Work context and clinical manifestations of COVID-19 in health professionals

Contexto de trabalho e manifestações clínicas da COVID-19 em profissionais de saúde

Contexto de trabajo y manifestaciones clínicas de la COVID-19 en profesionales de salud

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Abstract

Objective: To analyze associations between work context and clinical manifestations of COVID-19 in health professionals.

Methods: This is a cross-sectional study, with health professionals from the northeast of Brazil, from the medical, nursing and physiotherapy categories from different areas of expertise. A Google Forms questionnaire was sent through social networks, gathering demographic, academic, work context, clinical manifestations and data related to testing for COVID-19 (the test performed was not specified) and whether the result confirmed infection active or presence of antibodies (categorized as positive). Pearson's chi-square test and multivariate binary logistic regression analysis were performed, with Wald's chi-square test, considering p-value <0.05, Odds Ratio and 95% confidence interval.

Results: A total of 1,354 professionals agreed to participate in the study. Of these, 324 reported a positive test for COVID-19, with a prevalence of 23.9% (324/1,354). There was a statistical association between symptom onset and positive result (p=0.000). The work context characteristics related to the number of jobs, practice setting, contact with critically ill patients and employment in the capital were the independent variables associated with a positive result for COVID-19 (p<0.05). It was identified that 54.8% of the dependent variable can be related to the work sector, number of jobs, fever, loss of smell and taste.

Conclusion: Health professionals from urban centers, hospitals, critical care units and those with more than one job are more affected by COVID-19, with the positive test result being closely related to the symptoms of fever, loss of smell and taste that are characteristic of the illness.

Resumo

Objetivo: Analisar associações entre contexto de trabalho e manifestações clínicas da COVID-19 em profissionais de saúde.

Métodos: Estudo transversal, com profissionais de saúde do nordeste brasileiro, das categorias médica, enfermagem e fisioterapia de diferentes áreas de atuação. Foi enviado um questionário do Google *Forms* por meio de redes sociais reunindo variáveis demográficas, acadêmicas, do contexto de trabalho, manifestações clínicas e dados relacionados a realização de teste para COVID-19 (não foi especificado o teste realizado) e se o resultado confirmava infecção ativa ou presença de anticorpos (categorizado como positiva). Realizou-se teste de Qui-Quadrado de Pearson e análise multivariada de regressão logística binária, com teste de Qui-Quadrado de Wald, considerando p-value <0,05, Odds Ratio e Intervalo de Confiança de 95%.

Resultados: Aceitaram participar do estudo 1.354 profissionais. Destes, 324 referiram teste positivo para COVID-19, com prevalência de 23,9% (324/1.354). Evidenciou-se associação estatística entre manifestação

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de sintomas e resultado positivo (p=0,000). As características do contexto de trabalho relacionadas a número de empregos, cenário de prática, contato com pacientes críticos e emprego na capital foram as variáveis independentes associadas ao resultado positivo para COVID-19 (p<0,05). Identificou-se que 54,8% da variável dependente pode ser relacionada ao setor de trabalho, número de empregos, febre, perda de olfato e paladar.

Conclusão: Profissionais de saúde dos centros urbanos, contexto hospitalar, unidades de cuidados críticos e com mais de um emprego são mais acometidos pela COVID-19, tendo o resultado positivo do exame uma estreita relação com os sintomas de febre, perda de olfato e paladar característicos da doença.

Resumen

Objetivo: Analizar asociaciones entre contexto de trabajo y manifestaciones clínicas de la COVID-19 en profesionales de salud.

Métodos: Estudio transversal, con profesionales de salud del nordeste brasileño, de las categorías médica, enfermería y fisioterapia de distintas áreas de actuación. Se envió un cuestionario del Google *Forms* a través de redes sociales que reúnen variables demográficas, académicas, del contexto de trabajo, manifestaciones clínicas y datos relacionados con la realización de pruebas de COVID-19 (no se especificó la prueba realizada) y si el resultado confirmaba la infección activa o la presencia de anticuerpos (categorizado como positiva). Se realizó la prueba de chi-cuadrado de Pearson y el análisis multivariado de regresión logística binaria, con prueba de chi-cuadrado de Wald, considerando p-value <0,05, Odds Ratio e Intervalo de Confianza del 95 %.

