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ORIGINALES

Nursing personnel infected by COVID-19: working conditions and their associated factors in three hospitals in Lima-Peru

Personal de enfermería contagiados por COVID-19: condiciones de trabajo y sus factores asociados en tres hospitales de Lima-Perú

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ABSTRACT:

Objective: To determinate the prevalence of COVID-19 in the nursing personnel, working conditions, and their associated factors in three hospitals in Lima-Peru.
Method: A quantitative, descriptive cross-sectional study of the web survey was carried out between November 2020 and February 2021 with 495 nursing personnel members from the three public hospitals in Lima.
Results: 63% of the participants were from the Guillermo Almenara Irigoyen National Hospital, 20% from the San Isidro Labrador Hospital, and 17% from the II Vitarte Hospital. The prevalence of COVID-19 in the nursing personnel was 47.3%. When analyzing the demographic characteristics of the participants, a significant association of the education variable with the disease was evidenced (OR=1.50, *p* =0.04), showing that those with higher education are 1.5 times more likely to develop COVID-19 compared to those with postgraduate studies; the variables related to working conditions and risk factors did not show a significant association (p>0.05) with the disease.
Conclusions: Except for education, there is insufficient evidence to affirm a significant association of COVID-19 with demographic characteristics, work-related variables, and those considered a risk. This research makes significant contributions to nursing practice, research, and teaching.

Keywords: Nursing, coronavirus infections, worker health.

RESUMEN:

Objetivo: Determinar la prevalencia de la COVID-19 en el personal de enfermería, las condiciones de trabajo y sus factores asociados en tres hospitales de Lima-Perú.
Método: Estudio cuantitativo, descriptivo de corte transversal del tipo web-survey realizado entre los meses de noviembre 2020 a febrero de 2021 con la participación de 495 integrantes del personal de enfermería de tres hospitales públicos de la ciudad de Lima.
Resultados: El 63% de los participantes fueron del Hospital Nacional Guillermo Almenara Irigoyen, 20% del Hospital San Isidro Labrador, y 17% del Hospital II Vitarte. La prevalencia de la COVID-19 en el personal de enfermería fue de 47.3%. Al analizar las características demográficas de los participantes se evidenció asociación significativa de la variable escolaridad con la enfermedad (OR=1.50, *p*=0.04), mostrando que los que cuentan con estudios superiores tienen 1.5 veces mayor probabilidad de desarrollar la COVID-19 frente a los que poseen estudios de posgrado; las variables relacionadas con las condiciones de trabajo y factores de riesgo no evidenciaron asociación significativa (p>0.05) con la enfermedad.
Conclusiones: A excepción de la escolaridad no existe evidencia suficiente para afirmar asociación significativa de la COVID-19 con las características demográficas, las variables relacionadas al trabajo y las consideradas como riesgo. La investigación aporta contribuciones importantes a la práctica, la investigación y la docencia en enfermería.

Palabras clave: Enfermería, infecciones por coronavirus, salud del trabajador.

INTRODUCTION

Coronavirus disease (COVID-19) is an acute respiratory syndrome caused by a new coronavirus, SARS-CoV-2. The first cases were identified in China at the end of 2019 and, in just a few months, they spread throughout the world[(1)], its accelerated expansion exceeding any planning, prognosis, and response capacity, causing the highest rates of morbidity and mortality known until now in the XXI century[(2)]. In this dramatic context, it was considered a pandemic on March 11, 2020 [(3)].

Data obtained from John Hopkins University & Medical[(4)] on November 22, 2021, indicates 258,079,329 confirmed cases and 5,157,195 deaths from COVID-19. In Peru, the Ministry of Health[(5)] reported 2,234,075 confirmed cases on November 27; 201,108 deaths and 91,762 discharged, a situation that is increasing every day.

This health crisis has highlighted the precariousness and fragility of the world's health systems, subjected to increasing healthcare pressure. Likewise, the pandemic has exposed the shortage of health professionals, especially nurses, to manage care from the front line[(6)]. In this scenario, the nursing personnel has played a leading role, and with it, the social status of the profession and its work in times of pandemic has been reconfigured, revealing their capacities and potential in the face of an international health emergency[(7)].

