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Monitoring of COVID-19 in medical internship: experience of a federal university (2021-2023)

Seguimiento del COVID-19 en el internado médico: experiencia de una universidad federal (2021-2023)

Monitoramento da COVID-19 no internato médico em uma universidade federal brasileira (2021-2023)

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ABSTRACT

Objective: to estimate the frequency of COVID-19 and clinical symptoms among medical students enrolled in internship. **Method:** descriptive study with a cohort of medical students at a Medical School in Brazil. Data collection lasted from March-2021 to March-2023, starting from the internship's inception, when the monitoring team provided instructions on SARS-CoV2 transmission. An initial form was filled out, and a second form was used for weekly monitoring. **Results:** the study evaluated 520 medical students. The prevalence of COVID-19 was 27.59% (143/520) (suspected cases), and 12.11% (63/520) (positive test). During the monitoring period, 72.5% (377/520) were asymptomatic. Of the suspected cases, 44.05% (63/143) tested positive, 35.66% (51/143) tested negative, and 20.28% (29/143) did not have a test or did not return the weekly monitoring form. Of the students tested, 55.26% (63/114) had a confirmed diagnosis of COVID-19. Statistically significant differences were found in students' complaints regarding fever

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(p=0.023), fatigue (p=0.0037), headache (p=0.042) and loss of taste (p=0.005). **Conclusion:** the study showed a high prevalence of COVID-19, with fever, fatigue, headache, and dysgeusia being the most important symptoms. The protocol of behavioral interventions may be effective for protecting students in any pandemic scenario.
Descriptors: COVID-19; Students, Medical; Internship and Residency; Remote Patient Monitoring; Social Isolation.

RESUMEN
***Objetivo**: estimar la frecuencia de COVID-19 y síntomas clínicos entre estudiantes de medicina matriculados desde el inicio de su internado. **Método**: se realizó un estudio descriptivo en un grupo de estudiantes de prácticas médicas de una Facultad de Medicina de Brasil. El equipo de monitoreo hizo la recolección de datos desde marzo/2021 hasta marzo/2023, con instrucciones que suministraron instrucciones sobre la transmisión del SARS-CoV2. Se utilizaron dos formularios: uno inicial y otro de seguimiento semanal. **Resultados**: de los 520 estudiantes evaluados, la prevalencia de casos sospechosos de COVID-19 fue del 27,59% (143/520) y de pruebas positivas fue del 12,11% (63/520). Durante el período de seguimiento, el 72,5% (377/520) fueron asintomáticos. De los casos sospechosos, el 44,05% (63/143) fueron positivos, el 35,66% (51/143) negativos y el 20,28% (29/143) no realizó prueba o no devolvió formulario semanal. Hubo un 55,26% (63/114) diagnóstico confirmado de COVID-19 con diferencias estadísticamente significativas en las quejas de fiebre (p=0,023), fatiga (p=0,0037), dolor de cabeza (p=0,042) y pérdida del gusto (p=0,005). **Conclusión**: el estudio mostró una alta prevalencia de COVID-19 siendo los síntomas mencionados anteriormente los más importantes. El protocolo de intervenciones conductuales puede ser eficaz para proteger a los estudiantes en escenarios de pandemia.*
***Descriptores**: COVID-19; Estudiantes de Medicina; Internado y Residencia; Monitorización Remota de Pacientes; Aislamiento Social.*