Resultados: 1.354 profesionales aceptaron participar del estudio. De estos, 324 refirieron prueba positiva de COVID-19, con una prevalencia de 23,9 % (324/1.354). Se evidenció una asociación estadística entre la manifestación de síntomas y el resultado positivo (p=0,000). Las características del contexto de trabajo relacionadas al número de empleos, escenario de práctica, contacto con pacientes críticos y empleo en la capital fueron las variables independientes asociadas al resultado positivo de COVID-19 (p<0,05). Se identificó que 54,8 % de la variable dependiente puede estar relacionada con el sector de trabajo, número de empleos, fiebre, pérdida de olfato y paladar.

Conclusión: Profesionales de salud de los centros urbanos, contexto hospitalario, unidades de cuidados críticos y con más de un empleo son los más afectados por la COVID-19, y tiene el resultado positivo del examen una estrecha relación con los síntomas de fiebre, pérdida de olfato y de paladar característicos de la enfermedad.

Introduction

The world has been experiencing an important health crisis, triggered by Coronavirus Disease 2019 (COVID-19), a disease caused by coronavirus 2, Severe Acute Respiratory Syndrome (SARS-CoV-2), triggered in China in 2019 that quickly reached the continents, with high numbers of infected and dead.[2]

The form of transmission of SARS-CoV-2 between people is through respiratory droplets (aerosols in medical procedures), as well as contact with infected people through hands and surfaces contaminated through fomites.[2] A major concern of health care agencies involves infection through contact with infected and asymptomatic people. This condition reveals itself as a challenge for scholars and professionals, which prompted the implementation of preventive measures on a large scale (strict social distancing, use of masks and frequent hand hygiene) for the entire population and not just for the contacts of those infected.[3]

Nevertheless, some issues continue to concern and arouse the scientific community's interest, such as the possibility of infection due to aerosolization outside healthcare environments, effective drug treatment, behavior of human antibodies after infection, as well as the discovery of an effective vaccine.[3,4]

Until August 2020, more than two million cases were reported in Brazil, with an incidence of 1288/100 thousand inhabitants and mortality of 44.5/100 thousand inhabitants. This setting caused overcrowding in health services and demanded great efforts from health professionals to serve the population.[5]

In all health care settings, professionals work caring for people with different symptoms and severity levels of COVID-19, thus establishing themselves as a population at risk for coronavirus infection. In Brazil, up to the 30th epidemiological week, 786,417 health sector workers were notified as suspected cases of flu syndrome of COVID-19, of which 216,367 of these were confirmed. Nursing technicians or assistants were the category with the highest number of confirmed cases (34.4%, 74,323/216,367), followed by nurses (14.6%, 31,710/216,367), doctors (10.9%, 23,659/216,367) and community health agents (4.8%, 10,380/216,367). [5] Among the nursing category, the most affected professionals, 325 deaths have already been registered, with the Southeast and Northeast regions showing the highest mortality rates, 34.7% and 24.46% respectively.[6]

Strict biosafety guidelines were indicated for patient care in order to maintain the safety of profes-

sionals, such as the reinforcement of standard precautions, for contact, using droplets and aerosols, as well as the indication of isolation to suspected or infected cases by SARS-CoV-2. For professionals, the mandatory use of a respiratory mask, cap, goggles or face shield, aprons and gloves during the entire work period stands out.[4]

In this context, it is necessary to prioritize the protection of health professionals who provide assistance to victims of the pandemic, through the provision of training, adequate personal protective equipment (PPE), in addition to enabling them to provide safe care. It is also necessary to structure the laboratories so that they can safely collect biological material and provide test results quickly.[7]

Given the problem presented, the question emerged: what is the association between the characteristics of the work context and the clinical manifestations of COVID-19 in health professionals? Therefore, the objective was to analyze associations between the work context and clinical manifestations of COVID-19 in health professionals.

Methods

This is a cross-sectional study, guided by the STROBE tool, carried out in the state of Ceará, Brazil in May 2020.