Care is an inner good that pursues and defines nursing professionals. However, in this pandemic, the principles of comprehensive patient care and personal care came into conflict due to increased work pressure, risk of infection, physical stress and emotional stress, changes in daily work life, and the insufficient availability of adequate personal protective equipment (PPE)[(8)].

Therefore, psychologically supporting nurses is essential to preserve short- and long-term health, especially when the occupational stress levels are very high. Institutions

must guarantee the psychological well-being of these professionals with the use of different strategies that must focus on prevention, support, and treatment[9].

Considering the crisis caused by the new coronavirus, occupational conditions and illnesses, and the possible emotional impact on nursing professionals, the following research question arises: What are the working conditions and factors associated with COVID-19 in the nursing personnel who care for suspected and confirmed patients? To provide an answer, the study's objective was to determine the prevalence of COVID-19 in nursing personnel, working conditions, and its associated factors.

MATERIALS AND METHODS

A quantitative, descriptive cross-sectional study of the web survey was carried out between November 2020 and February 2021 with nursing personnel from three public hospitals in Peru: The Guillermo Almenara Irigoyen National Hospital, II Vitarte Hospital, and San Isidro Labrador Hospital, located in Lima. These hospitals, during the pandemic, implemented exclusive services for the care of patients with suspected and diagnosed COVID-19.

The study sample was for convenience through a non-probabilistic sampling process; for the calculation, the formula for estimating proportions for a known population was used (N=1,180), with a confidence level of 95% and a margin of error of 3%, finally obtaining a sample of 513 participants.

The inclusion criteria considered in the study were nurses and nursing technicians/assistants working in the care of patients with COVID-19, work experience in the Inpatient Unit or the ICU with a time equal to or greater than six months. The exclusion criteria were professionals on vacation or sick leave during the data collection period and non-acceptance of informed consent.

For data collection, the participants had access to the link to the web-based survey form, which was sent via social networks. The form contained the informed consent and the instrument that consisted of two sections: The first collected sociodemographic information such as sex, age, level of education, housing conditions, with whom they live, use of transportation to go to work, family income, and risk factors presented by the personnel.

The second section included questions such as whether you had a positive diagnosis of COVID-19, how to get to your workplace, information on working conditions, work in more than one place, the availability of Personal Protective Equipment (PPE), and whether you had previous training to care for patients with COVID-19.

Data processing was performed with the Statistical Package for the Social Sciences (SPSS) v. 26. Data cleaning was carried out considering as elimination criteria those cases that had at least one missing piece of data; Of the 567 who answered the form, 72 participants were eliminated, leaving 495 valid data as the final sample.

Bivariate analysis was performed through the Chi-square test for categorical variables; in the numerical variables, the fit of the data distribution to a theoretical distribution was verified. Since the assumptions of normality were not verified, the analysis was

carried out through the Mann Witney U. Odds Ratio (OR) were also calculated to analyze the occurrence of COVID-19. The analysis was performed considering a significance of 0.05.

The authorization to carry out the study was approved on October 30, 2020, by resolution No. 42-IETSI-ESSALUD-2020, within the framework of the COVID-19 pandemic.

RESULTS

Of the 495 professionals from the three health institutions, 63% (312) were from the Guillermo Almenara Irigoyen National Hospital, 20% (99) from the San Isidro Labrador Hospital, and 17% (84) from the Vitarte Hospital.

The prevalence of nursing personnel infected by COVID-19 was 47.3%. The variables sex (OR=0.912, *p* =0.727), marital status (OR=1.225, *p* =0.270), age (OR=0.986, *p* =0.135) and number of people at home (OR=1.053, *p* =0.189) showed no association with the disease. The education variable was the only one that showed a significant association (OR=1.500, *p* =0.044), evidencing a probability of having COVID-19 that was 1.5 times greater in those with higher education compared to those with postgraduate studies (OR=1.50), *p* =0.04).