RESUMO
***Objetivo**: estimar a frequência de COVID-19 e sintomas clínicos entre estudantes de medicina matriculados a partir do início do internato. **Método**: foi realizado um estudo descritivo em uma coorte de estudantes de internato médico de uma Faculdade de Medicina no Brasil. A coleta de dados durou de março/2021 a março/2023, quando a equipe de monitoramento forneceu instruções sobre a transmissão do SARS-CoV2. Dois formulários foram usados: um inicial e outro usado para monitoramento semanal. **Resultados**: o estudo avaliou 520 estudantes de medicina. A prevalência de casos suspeitos de COVID-19 foi de 27,59% (143/520) e de testes positivos de 12,11% (63/520). Durante o período de monitoramento, 72,5% (377/520) foram assintomáticos. Dos casos suspeitos, 44,05% (63/143) positivaram, 35,66% (51/143) negativaram e 20,28% (29/143) não realizaram o teste ou não retornaram o formulário de monitoramento semanal. Houve 55,26% (63/114) de diagnóstico confirmado de COVID-19 com diferenças estatisticamente significativas nas queixas quanto à febre (p=0,023), fadiga (p=0,0037), dor de cabeça (p=0,042) e perda do paladar (p=0,005). **Conclusão**: o estudo mostrou alta prevalência de COVID-19, sendo os sintomas citados anteriormente os mais importantes. O protocolo de intervenções comportamentais pode ser eficaz para proteger os alunos em cenários de pandemia.*
***Descritores**:* COVID-19; Estudantes de Medicina; Internato e Residência; Monitoramento Remoto de Pacientes; Isolamento Social.

INTRODUCTION

In March 2020, the World Health Organization (WHO) published guidelines to help prevent SARS-CoV-2 transmission in response to the COVID-19 pandemic[1]. In many countries, more than 1.5 billion students- across all levels of education- including university students- had been affected by the suspension of in- person academic institutions activities[2]. According to the United Nations Children's Fund (UNICEF), Brazil ranked fifth globally in terms of the longest duration of school closures during the COVID-19 pandemic[3]. Pedagogical activities were interrupted by Higher Education Institutions (HEIs), which was an important milestone in the implementation of social isolation strategies to protect all students[4].

The COVID-19 pandemic abruptly interfered in the educational process of future doctors, with repercussion on practical activities, redistribution of workloads, and the adaptation of face-to-face activities to the remote model[5]. At same time, medical students reported that they experienced financial difficulties, experiencing health issues, psychological illnesses and anxiety (28%)[6,7]. A study of quality of life during the COVID-19 pandemic involving 310 university students used the WHOQOL, and showed that the physical and psychological domains were highly affected[8].

Proximity with infected patients was associated to risk sevenfold greater to contract SARS-CoV-2 among medical students who visited the index case and the frequency of illness increased in function of proximity of exposure to the patient[9]. Medical interns attend health services every day, and must be aware that be present four or more times a week increases more than three times the risk of COVID-19[10]. On the other hand, the virtual internship imposed several challenges on medical and health education including the difficulty to navigate the virtual environment, professional and social pressures, quality of learning, and the uncertainties in professional identity built in a virtual environment[11].

In August 2020, Brazilian university authorities established protocols to resume mandatory face-to-face internship activities (medical internship) for students enrolled in the last two years of medical school[5]. At that time, there was no vaccine against SARS-CoV-2 approved and available to the general population, and the lack of proven-effective therapies necessitated

measures to prevent and control the transmission of SARS-CoV-2, and to ensure the safe return not only for students but also for others working at hospital environment.

The monitoring strategy, which included immediate quarantine of suspected cases, detection of symptomatic positive cases via confirmatory testing, and the investigation of contacts, was essential for controlling the transmission of the disease in hospitals, families, and social environments[12,13].

Young adults infected with SARS-CoV-2 often exhibited mild or asymptomatic symptoms[14,15]. Social distancing measures aimed at mitigating the spread of COVID-19 among medical internship students have been proposed to protect vulnerable groups most at risk of severe COVID-19 infection[16,17]. Although timely, measures to contain the COVID-19 pandemic have slowed, and threatened the progress and initiatives aimed at achieving the 2030 Agenda for Sustainable Development Goals (SDGs)[18,19].

Considering that the initiatives to face COVID-19 must be extended to all sectors of society, the current study focuses on medical education, and was guided to answer two research questions: (I) What is the prevalence of COVID-19? and (II) what are the clinical features manifested by students infected with COVID-19 during their medical internship? Thus, the objective was to estimate the prevalence of COVID-19 among students in medical internships and to describe the clinical manifestations associated with its suspected cases.