The population consisted of health professionals from the city of Fortaleza and 91 cities in the countryside of the state. Contact with health professionals from all over Ceará was sought on social networks. The method used was a convenience sample. The inclusion criteria were: to be a medical, nursing or physiotherapy professional; training time of at least one year. Professionals who returned the incomplete data collection instrument were excluded.

Data were collected through a semi-structured questionnaire created by the researchers, generated on Google Forms and distributed virtually to health professionals through each professional's social networks (WhatsApp, Instagram, Facebook).

The questionnaire included sociodemographic (gender, age, marital status), academic (graduation and graduate degree time), work context (area of work and professional category, number of jobs, exposure to patients with COVID-19 in the unit), city in which they work, type of facility and sector, daily working hours/shift) and variables related to COVID-19 (presence of signs and symptoms, test and result).

The dependent variable determined in the study was the performance of a test for COVID-19: whether professionals had performed any test/exam for SARS-CoV-2 (it was not specified which test was performed) and whether the result confirmed active infection or the presence of antibodies (this variable was categorized as positive when the answer was yes). Independent variables included clinical and occupational factors such as signs and symptoms of the disease, work in assistance, workplace (hospital, emergency care unit and other services), sector in which they work, workload, number of jobs and city.

Data were consolidated on Excel®, exported to Statistical Package for Social Sciences (SPSS), version 23.0. Descriptive statistics (simple and absolute frequencies, mean, standard deviation) and analytical statistics were used as well as the prevalence presented. For bivariate analysis, data that had more than two categories were dichotomized, Pearson's chi-square test was applied; and for the characteristics and symptoms that presented $p < 0.05$, multivariate analysis of binary logistic regression, with Wald's chi-square test, considering p-value <0.05, Odds Ratio (OR), and 95% Confidence Interval (95%CI).

In developing the study, the ethical precepts that govern research with human beings in Brazil were respected. The beginning of this study took place after approval by the Institutional Review Board of the *Universidade Federal do Ceará*, as per Opinion 4.029,492 (CAAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration) 30873320.6.0000.5054). As this is an online survey, at the end of the explanatory text of the Informed Consent Form, the participant who wished to participate should check the option *I read and agree to participate in the survey*.

Results

A total of 4,232 professionals were invited to participate in the research through private messages on their social networks, considering that only they would have access to the instrument through this private means. Of this amount, 1,372 returned the questionnaire, 18 of which were excluded, as the questionnaires were not completely filled out, totaling 1,354 health professionals in the final sample.

There was a predominance of females, 84.7% (n=1147), and a mean age of 34.2 (±8.8) years old, ranging between 18 and 66 years old, with a more significant percentage between 18 and 35 years old, 61, 9% (n=838). Regarding marital status, 48.5% (n=657) declared to be married/in a stable relationship.

The average time since training was 9.0 (± 7.9) years, in which 13.5% (n=182) had only been trained for one year. With regard to professional status, 92.6% (n=1270) were employed. Among the 102 professionals outside the labor market, nursing professionals stand out, comprising 71.6% (73/102) of the unemployed. Within the nursing category, the unemployment rate was 7.7% (73/953). There was no statistical association between being unemployed and time since graduation. However, at the time of data collection, 2.4% (n=32) were away from their work activities.

Table 1 presents other academic and occupational variables of professionals.

Among graduate participants, 67 areas of study were reported as the object of training, with a prevalence of 12.9%, in the Intensive Care Unit (ICU) or emergency, and 6.9% in Family and Community Health.

Regarding professionals' clinical and laboratory situation, it was identified that 53% (718/1354) manifested signs and symptoms of COVID-19; among those who manifested signs and symptoms, 77.8% (559/718) underwent a test (which test was not specified); of these, 58% (n=324/559) considered a positive result (active infection or presence of antibodies), accounting for a prevalence of 23.9% (324/1354) of the disease among participants.

