COVID-19 monitoring in workers at a Brazilian public university: a retrospective cohort study

Monitoramento da COVID-19 em trabalhadores de uma universidade pública brasileira: um estudo de coorte retrospectivo

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ABSTRACT

Introduction: primary care action strategies are relevant for disease prevention and health promotion, as well as for the initial management of suspected cases and the individual monitoring of patients with confirmed diagnoses of COVID-19. This study aimed to evaluate the outcome of clinical worsening and demographic, occupational, and clinical variables of workers with COVID-19 in a community health center at a public university in southeastern Brazil. **Methods**: a retrospective cohort study was conducted with 1,459 symptomatic workers with COVID-19. Data were extracted from the database of the unit's epidemiological surveillance center between March 2020 and March 2021. **Results:** The average age of participants was 41.1 (SD 10.8) years, most women (71.1%), who had obesity (19.9%) and hypertension (17.0%). Among the symptoms, headache (75.3%) and cough (74.9%) stood out. The worsening of clinical outcome during follow-up occurred in 3.4% of cases. The demographic, occupational and clinical factors associated with clinical worsening were gender, professional category, hypertension, diabetes mellitus, obesity, dyslipidemia, olfactory disorders, cough, fever, and dyspnea. The Poisson regression showed that the prevalence of clinical worsening was greater with age, obesity, fever, and dyspnea. **Conclusion**: Clinical worsening occurred in 3.4% of the cases and was more prevalent according to age, obesity, fever, and dyspnea. The follow-up has shown promise in the early detection and treatment of COVID-19.

Keywords: Epidemiology, COVID-19, SARS-CoV-2, Primary health care.

RESUMO

Introdução: as estratégias de ação da atenção primária são relevantes para a prevenção de doenças e promoção da saúde, bem como para o manejo inicial de casos suspeitos e acompanhamento individual de pacientes com diagnóstico confirmado de COVID-19. Este estudo teve como objetivo avaliar o desfecho da piora clínica e variáveis demográficas, ocupacionais e clínicas de trabalhadores com COVID-19 em um centro comunitário de saúde de uma universidade pública do sudeste do Brasil. **Métodos:** estudo de coorte retrospectivo com 1.459 trabalhadores sintomáticos com COVID-19. Os dados foram extraídos do banco de dados do núcleo de vigilância epidemiológica da unidade entre março de 2020 e março de 2021. **Resultados:** A média de idade dos participantes foi de 41,1 (DP 10,8) anos, sendo a maioria mulheres (71,1%), com obesidade (19,9%) e hipertensão (17,0%). Dentre os sintomas, destacaram-se a cefaleia (75,3%) e a tosse (74,9%). A piora do quadro clínico durante o seguimento ocorreu em 3,4% dos casos. Os fatores demográficos, ocupacionais e clínicos associados à piora clínica foram sexo, categoria profissional, hipertensão arterial, diabetes mellitus, obesidade, dislipidemia, distúrbios do olfato, tosse, febre e dispneia. A regressão de Poisson mostrou que a prevalência de piora clínica foi maior com a idade, obesidade, febre e dispneia. **Conclusão:** A piora clínica ocorreu em 3,4% dos casos e foi mais prevalente conforme idade, obesidade, febre e dispneia. O acompanhamento mostrou-se promissor na detecção precoce e no tratamento da COVID-19.

Palavras-chave: Epidemiologia, COVID-19, SARS-CoV-2, Atenção primária à saúde.

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INTRODUCTION

The 2019 coronavirus disease pandemic (COVID-19) caused by SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2) is a public health emergency with an overwhelming impact on the health of the global population. Since the detection of SARS-CoV-2 in Hubei, Wuhan Province, China, in December 2019, efforts have been directed towards understanding its transmissibility, pathogenicity, clinical course, and treatment.[1] Until February 20, 2023, more than 750 million people have been infected with the virus worldwide and deaths exceed four million.[2]

Brazil was the first country in South America to report a confirmed case of COVID-19[3], which occurred on February 26, 2020. Until February 24, 2023, Brazil had more than 37 million confirmed cases and more than 698,000 deaths, with a fatality rate of 1.9%.[4]