METHOD

This descriptive observational study was conducted with a cohort of medical students prospectively enrolled in a medical internship program between March 2021 and March 2023. During the study period, the main Gamma, Delta and Ômicron viral variants predominated globally[20].The study followed the guidelines established by Strengthening the reporting of observational studies in epidemiology (STROBE)[21].

The Federal Medical School, located in Southeastern Brazil, offers an enrollment of 90 students per academic semester and a 24-month medical internship program comprising mandatory rotational training in the fields of Clinical Medicine, General Surgery, Pediatrics, Gynecology and Obstetrics, Mental Health and Primary

Care, as well as training in elective fields chosen by the student. The research location was selected based on authors' academic and professional affiliation with the institution, which facilited both execution of the study and the data collection process.

Study participants were recruited prospectively at the beginning of each academic semester's internship program from March 2021 to March 2023. All incoming students were eligible to participate in the study. They received an invitation via an electronic newsletter sent to their e-mail addresses, which were provided by the Medical School's COVID-19 Monitoring Committee. Medical students under aged 18 years old were excluded. Students who refused to participate also were excluded (n=7). The study population comprised 520 students.

Prior to the commencement of the internship activities, all medical students attended theoretical and practical classes that covered COVID-19 topics such as transmission, handwashing techniques, and the use of personal protective equipment (PPE).

The date of admission to the internship program marked the beginning of the students' weekly monitoring process.

Data collection instruments were developed using Google Forms. The initial form was sent to all participants to be filled out when they joined the internship program. Students who exhibited COVID-19 symptoms at any time during the internship were considered as having a suspected infection and were advised to undergo a COVID test, refrain from participating in internship practical activities and fill out a weekly version of the monitoring form. The same form was used to control the clinical evolution of the participants, as well as to collect information about their symptoms and laboratory results. All participants with suspected infection were instructed to return the correctly-filled monitoring questionnaire.

Variables of interest included: a) socio-demographic aspects and lifestyle: gender, age, sharing the same house (cohabitation), having private health insurance, engaging in physical activity, smoking habits, and alcohol consumption; b) COVID-19 symptoms: cough, fever, fatigue, sore throat, body pains, joint pains, headache, nasal congestion/runny nose, anosmia, dysgeusia, diarrhea, vomiting/nausea, and breathlessness/dyspnea; c) comorbidities: high blood pressure, immunodeficiency, diabetes, peripheral

arterial disease, dyslipidemia, asthma, and obesity.

The data were analyzed considering three subgroups formed based on the COVID-19 diagnostic method: (i) the COVID group with a positive test (participants showing COVID-19 symptoms and positive RT-PCR results), (ii) the COVID group with a negative test (participants showing COVID-19 symptoms and negative RT-PCR results), (iii) the COVID group with an unknown test (participants showing COVID-19 symptoms but with no information about the COVID-19 test).

Descriptive statistics were performed to estimate the prevalence of COVID-19 among internship students. Absolute and relative frequencies were used to describe categorical variables, and comparisons between groups were conducted via the Pearson's chi-square test or Fisher's exact test with a significance level of 5%. Means and standard deviations (SD) were obtained for continuous numerical variables, and statistical differences were assessed via Student's t-test with a significance level of 5%.

The study was conducted in accordance with the ethical recommendations for scientific research involving human beings in Brazil. The study protocol was approved by the Research Ethics Committee of the Higher Education Institution, with the registration of the Certificate of Presentation of Ethical Appreciation (CAAE) with file number: 44666621.2.0000.5243. All medical students participating in this study signed an Informed Consent Form prior to any study procedure.

RESULTS

The study assessed 520 students enrolled in a medical internship program. Regardless of the diagnostic method used, the prevalence of COVID-19 was estimated to be 27.59% (143/520), whereas when only students with positive test results were considered, the prevalence was 12.11% (63/520). The mean age of the students was 25.35 years (SD: 3.73 years). There was a slight predominance of males (50.58% vs 49.42%) and students under 25 years of age (51.35% vs 48.65%). There was no difference in mean age between male (25.35 years) and female (25.35 years) groups (p-value:0.991) (Table 1).