Symptoms reported by more than half of professionals were headache (68.5%, 492/718), myalgia (62.3%, 447/718) and sore throat (58.2%, 418/718). However, other symptoms were mentioned, such as runny nose (48.6%, 349/718), fever (39.5%, 284/718), fatigue (38.8%, 279/718), diarrhea (36.1%, 259/718), loss of smell (25.3%, 182/718), loss of taste (25.9%, 186/718) and dyspnea (17.4%, 125/718).

There was a statistically significant association between the manifestation of symptoms and the positive result (p=0.000, OR=8.320, CI= 5.320 – 12.976), as well as an association

Table 1. Sample distribution according to academic and occupational variables of health professionals

Characteristics	n(%)
Professional category (n=1,354)	
Nurse	773(57.1)
Doctor	255(18.8)
Nursing technician	180(13.3)
Physical therapist	146(10.8)
Training time (years) (n=1,354)	
<3	400(295)
<4	954(70.5)
Graduate degree (n=1,174)§	
Yes	859(73.2)
No	315(26.8)
Type of graduate degree (n=859)	
Specialization	506(58.9)
Residency	160(18.6)
Master's degree	142(16.5)
Doctoral degree	51(5.9)
Professional practice area (n=1,238)*	
Assistance	1160(85.7)
Teaching	40(3.0)
Management	38(2.8)
Number of jobs(n=1,270)†	
One only	850(66.9)
More than one	420(33.1)
City where they work (n=1,270)†	
Fortaleza	857(67.5)
Countryside/metropolitan region	413(32.5)
Type of facility (n=1,238)*	
Hospital	803(64.9)
Basic Health Unit	231(18.7)
Emergency Care Unit	51(4.1)
Outpatient clinic	50(4.0)
Others	45(3.6)
Higher Education Institution	40(3.2)
Emergency Mobile Care Service	18(1.5)
Work sector (n=854)‡	
Intensive Care Unit	415(48.6)
Emergency	183(21.4)
Ward/Inpatient Unit	183(21.4)
Others	44(5.2)
Operating center	29(3.4)

§ Graduated professionals only; *Professionals who had an employment relationship and are working during the research period; †Professionals who had a job, even if they were not working at the time; ‡ Professionals who worked in hospital and Emergency Care Unit (ECU, secondary care service)

Table 2. Association between work context variables and COVID-19 test results in health professionals

Variables	COVID-19 test result					
	Negative n(%)	Positive n(%)	Inferior	OR*	Superior	p-value†
Professional Category						0.051
Nursing technicians	47(81.0)	11(19)	-	-	-	
Nursing	108(34.0)	210(66.0)				
Doctor	66(48.9)	69(51.1)	-	-	-	
Physical therapist	14(29.2)	34(70.8)	-	-	-	
Area of expertise (n=545)§			0.517	0.967	1.810	0.917
Assistance	209(41.7)	292(58.3)				
Teaching and Management	18(40.9)	26(59.1)				
Training time (years) (n=559)			0.907	1.190	1.754	0.308
<3	62(45.3)	75(54.7)				
<4	173(41.0)	249(59.0)				
Type of facility (n=545)§			1.255	1.815	2.624	0.001
Hospital/ECU**	141(37.2)	238(62.8)				
Other	86(51.8)	80(48.2)				
Sector (n=545)§			1.179	1.659	2.320	0.004
Other	122(48.2)	131(51.8)				
ICU/Emergency	105(36.0)	187(64.0)				
Number of jobs (n=545)§			1.177	1.840	2.338	0.001
One	165(46.7)	188(53.3)				
More than one	62(32.3)	130(67.7)				
City (n=545)§			1.306	1.901	2.765	0.001
Capltal	144(37.1)	244(62.9)				
Countryside	83(52.9)	74(47.1)				

*OR – Odds Ratio; †Pearson's Chi-Square Test; ‡All professionals who performed the test; §Only professionals who are inserted in the labor market; **Emergency Care Unit

Table 3. Final logistic regression model between work context, symptoms and COVID-19 test result in health professionals