COVID-19 is a potentially serious acute respiratory infection with high transmissibility, global distribution, and unpredictable clinical course.[5] It can be asymptomatic or manifest itself in different ways: mild, moderate, severe, critical, and fatal. In the mild form, which accounts for approximately 80% cases, and the most common clinical manifestations are fever, fatigue, dry cough, anosmia, ageusia, and gastrointestinal manifestations, such as nausea, vomiting, and diarrhea.[6,7] In the moderate form, which accounts for approximately 15% of cases, symptoms are more intense, such as dyspnea, cough, and no noticeable hypoxia.[7] Severe conditions, which affect approximately 5% of all cases, are characterized by worsening of the respiratory condition, severe pneumonia, hypoxemia, and fever,[7] with complications, such as respiratory failure, sepsis and septic shock, thromboembolism and/or multiple organ failure, including acute liver or heart damage, requiring intensive care.[8]

The conditions and risk factors associated with a higher probability of serious conditions, possible complications, and worse prognosis are age greater than or equal to 60 years, smoking, obesity, cardiomyopathies, hypertension, cerebrovascular disease, chronic obstructive pulmonary disease, and diabetes mellitus (DM), among others.[9]

Primary care action strategies are relevant for disease prevention and health promotion, as well as for the initial management of suspected cases and the individual monitoring of patients with confirmed diagnoses of COVID-19, identifying warning signs for adequate guidance/management, and minimizing unfavorable outcomes. In addition, interventions are urgent for the management of post-COVID-19 cases[10], including those in primary health services, in which simultaneous approaches of the pre-existing and emerging comorbidities resulting from COVID-19 have been nominated.[11]

It is expected that the mapping and understanding of the epidemiological characteristics of COVID-19 in these workers support guidelines and public health strategies that can be replicated with a view to better managing the impact of COVID-19 on the health of the population.

Thus, considering the relevance of monitoring confirmed COVID-19 cases from population strata treated at a primary health care service, this study aimed to evaluate the outcome of clinical worsening and demographic, occupational, and clinical variables of workers with COVID-19 in a community health center at a public university in southeastern Brazil.

METHODS

A retrospective cohort study was carried out between March 2020 and March 2021. All the attendees who met the following criteria were selected: symptomatic active workers with COVID-19, aged 18 years or over, attending a community health center of a public university in southeastern Brazil. The final sample consisted of 1,459 participants. The service provides free outpatient care for students, faculty, and non-teaching staff, with services in dentistry, physical therapy, mental health, physicians in various specialties and nursing; as well as programs and groups that work in health promotion and disease prevention.

The documentary research included the use of secondary data available from different sources: 1) the health file of confirmed cases of COVID-19, which is detailed on the monitoring

spreadsheet of the epidemiological surveillance center (ESC) of that service; 2) the flu syndrome notification form from the National Notification system (https://notifica.saude.gov.br/login) on the first visit to workers suspected of having COVID-19, with 3) additional data gathered from their monitoring by the ESC.

In this study, the "monitoring period" was defined as the period after the worker's first visit to the community health center, when they were notified about the laboratory confirmation of COVID-19 by the Reverse transcription polymerase chain reaction (RT-PCR) nasal and pharyngeal swab test until the resolution of symptoms. Conversely, "the follow-up period" corresponds to the whole evaluation period, including the worker's first visit to the community health center.

Variables of interest in the search for documents were the total number of notification records; demographic, occupational, and clinical profile: age (in years), gender (female and male), professional category (health care worker or general worker), high blood pressure (yes or no), diabetes mellitus (yes or no), obesity (yes or no), dyslipidemia (yes or no), lung disease (yes or no), cardiovascular disease (yes or no), smoking (non-smoker, smoker, or ex-smoker); presenting symptoms: cough (yes or no), fever (yes or no), dyspnea (yes or no), sore throat (yes or no), headache (yes or no), coryza (yes or no), gustatory disorders (yes or no), olfactory disorders (yes or no), others (yes or no), and clinical outcome (improvement or worsening).

Symptoms were collected in person at the health service on the first visit when the cases were reported. During the monitoring period, reported cases were monitored by the nursing staff by telephone contact, as recommended by the COVID-19 Epidemiological Surveillance Guide.[12] The outcomes were categorized as clinical improvement or worsening. The regression of symptoms without the need for hospitalization was considered clinical improvement and the occurrence of hospitalization or death was defined as clinical worsening.