Table 1 - Characteristics of medical internship students monitored during the COVID-19 pandemic, Brazil, 2021-2023.

Features	Total (n=520)	Male (n=263)	Female (n=257)
Age			
< 25 years	267 (51.35%)	137(52.09%)	130 (50.58%)
≥ 25 years	253 (48.65%)	126 (47.91%)	127 (49.42%)
Living			
With friends	216 (41.54%)	110 (41.83%)	106 (41.25%)
With family	225 (43.27%)	107 (40.68%)	118 (45.91%)
Alone	72 (13.85%)	42 (15.97%)	30 (11.67%)
No information	7 (1.35%)	4 (1.52%)	3 (1.17%)
Private Health Insurance			
Yes	339 (65.19%)	160 (60.84%)	179 (69.65%)
No	174 (33.46%)	100 (38.02%)	74 (28.79%)
No information	7 (1.35%)	3 (1.14%)	4 (1.56%)
Smoking			
Yes	28 (5.38%)	23 (8.75%)	5 (1.95%)
No	482 (92.69%)	235 (89.35%)	247 (96.1%)
No information	10 (1.92%)	5 (1.90%)	5(1.95%)
Physical Activity			
Yes	370 (71.15%)	198 (75.29%)	172 (66.93%)
No	140 (26.92%)	60 (22.81%)	80 (31.13%)
No information	10 (1.92%)	5 (1.90%)	5 (1.95%)
Alcohol Consumption			
Yes	99 (19.04%)	49(18.63%)	50 (19.84%)
No	411 (79.04%)	209 (79.47%)	202 (80.16%)
No information	10 (1.92%)	5 (1.90%)	5 (1.95%)

During the internship, 72.5% (377/520) of the students had no symptoms related to COVID-19, of which 27.59% (143/520) were classified as suspected cases. In total, 63 (44%) students belonging to the group of 143 "suspected cases" tested positive for COVID-19, 51 (35.66%) students tested negative, and 29 (20.28%) students did not take the test or did not submit it via the weekly form. Of the total number of students who received laboratory testing, 55.26% (63/114) were confirmed with COVID-19 disease (Table 2).

Table 2 - Characteristics of 143 medical students considered suspected cases, following COVID-19 test categorization, Brazil, 2021-2023.

Variables	Total of suspected cases *(n=143)*	Positive Test *(n=63)*	*Negative* Test *(n=51)*	Unknown Test *(n=29)*
Age				
< 25 years	70 (48.95%)	33 (52.38%)	25 (49.02%)	12 (41.38%)
≥ 25 years	73 (51.05%)	30 (47.62%)	26 (50.98%)	17 (58.62%)
Living				
With friends	58 (40.56%)	23 (36.51%)	24 (47.06%)	11 (37.93%)
With family	60 (41.96%)	30 (47.62%)	19 (37.25%)	11 (37.93)%)
Alone	18 (12.59%)	7 (11.11%)	7 (13.73%)	4 (13.79%)
No information	7 (4.90%)	3 (4.76%)	1 (1.96%)	3 (10.34%)
Private Health Insurance				
Yes	90 (62.64%)	44 (69.84%)	30 (58.82%)	16 (55.17%)

Continuation (Table 2)

No	47 (32.87%)	17 (26.98 %)	20 (39.22 %)	10 (34.48%)
No information	6 (4.2%)	2 (3.17%)	1 (1.96%)	3 (10.34%)
Smoking				
Yes	7 (4.9%)	3 (4.76%)	4 (7.84%)	0
No	127 (88.81%)	55 (87.30%)	46 (90.20%)	26 (89.66%)
No information	9 (6.29%)	5 (7.94%)	1 (1.96%)	3 (10.34%)
Physical Activity				
Yes	96 (67.13%)	38 (60.32%)	38 (74.51%)	20 (68.97%)
No	38 (26.57%)	20 (31.75%)	12 (23.53%)	6 (20.69%)
No information	9 (6.29%)	5 (7.94%)	1 (1.96%)	3 (10.34%)
Alcohol Consumption				
Yes	26 (18.18%)	7 (11.11 %)	11 (21.57%)	8 (27.59%)
No	108 (75.52%)	51 (80.95%)	39 (76.47%)	18 (62.07%)
No information	9 (6.29%)	5 (7.94%)	1 (1.96%)	3 (10.34%)

Internship monitoring detected statistically significant differences among the COVID-19 testing groups regarding the frequency of symptoms such as fever (p=0.023), fatigue (p=0.037), headache (p=0.042), and dysgeusia (p=0.005). The COVID-19 diagnostic subgroup-based symptoms are shown in Table 3.