	B § (SE)*	p-value‡	95%CI† for Exp b§§		
			Inferior	Exp b	Superior
Included					
Constant	-1.638 (0.297)				
Number of jobs	0.888 (0.311)	0.004	1.321	2.429	4.467
Work sector	1.690 (0.308)	0.000	2.965	5.420	9.909
Loss of smell	2.823 (1.162)	0.015	1.726	16.819	163.867
Loss of taste	3.874 (1.131)	0.001	5.239	48.124	442.052
Fever	0.867 (0.294)	0.003	1.337	2.380	4.234

§Estimated regression coefficient; * SE - standard error; † CI - confidence interval; ‡Wald's chi-square test; §§ Factor by which the odds change in relation to the independent variable

between the laboratory diagnosis and symptoms: fatigue (p=0.002), fever (p=0.013), loss of smell (p=0.000) and loss of taste (p=0.000). The bivariate analysis between the result of the COVID-19 test and some characteristics of the work context are presented in Table 2.

After the results of bivariate analysis, a binary logistic regression analysis was performed (Table 3). Only the variables more than one job, work sector, fever, loss of smell and taste remained in the final model (Table 3), considering that the others showed little adherence, with no statistical significance for the model.

The model containing the five variables shown in Table 3 was significant [χ^2=8.982; p<0.003, $_{Nagelkerke}R^2$=0.548], maintaining a positive relationship with the outcome, confirmed by Exp b > 1. The $_{Nagelkerke}R^2$ of the model summary was 0.548, indicating that 54.8% of the dependent variable can be related to the variables: more than one job, work sector (ICU and emergency), fever, loss of smell and loss of taste.

Discussion

The results showed that 54.8% of Sars-Cov-2 infections among professionals participating in the study can be related to the number of jobs, the work sector (ICU and emergency) and the symptoms of fever, loss of smell and taste.

The association found between the number of jobs and COVID-19 infection can be justified by the fact that professionals who perform their functions in only one health facility are less exposed to risks of infection in care and in travel between a service and other. Corroborating this reflection, a

review study that evaluated the workload of nurses and its influence on the quality of care indicated that factors such as double working hours due to low wages, increased workloads and absenteeism are linked to the overload that affect the physical and mental health of these professionals, in addition to negative consequences on the care provided.[8]

There is evidence that healthcare professionals, faced with the COVID-19 pandemic, are at increased risk for anxiety, depression, burnout, chemical dependency and post-traumatic stress disorder.[9,10]

This health crisis should help us to better understand the vulnerability of health professionals to psychological distress, in order to strengthen primary prevention strategies and training in the psychological issues of care, relationships and management of health crisis situations.[9] It is recommended to offer them psychological help to reduce the emotional impact of COVID-19 and thus ensure not only the mental health of our health professionals, but also the adequate care they provide.[10]

Although no difference was found in the risk of coronavirus infection between professional categories, the work environment in critical care units was significantly associated with a higher risk of infection. A study explains that the ICU environment, including sinks and medical equipment, is associated with a higher risk of contamination and cross-transmission of pathogens between health professionals, the environment and patients.[11]

It is known that the main route for the spread of COVID-19 is through droplets that are expelled during coughing, sneezing or breathing, but there are also concerns about possible airborne transmission.[12] As ICUs concentrate the most severely ill patients, they are also responsible for the largest number of aerosol-generating procedures, including nebulizer treatments, two-level positive airway pressure ventilation (BiPAP), intubation ventilation tracheal and bronchoscopy; perhaps the explanation for the greater infection by COVID in the sample of professionals in this practice setting lies in these peculiarities.[12]

When associating the clinical condition with the symptoms presented, it is observed, in the international setting, that the most common were fever (97.2%), dry cough (62.6%) and dyspnea (30.8%).[13] The disease follows the course with symptoms similar to the flu-like illness with fever, cough and myalgia, making it difficult to make a precise diagnosis, which can only be done by laboratory criteria.

Loss of taste and smell are specific symptoms that were presented, in this study, together with fever, as more indicative of the disease among the professionals investigated.