Data were entered into an electronic spreadsheet (Excel®), transferred, and analyzed using the Statistical Analysis System 9.4 (SAS) software with the help of the institution's statistician. Descriptive and inferential analysis were used. To test for possible associations between qualitative variables, the Chi-square test was applied.[13] For cases where the assumptions of the Chi-square test were not met, Fisher's exact test was applied.[14] Two modified multiple Poisson regression models[15] with robust variance were constructed, considering the clinical outcome as a dependent variable. In the first model, variables of the demographic, occupational, and clinical profile were considered independent, and in the second model, symptoms were considered as independent variables. In these models, prevalence ratio (PR) estimates are presented, as well as their confidence intervals and p-values. For the analysis, a significance level of 5% was adopted.

This study was approved by the local Research Ethics Committee (Document number: 45538121.3.0000.5404).

RESULTS

During the study period, 8,169 people from the university community were tested for SARS-CoV-2, and of these, 1,857 had a positive sample for SARS-CoV-2. Three hundred and ninety-eight cases were excluded because they did not meet the inclusion criteria, being: 261 students, 39 retired workers, 05 under 18 years old, and 93 for being asymptomatic.

The time elapsed between the onset of symptoms and the first visit was 3.3 (SD 2.1) days, and the monitoring period ranged from zero to 76 days, with a mean of 11 (SD 6.5) days.

Workers included in the study (n=1,459) were characterized by a mean age of 41.1 (SD 10.8) years, ranging from 18 to 76 years, with a predominance of women (71.1%). Obesity was the most common comorbidity (19.9%), followed by hypertension (17.0%). Among participants with worsening clinical outcomes, one (0.1%) died. Table 1 lists the variables of the epidemiological and clinical profile and clinical outcome.

Regarding the presence of symptoms in workers with SARS-Cov2 infection, headache (75.3%) and cough (74.9%) were the main ones. Those most frequently reported during the follow-up period were cough (43.2%),

headache (36.0%), sore throat (21.4%), and olfactory disorders (21.0%). Considered an alert symptom, dyspnea occurred more frequently during monitoring (11.0%). Other symptoms included myalgia (49.6%), tiredness (29.1%), nasal congestion (28.8%), weakness (20.2%), and diarrhea (19.8%) (Table 2).

The professional category and gender variables, as well as the clinical variables such as hypertension, DM, obesity, and dyslipidemia, were associated with the clinical outcome. In the modified multiple Poisson regression model, with robust variance, age and obesity were statistically associated with worsening clinical outcome. The one-year increase in age resulted in a 3% increase in the prevalence of clinical worsening. The probability of obese patients presenting clinical worsening was 2.42 times the probability of non-obese patients presenting clinical worsening (Table 3).

The occurrence of clinical worsening was slightly more prevalent among workers with headache during follow-up, sore throat in the first visit, and those who did not present gustatory disorders and coryza. However, in none of these cases, there was statistical significance.

Olfactory disorders, cough, fever, and dyspnea were associated with the worsening of clinical outcomes. The result of the Poisson regression analysis, with robust variance, indicated that those who reported fever at the first visit, during monitoring, and throughout the follow-up, and

Table 1

Demographic, occupational, and clinical characteristics and clinical outcome of workers infected by COVID-19 from a Brazilian public university (n=1,459)

Variable	n	%
Professional category		
Health worker	1,202	82.4
General worker	257	17.6
Sex		
Male	423	29.0
Female	1,036	71.0
Hypertension		
No	1,211	83.0
Yes	248	17.0
Diabetes Mellitus		
No	1,374	94.2
Yes	85	5.8
Obesity		
No	1,169	80.1
Yes	290	19.9
Dyslipidemia		
No	1,371	94.0
Yes	88	6.0
Lung diseases		
No	1,361	93.3
Yes	98	6.7
Cardiovascular diseases		
No	1,419	97.3
Yes	40	2.7
Smoking		
Non-smoker	1,437	98.5
Smoker	8	0.5
Ex-smoker	14	1.0
Clinical outcome		
Improvement	1,409	96.6
Worsening	50	3.4

Source: Research Data.