Table 3 - Symptoms reported by 143 medical internship students classified in COVID-19 diagnostic subgroups, Brazil, 2021-2023.

Symptoms	**Suspected cases**	**COVID-19 Test**			*p-value*
	*Total (n=140)	Positive (n=62)	Negative (n=49)	Unknown (n=29)	
Cough					0.229
Yes	97 (69.29%)	44 (70.97%)	30 (61.22%)	23 (79.31%)	
No	43 (30.71%)	18 (29.03%)	19 (38.78%)	6 (20.69%)	
Fever					**0.023**
Yes	54 (38.57%)	31 (50%)	12 (24.49%)	11 (37.93%)	
No	86 (61.43%)	31 (50%)	37 (75.51%)	18 (62.07%)	
Fatigue					**0.037**
Yes	85 (60.71%)	45 (72.58%)	25(51.02%)	15(51.72%)	
No	55 (39.29%)	17 (27.42%)	24 (48.98%)	14 (48.28%)	
Sore throat					0.866
Yes	101(72.14%)	46 (74.19%)	35 (71.43%)	20(68.97%)	
No	39 (27.86%)	16 (25.81%)	14 (28.57%)	9 (31.07%)	
Body pain					0.062
Yes	72 (51.43%)	38 (61.29%)	19 (38.78%)	15 (51.72%)	
No	68 (48.57%)	24 (38.71%)	30 (61.22%)	14 (48.28%)	
Joint pain					0.473
Yes	11 (7.86%)	6 (9.68%)	2 (4.08%)	3 (10.34%)	
No	129 (92.14%)	56 (90.32%)	47 (95.92%)	26 (89.66%)	
Headache					**0.042**
Yes	82 (58.57%)	37 (59.68%)	23 (46.94%)	22 (75.86%)	
No	58 (41.43%)	25 (40.32%)	26 (53.06%)	7 (24.14%)	
Nasal congestion/Runny nose					0.827
Yes	124 (88.57%)	56 (99.32%)	43 (87.76%)	25 (86.21%)	
No	16 (11.43%)	6 (9.68%)	6 (12.24%)	4 (13.79%)	
Loss of smell					0.192
Yes	17 (12.14%)	11 (17.74%)	4 (8.16%)	2(6.90%)	
No	123 (87.86%)	51 (82.26%)	45 (91.84%)	27 (93.10%)	

Continuation (Table 3)

Dysgeusia					**0.005**
Yes	13 (9.29%)	11 (17.74%)	0	2 (6.90%)	
No	127 (90.71%)	51 (82.26%)	49 (100%)	27 (93.10%)	
Diarrhea					0.169
Yes	21 (15%)	13 (20.97%)	4 (8.16%)	4 (13.79%)	
No	119 (85%)	49(79.03%)	45 (91.84%)	25(86.21%)	
Vomiting/Nausea					0.079
Yes	16 (11.43%)	11 (17.74%)	2 (4.08%)	3 (10.34%)	
No	124 (88.57%)	51 (82.26%)	47 (95.92%)	26 (89.66%)	
Shortness of breath					0.219
Yes	5 (3.57%)	3 (4.84%)	0	2 (6.90%)	
No	135 (96.43%)	59 (95.16%)	49 (100%)	27 (93.10%)	

*Absence of information about symptoms (n=3)

These medical students monitored for COVID-19 did not report any cardiovascular comorbidities or chronic liver disease. Investigation of other comorbidities did not show statistically significant differences among the COVID-19 diagnostic subgroups (Table 4).

