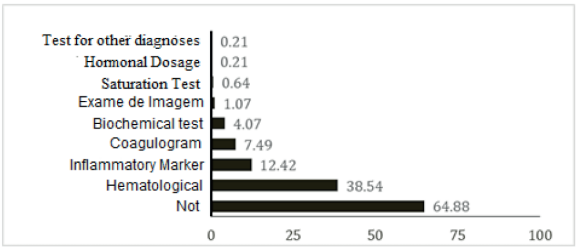

Figure 2: Monitoring of laboratory parameters during COVID19 infection through tests performed.

Due to the scarcity of supplies during the critical period of the pandemic, a more careful monitoring of patients with a more severe condition was possibly prioritized (HAYIROĞLU; et al, 2020). But it is known that complementary laboratory tests are essential to confirm the diagnosis and indicate a possible prognosis (TIAGO, 2021).

Among the participants, only 10.92% (n=51) repeated some laboratory test even during the COVID-19 infection. The Complete Blood Count and Diagnostic Tests had the same percentage 38.24% (n=13), while 26.47% (n=9) of the repeated tests was some inflammatory marker (FIGURE 3).

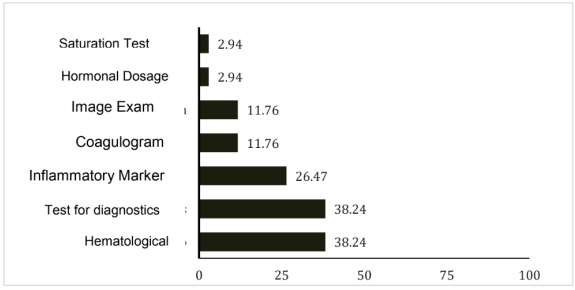

Figure 3: Follow-up of laboratory parameters during COVID-19 infection through repeated examinations during COVID-19.

D-dimer reference values may be related to mortality and the occurrence of pulmonary thromboembolism, one of the major complicating factors of the clinical picture in patients with COVID-19 (CARIA; et al, 2021). Another laboratory parameter involved in the poor prognosis of patients is the Prothrombin Time which, when altered, shows a relationship between the rate of hospitalization in the Intensive Care Unit (ICU) and other complications of the patient's clinical condition. Changes in CRP values were related to the presence of comorbidity, ICU admission (JACINTO, 2020).

The complete blood count is an important tool for monitoring the health conditions of patients in general, providing a picture of white and red cell lines in peripheral blood. The main alterations in the blood count of COVID-19 patients are: absolute lymphopenia, associated with low lymphocytic atypia. It must be noted that lymphopenia is more pronounced in patients with moderate to severe inflammatory conditions, associated with a reduction in the level of hemoglobin and the number of neutrophils (FLUERY, 2020).

Monitoring inflammatory markers such as C-reactive protein (CRP) and lactate dehydrogenase (LDH) may be indicative of a worse prognosis for the disease. The increase in these two biomarkers was observed in hospitalized patients and may be strongly associated with the progression of the infection (ULHAQ; et al, 2020).

CONCLUSION

Therefore, the COVID-19 pandemic posed a challenge for Brazil's health systems. It is important to emphasize that the Unified Health System was fundamental for society in facing the COVID-19 pandemic. This system was responsible for welcoming and caring for the most diverse patients with different socioeconomic profiles.

It must be noted that the pandemic is still ongoing, so we need to be aware of the risks of the disease, the importance of vaccines and the need for public health policies aimed at risk groups, prevention activities and reduction of medium and long-term sequelae term

and greater investments in research to seek increasingly effective and efficient treatments for COVID-19.

As much as the results show that the minority of participants underwent additional tests, it is known that laboratory monitoring is of paramount importance for a better understanding of an infection, especially when it comes to COVID-19, as studies are still scarce. The exams can provide a set of information as tools to aid in the prognosis and understanding of the evolution of the pathology, and help to guide the treatment and monitoring of patients during the course of the disease.

In view of this, the findings help to identify the profile of laboratory tests performed on patients in the public and private network during the Coronavirus infection and provide access to how the care provided to patients during the pandemic occurred so that new strategies can be devised for the future. Through these collected data, it will be possible to enable future comparisons between the variables, so that the characteristics of this profile are better established, contributing to a better understanding of COVID-19.

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