Table 2

Occurrence of symptoms in workers infected by COVID-19 according to the first visit, in the monitoring period, and throughout the follow-up (n=1,459)

Symptoms	n	%	First visita		Monitoring Periodb		Follow-up periodc	
			n	%	n	%	n	%
Olfactory disorders								
Yes	491	33.6	23	1.6	161	11.0	307	21.0
Gustatory disorders								
Yes	797	54.6	32	2.2	553	37.9	212	14.5
Sore throat								
Yes	495	58.0	364	27.6	131	9.0	312	21.4
Headache								
Yes	1,098	75.3	322	22.1	251	17.2	525	36.0
Fever								
Yes	595	40.4	364	24.6	94	6.4	137	9.4
Coryza								
Yes	734	50.4	286	19.6	240	16.5	208	14.3
Cough								
Yes	1,093	74.9	260	17.8	203	13.9	630	43.2
Dyspnea								
Yes	264	18.1	76	5.2	161	11.0	27	1.9
Others								
Yes	1,254	85.9	120	8.2	537	36.8	597	40.9

[a]Symptoms presented only in the first visit; [b]Symptoms presented only during monitoring, i.e., after the first visit until outcome; [c]Symptoms presented throughout the follow-up period, which included the first visit until the outcome.
Source: Research Data.

Table 3

Factors associated with the clinical outcome among workers infected by COVID-19 from a Brazilian public university (n=1,459)

Variable	Clinical outcome				p-value	PRa,b	CI95%	p-valueb
	Improvement		Worsening					
	n	%	n	%				
Age	-	-	-		-	1.03	10.01;1.06	0.022
Professional category					0.019c			
Healthcare worker	1,167	97.1	35	2.9		1.00	1.00	
General worker	242	94.2	15	5.8		1.79	0.99;3.23	0.055
Sex					0.039c			
Male	402	95.0	21	5.0		1.48	0.83;2.64	0.182
Female	1,007	97.2	29	2.8		1.00	1.00	
Hypertension					<0.001c			
No	1,181	97.5	30	2.5		1.00	1.00	
Yes	228	91.9	20	8.1		1.41	0.70;2.83	0.330
Diabetes Mellitus					<0.001c			
No	1,335	97.2	39	2.8		1.00	1.00	
Yes	74	87.1	11	12.9		2.05	0.89;4.72	0.092
Obesity					<0.001c			
No	1,142	97.7	27	2.3		1.00	1.00	
Yes	267	92.1	23	7.9		2.42	1.33;4.41	0.003
Dyslipidemia					0.008d			
No	1,329	96.9	42	3.1		1.00	1.00	
Yes	80	90.9	8	9.1		1.13	0.48;2.66	0.775
Lung diseases					1.000d			
No	1,314	96.5	47	3.4		1.00	1.00	
Yes	95	96.9	3	3.1		0.74	0.27;1.99	0.546
Cardiovascular diseases					0.645d			
No	1,371	96.6	48	3.4		1.00	1.00	
Yes	38	95.0	2	5.0		0.97	0.24;4.02	0.969

Note: RP: Prevalence ratio; CI 95%: confidence interval; [a]The prevalence of clinical worsening was estimated; [b]Prevalence ratio and p-value obtained using the modified multiple Poisson regression model, with robust variance; [c]p-value obtained through the Chi-square test; [d]p-value obtained using Fisher's exact test.

Source: Research Data.

dyspnea in the monitoring and throughout the follow-up, had a significantly higher PR of clinical worsening (Table 4)

DISCUSSION

In this retrospective cohort study, the demographic, occupational, and clinical variables, and clinical outcome of workers with a positive sample for SARS-CoV-2, treated in a community health center at a Brazilian public university, were evaluated. It should be noted that this health center is a reference for the entire community of students, faculty, and non-teaching staff and, as a primary care service, it has great importance in the current COVID-19 pandemic since this location is usually the first access in the search for health care.