Table 4 - Comorbidities reported by 143 medical internship students classified in COVID-19 diagnostic subgroups, Brazil, 2021-2023.

Comorbidities	**Suspected cases**	**COVID-19 Test**			***p-value***
	Total (n=143)	Positive (n=63)	Negative (n=51)	Unknown (n=29)	
Hypertension					0.547
Yes	2 (1.4%)	1 (1.59%)	1 (1.96%)	0	
No	133 (93.01%)	58 (92.06%)	49 (96.08%)	26(89.66%)	
No information	8 (5.59%)	4(6.35%)	1(1.96%)	3 (10.34%)	
Immunodeficiency					0.149
Yes	1(0.7%)	0	0	1 (3.45%)	
No	133(93.01%)	58(92.06%)	50 (98.04%)	25 (86.21%)	
No information	9 (6.29%)	5 (7.94%)	1 (1.96%)	3(10.34%)	
Diabetes					0.423
Yes	1 (0.70%)	1 (1.59%)	0	0	
No	134 (93.71%)	58 (92.06%)	50 (98.04%)	26 (89.66%)	
No information	8 (5.59%)	4 (6.35%)	1 (1.96%)	3 (10.34%)	
Peripheral Arterial Disease					0.156
Yes	1 (0.7%)	0	0	1 (3.45%)	
No	134 (93.71%)	59 (93.65%)	50(98.04%)	25 (86.21%)	
No information	8 (5.59%)	4 (6.35%)	1 (1.96%)	3 (10.34%)	
Dyslipidemia					0.447
Yes	3 (2.1%)	0	2 (3.92%)	1 (3.45%)	
No	130 (90.91%)	58(92.06%)	47(92.16%)	25 (86.21%)	
No information	10 (6.99%)	5 (7.94%)	2 (3.92%)	3 (10.34%)	
Asthma					0.343
Yes	12 (8.39%)	5 (7.94%)	6 (11.76%)	1(3.45%)	
No	121 (84.62%)	52 (82.54%)	44(86.27%)	25(86.21%)	
No information	10 (6.99%)	6 (9.52%)	1 (1.96%)	3 (10.34%)	
Obesity					0.390
Yes	5 (3.5%)	2 (3.17%)	1 (1.96%)	2 (6.90%)	
No	130 (90.91%)	57 (90.48%)	49(96.08%)	24 (82.76%)	
No information	8 (5.59%)	4 (6.35%)	1 (1.96%)	3 (10.34%)	

DISCUSSION

In the current study, the prevalence of SARS-Cov-2 infection (confirmed by positive COVID-19 test results) was 12.1% (63/520) among weekly monitored medical students. This prevalence reached 44% (63/143) when only symptomatic students were considered.

A study in Porto Alegre, Brazil, involving four medical schools detected the prevalence of COVID-19 of 14.9% among medical students, interns and residents. Among interns, the frequency was slightly higher (14.4%) than that found in the current study (12.1%)[10]. Similarly, study conducted in University of Jordan showed that 13% students tested positive for COVID-19 with higher prevalence among clinical students (15.2%) compared to pre-clinical students (11.2%)[22].

Prior to the spread of the Omicron variant, the prevalence of COVID-19 was estimated to be 3.7%, and among American students it was 60.3%[23,24]. Healthcare professionals were more likely to be infected with COVID-19. The prevalence of confirmed cases in the current study (12.1%) was lower than that reported among health professionals, whose frequency of infection reached 21.5%[25-27].

However, measurements of all symptomatic cases (both confirmed and suspected cases) recorded a prevalence of 27.5%. At least two factors could explain the lower values observed: adherence to the recommendations outlined in the protocols mentioned herein and a favorable epidemiological scenario during the timeframe of the investigation (characterized by a decline in the number of confirmed COVID-19 cases and associated deaths).

A previous study conducted in Germany during the pre-vaccine period recorded a 2.7% COVID-19 prevalence among basic education students[28], whereas another study conducted in more than 100 English schools reported a COVID-19 prevalence of 1.2% and 1.3% in students and employees, respectively[29].