Loss of taste and smell can indicate implications for the central nervous system, and the long-term consequences on workers' health are still unknown, thus raising the need for studies to monitor this evolution. Some researches already point to data that show the prevalence of anosmia and dysgeusia in patients with COVID-19 in France,[14,15] among others. A systematic review of literature points out that 34 studies in different parts of the world showed the loss of smell and taste as a frequent clinical characteristic among patients infected with COVID-19.[16]

Also noteworthy is the prevalence of infection in 23.8% of professionals. There are few published studies on the prevalence of COVID-19 among health personnel. In a survey of 217 healthcare professionals at a university hospital, with specific weekly serology for SARS-CoV-2 (IgA/IgG), participants estimated their personal probability of having had a SARS-CoV-2 infection with a mean of 21 %. On the other hand, the prevalence of anti-SARS-CoV-2 IgG was around 1-2% at baseline. The authors emphasized that regular testing for IgG anti-SARS-CoV-2 by healthcare professionals can help direct resources towards protective measures and long-term care for patients with COVID-19.[17]

Studies show that there was intra-hospital transmission of SARS-CoV-2 to health professionals and from these to patients hospitalized for another cause, especially at the beginning of the epidemic.[18,19]

In the U.S., healthcare professionals with COVID-19 had higher patient exposures compared to those who did not develop the disease. In addition to this, physical examinations and exposure to patients during nebulizer treatment have been shown to be more common among healthcare pro-

fessionals with laboratory-confirmed COVID-19 than among those without COVID-19.[18]

When analyzing participants' level of education, an important number of professionals with a graduate degree was observed, but only a minority in ICU or emergency. Even if only around 5% of patients infected with COVID will need an ICU bed, there is a need for services to provide such a structure, not only physical, but human resources.[20]

In Australia, ICU experts trained a large number of nursing professionals who were going to start working in this unit, whose objective was to ensure quality care in the short term, considering the pandemic reality.[21]

Thus, one should reflect on the crisis triggered by COVID-19, the gaps in government agencies in preparing for a pandemic and the lack of qualification for the job. Revisiting the history of previous outbreaks, the occurrence of severe acute respiratory syndrome that occurred in China in 2002/2003 with a mortality of 9.6%, the MERS-CoV virus that causes the Middle East respiratory syndrome with a mortality of 34% and even the epidemic of Ebola, proved to be dangerous for health workers with a strong impact on the affected countries' public health and that they should have better prepared the nations for situations like the one presented here.[22,23]

In this study, a statistically significant association was obtained for infection by the virus and the city where they work, as well as for those who worked in a hospital and Emergency Care Unit (ECU) and in ICU. The large centers, where the virus began to spread, have health services of greater complexity and with a greater number of ICU beds, as well as potentially continuous flow emergencies, providing professionals with greater contact with critically ill patients from various locations. It is worth noting that currently the number of cases is increasing in countryside cities, configuring an inversion of the initial profile of the pandemic in the country.[5,24]

As a possible limitation of this study, it is pointed out that the time frame only presents the reality of the moment studied and of a specific region of Brazil. As COVID-19 is a new disease, periodic surveys on health professionals' occupational and clinical situation are encouraged, with a view to identifying changes in this profile and the need for adjustments to the reality faced, as well as knowing the long-term impact of this illness on professionals' health.

The disclosure of these data is relevant for establishing an association between professionals' work context and laboratory diagnosis for COVID-19, highlighting the fact of working in a hospital or ECU, especially in intensive care or emergency units. Moreover, the study brings to light data related to the manifestation of signs and symptoms in subjects infected by the new coronavirus, encouraging recognition of the magnitude of the problem in this population that has played a leading role in the care of patients with COVID-19.

Conclusion

The associations of the work context with the clinical manifestations of COVID-19 in health professionals were analyzed. A prevalence of 23.8% of COVID-19 was found among the people studied, with statistical significance for work in a hospital/ECU, practice of functions in the urban center, work in ICU/emergency, and number of jobs. Logistic regression showed that the work sector (critical care units), the number of jobs (more than one), fever, loss of smell and taste can explain 54.8% of the dependent variable.

Collaborations

Coelho MMF, Cavalcante VMV, Cabral RL, Oliveira RM, Nogueira PSF, Silva FAA, Correia DL and Rocha LEV contributed to study design, data analysis and interpretation, article writing, relevant critical review of the intellectual content and approval of the final version to be published.

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