The sample, consisting of 1,459 workers with COVID-19, was characterized by the predominance of women and university health professionals. Although the number of women affected by COVID-19 was higher, the clinical worsening of the disease tended to be greater in men. In other international surveys, the male gender was associated with a poor prognosis due to many different factors, such as immunological response, social, and behavioral differences.[16,17]

Table 4

Symptoms associated with the clinical course of workers infected by COVID-19 (n=1,459)

Variable	Clinical outcome				p-value	PR[a,b]	CI 95%	p-value[b]
	Improvement		Worsening					
	n	%	n	%				
Olfactory disorders					0.006[c]			
Did not present	575	95.0	30	5.0				
Presented on the first visit	23	100.0	0	0.0				
Presented during monitoring	506	96.6	18	3.4				
Presented throughout follow-up	305	99.4	2	0.6				
Gustatory disorders					0.055[c]			
Did not present	631	95.3	31	4.6				
Presented on the first visit	31	96.9	1	3.1				
Presented during monitoring	537	97.1	16	2.9				
Presented throughout follow-up	210	99.1	2	0.9				
Sore throat					0.393[c]			
Did not present	628	96.3	24	3.7		1.00		
Presented on the first visit	348	95.6	16	4.4		1.11	0.63;1.97	0.709
Presented during monitoring	128	97.7	3	2.3		0.61	0.19;1.91	0.395
Presented throughout follow-up	305	97.8	7	2.2		0.60	0.27;1.36	0.222
Headache					0.766[c]			
Did not present	349	96.7	12	3.3		1.00		
Presented on the first visit	310	96.3	12	3.7		1.00	0.51;1.94	0.994
Presented during monitoring	245	97.6	6	2.4		0.66	0.26;1.69	0.389
Presented throughout follow-up	505	96.2	20	3.8		0.97	0.50;1.90	0.928
Fever					<0.001[d]			
Did not present	856	99.1	8	0.9		1.00		
Presented on the first visit	352	96.7	12	3.3		3.45	1.44;8.23	0.005
Presented during monitoring	83	88.3	11	11.7		7.76	3.17;18.97	<0.001
Presented throughout follow-up	118	86.1	19	13.9		9.69	4.25;22.07	<0.001
Coryza					0.244[c]			
Did not present	695	95.9	30	4.1		1.00		
Presented on the first visit	275	96.1	11	3.9		0.87	0.44;1.69	0.672
Presented during monitoring	236	98.3	4	1.7		0.45	0.17;1.19	0.107
Presented throughout follow-up	203	97.6	5	2.4		0.79	0.34;1.83	0.578
Cough					0.001[c]			
Did not present	365	99.7	1	0.3				
Presented on the first visit	249	95.8	11	4.2				
Presented during monitoring	197	97.0	6	3.0				
Presented throughout follow-up	598	94.9	32	5.1				
Dyspnea					<0.001[d]			
Did not present	1,177	98.5	18	1.5		1.00		
Presented on the first visit	73	96.0	3	4.0		2.31	0.72;7.36	0.157
Presented during monitoring	135	83.9	26	16.1		7.57	4.10;13.95	<0.001
Presented throughout follow-up	24	88.9	3	11.1		4.70	1.38;16.05	0.013
Others					0.050[c]			
Did not present	201	98.0	4	2.0				
Presented on the first visit	119	99.2	1	0.8				
Presented during monitoring	521	97.0	16	3.0				
Presented throughout follow-up	568	95.1	29	4.9				

Note: RP: Prevalence ratio; CI 95%: confidence interval; [a]The prevalence of clinical worsening was estimated; [b]Prevalence ratio and p-value obtained using the modified multiple Poisson regression model, with robust variance; [c]p-value obtained through the Chi-square test; [d]p-value obtained using Fisher's exact test

Source: Research Data.

Other authors who studied the population of health workers reported the predominance of COVID-19 among women[18] and evidenced the greater susceptibility of these professionals to become infected, probably due to increased exposure to the SARS-CoV-2 virus.[19] We should emphasize that women are in great numbers among health professionals, especially in nursing.

Among the pre-existing clinical conditions, obesity and hypertension were prevalent, diseases belonging to the group of Chronic Non-Communicable Diseases (NCDs). In recent decades, NCDs have assumed increasing importance in the world context, as they are the main cause of death, causing premature death and disability,[20] an impact that is aggravated by the association of these diseases with the worst clinical course of COVID-19. The comorbidities investigated in this study, such as hypertension, DM, obesity, and dyslipidemia were associated with the clinical outcome. It should be noted, however, that this study did not deal with causal relationships between the variables, but rather with the association between them.