Students with COVID-19 symptoms who tested positive were kept away from participating in practical activities and were supervised by a monitoring committee. A study conducted in California demonstrated that a positive COVID-19 test was 12.7 times higher among symptomatic participants, suggesting that integrated monitoring systems are effective in

identifying at-risk students to SARS-CoV-2 testing[30].

A statistically significant difference was observed between COVID-19 positivity and the presence of specific symptoms, including fever, fatigue, headache, and dysgeusia. Recent studies suggested that olfactory and taste disorders may remain a diagnostic marker of suspicion of SARS-CoV-2 infection[31,32].

Clinical manifestations may vary in patients with COVID-19 infection. Symptoms affecting the overall population include fever, fatigue, cough, headache, dyspnea, and diarrhea[33]. A study conducted in Italian young adults demonstrated that fever, cough, dyspnea, fatigue, anosmia, diarrhea, and chest pain were the most common COVID-19 symptoms[34].

A significant difference in dysgeusia symptoms (24%) was observed between the positive and negative COVID-19 groups[35]. This finding suggests that dysgeusia is an important symptom with positive predictive value for COVID-19 infection. Several studies have reported that the prevalence rate of dysgeusia ranges from 8.5% to 15% in patients with positive COVID-19 test results[36-39].

The emergency of new SARS-CoV-2 variants e successive waves underscore the importance of monitoring cases in medical students during the return to educational activities. Evidence indicates that educational settings may serve as amplifiers of viral transmission, increasing the risk of outbreaks and consequent institutional closures[40]. In Brazil, universities remained closed for more than one year-one of the longest interruptions worldwide[41].

A systematic review in healthcare workers identified that not washing hands constantly, use personal protective equipment (PPE) insufficient or inadequately and working in high-risk areas, were the independent risk factors for COVID-19 infection[42]. These findings highlight the critical importance of consistent and appropriate use of PPE at all times in hospital.

The safety protocol implemented during this public health emergency has now been incorporated into the daily routine of students prior to the start of their medical internship, with an emphasis on a 96% adherence rate among students. A Brazilian multicenter study conducted in healthcare professionals demonstrated high adherence to standard precautions-

measures for hygiene, infection control, and prevention of occupational exposures during the COVID-19 pandemic[43].

The combination of the type of SARS-CoV-2 virus transmission and the university environment was a contributing factor to the high rate of COVID-19 transmission among students circulating in hospital wards, outpatient clinics, classrooms, libraries, and school canteens[44-47]. Protecting the university community was essential to reduce the risk of COVID-19 transmission in the most vulnerable groups[16,48].

Although still limited, Brazilian literature has begun to explore the clinic manifestations and prevalence o COVID-19 among medical students with multicentric study report higher infection rates among residents and interns than in undergraduate students[10].

The impact caused by the COVID-19 pandemic required universities to adopt public health measures to help mitigate the emergence of new cases. The monitoring committee provided an email-based communication channel for students to be notified when the initial symptoms of an infection appeared. Suspected COVID-19 cases were advised not to attend university facilities for 10 days[49] and to undergo RT-PCR testing for SARS-CoV-2 and seek medical care.

The current study has limitations. First, it is based on a cohort of students enrolled in a medical internship program, whose results do not reflect the frequency of this disease in the basic and clinical cycles. However, it is assumed that this experience can be used to guide measures generally applicable to medical school programs. Moreover, there were symptomatic students who did not undergo diagnostic testing as instructed by the monitoring committee. This factor reduced the diagnostic accuracy of suspected cases. However, the study outlined the COVID-19 clinical profile of students by creating unknown test subgroups.

CONCLUSION

The weekly monitoring of medical students coupled with diagnostic tests proved that the prevalence of COVID-19 infection among medical internship students was higher than 10%. In addition, 44% of the students belonging to the suspected group, presented a test positive for COVID-19. This study contributes to the development of planning strategies that can mitigate the transmission of

infectious diseases in university environments. Moreover, the study reported that protocols covering behavioral, monitoring, and diagnostic-test interventions are determining factors for in-person activities to be carried out in pandemic scenarios.

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