In a study with a case series design conducted with 5,700 participants diagnosed with COVID-19, the most frequent comorbidities among hospitalized participants were hypertension (56.6%), obesity (41.7%), and DM (33.8%).[21] Comorbidities and age have been identified as a risk factor for worsening COVID-19,[6] and the results of the present study corroborate these findings.

The infection caused by SARS-CoV-2, in turn, in addition to increasing the risk of complications and death, can decompensate existing diseases and trigger new complications.[7,22]

Poisson regression results showed that age and obesity increase the probability of clinical worsening. The literature points to a greater vulnerability of severe outcomes at older ages.[23] It is likely that the elderly have a dysregulation of immune function[24] that contributes to the greater severity of the clinical course of COVID-19 in this age group.

The literature indicates that COVID-19 has a higher occurrence, worse prognosis, and higher mortality in people with obesity and associated complications, such as cardiovascular disease and metabolic syndrome.[9,25] A systematic review study showed that obese individuals diagnosed with COVID-19 have a 113% higher risk of hospitalization (OR = 2.13; 95% CI, 1.74-2.60; p <0.0001), 74% higher admission to the intensive care unit (OR = 1.74; 95% CI, 1.46-2.08) and a 48% increase in mortality (OR = 1.48; 95% CI, 1.22-1.80; p<0.001).[26]

Regarding symptoms, olfactory disorders, cough, fever, and dyspnea were associated with the clinical outcome of the cases investigated in the present study. According to the WHO,[27] the initial symptoms of COVID-19 are similar to a common flu and vary from person to person. Most patients have mild to moderate symptoms and the most common are fever, cough, fatigue, myalgia, and dyspnea[28], corroborating the findings of this study.

Rapid screening strategies for COVID-19 and follow-up for signs and symptoms are of great relevance to disease outcomes.[29] In this study, workers from the university community with COVID-19 infection were monitored by telephone calls made by trained health professionals to investigate symptoms of disease aggravation, as well as guidance for an early search for a health service referenced to COVID-19 when necessary. In addition, during telephone contacts, professionals provided guidance on isolation measures, search for contacts, and clarification of doubts regarding COVID-19.

In this study, the prevalence of clinical worsening was higher in workers with symptoms of fever at the first visit, during the monitoring and throughout the follow-up, and dyspnea during the monitoring and throughout the follow-up. A cohort study with 418 patients also found that dyspnea was an important predictor of severe disease (OR 2.71, 95% CI 1.82–4.07).[16] In a multicenter study carried out with 205,654 patients with fever, cough, muscle pain, difficulty breathing, nausea, headache, and impaired consciousness were more likely to die from COVID-19.[30]

This study has strengths and limitations. Strengths are related to the relevance of mapping and epidemiological characterization of COVID-19 in a population stratum, which will support the design of preventive and rehabilitative measures

for workers affected by COVID-19. Our findings suggest the feasibility of remote monitoring of COVID-19 in a primary care setting, aiming to prevent the future worsening of cases through screening strategies for those at the highest risk and by promoting measures to control risk factors and comorbidities. Furthermore, this monitoring model can be replicated in the primary care services of municipalities to extend its benefits to the general population.

One limitation is the cross-sectional design, which prevents the evaluation of variables over time and the inference of causal relationships between them and the use of secondary data, which are likely to suffer the effect of information bias. Future studies are required to screen workers with a detectable sample for asymptomatic SARS-CoV-2 infection, considering the likely early neutralization of antibodies in asymptomatic cases and the increased risk of reinfection.

CONCLUSION

The worsening of clinical outcomes during the outpatient follow-up of workers with COVID-19 occurred in 3.4% of the cases studied. The demographic, occupational, and clinical factors associated with clinical worsening were gender, professional category, hypertension, DM, obesity, dyslipidemia, olfactory disorders, cough, fever, and dyspnea. In Poisson regression, with robust variance, the prevalence of clinical worsening was greater with age, obesity, fever, and dyspnea. This study strengthens the relevance of primary care services in the COVID-19 pandemic due to its fundamental role in health promotion and recovery. The monitoring of workers with COVID-19 by remote monitoring has shown promise in the early detection and treatment of symptomatic cases of COVID-19.

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