Table 1: Association between the demographic characteristics of nursing personnel and COVID-19 in health institutions. Peru, 2021

Identification variables and categories	non-COVID		COVID		*OR*	*P*
	n	%	N	%		
Sex						
Female	227	53.0	201	47.0	0.912	0.727
Male	34	50.7	33	49.3	Ref.	
Marital Status						
With partner	149	50.7	145	49.3	1,225	0.270
No partner	112	55.7	89	44.3	Ref.	
Education						
Higher	176	49.9	177	50.1	1,500	0.044
Postgraduate	85	59.9	57	40.1	Ref.	
	□	**(*s*)**	□	**(*s*)**	***OR***	***P***
Age	40.06	9.80	38.77	9.22	0.986	0.135
Number of people at home	4.38	2.14	4.65	2.48	1,053	0.189

The variables related to work as a professional category (OR=1.275, *p* =0.181), being a boss or coordinator (OR=1.277, *p* =0.485), having received training (OR=1.154, *p* =0.455), working in an exclusive area COVID (OR=1.275, *p* =0.201), traveling by public transport (OR=1.254, *p* =0.308), traveling by private car (OR=1.033, *p* =0.897), using transportation by application (OR=0.854, *p* = 0.607), on foot (OR=0.892, *p* =0.803), using another type of transport (OR=2.530, *p* =0.116), lack of PPE (OR=1.137, *p* =0.480), and working time (OR= 1,000, *p* =0.878) did not present a significant association with COVID-19. Regarding salary, no category showed association (*p* >0.05).

Table 2: Association between the working conditions of nursing personnel and COVID-19 in health institutions. Peru, 2021

Identification variables and categories	non-COVID		COVID			
	n	%	N	%	*OR*	*P*
Professional category						
Nurse	155	55.4	125	44.6	Ref.	0.181
Nursing technician	106	49.3	109	50.7	1,275	
Are you a boss or a coordinator?						
No	240	52.3	219	47.7	1,277	0.485
Yes	21	58.3	15	41.7	Ref.	
Work Area						
COVID hospitalization	93	50.3	92	49.7		
Respiratory Intensive Care Unit (COVID).	35	50.0	35	50.0		
Adults Hospitalized Medicine/Surgery Unit	27	49.1	28	50.9		
Adults Intensive Care Unit	17	63.0	10	37.0		
Emergency	12	40.0	18	60.0		
Outpatient Service	11	55.0	9	45.0		
Neurological Intensive Care Unit	5	55.6	4	44.4		
Surgery Center	5	55.6	4	44.4		
Pediatric Hospitalization Unit	4	44.4	5	55.6		
Material and Sterilization Center	2	100.0	0	0.0		
Coronary Intensive Care Unit	1	50.0	1	50.0		
Neonatal/Pediatric Intensive Care Unit	0	0.0	1	100.0		
Support Service for Therapeutic Diagnosis	1	100.0	0	0.0		
Other	48	64.0	27	36.0		
Wage**						
From 1 to 3 minimum wages	172	51.8	160	48.2	1,488	0.493
From 4 to 6 minimum wages	71	54.6	59	45.4	1,330	0.633
From 7 to 9 minimum wages	10	50.0	10	50.0	1,600	0.517
10 or more minimum wages	8	61.5	5	38.5	Ref.	
Did you receive training?						
Yes	180	53.9	154	46.1	Ref.	0.455
No	81	50.3	80	49.7	1,154	
Work in a COVID-exclusive area						
Yes	163	50.6	159	49.4	1,275	0.201
No	98	56.6	75	43.4	Ref.	
Public transport						
Yes	201	51.5	189	48.5	1,254	
No	60	57.1	45	42.9	Ref.	0.308
Transportation by private car						
No	222	52.6	200	47.4	1,033	0.897
Yes	39	53.4	34	46.6	Ref.	
Transport by application						
No	234	52.3	213	47.7	Ref.	0.607
Yes	27	56.3	21	43.8	0.854	
Transportation on foot						
No	251	52.8	224	47.2	0.892	0.803
Yes	10	50.0	10	50.0	Ref.	
Other types of transport:						
No	250	52.1	230	47.9	2,530	0.116
Yes	11	73.3	4	26.7	Ref.	
	□	**(*s*)**	□	**(*s*)**	***U***	***P***
Working time	40.06	9.80	38.77	9.22	1.000*	0.878

Note: * Mann-Whitney U test ** In Peru, the minimum wage corresponds to S/. 930.00 soles or its equivalent to USD 226.83.

Regarding the variables related to the availability of personal protective equipment, such as the lack of PPE in the institution (OR=1.137, *p* =0.480), N95 respirator (OR=0.913, *p* =0.64), elastomeric respirator (OR=1.709 , *p* =0.244), surgical mask

(OR=1.860, *p* =0.170), protective goggles (OR=1.367, *p* =0.386), disposable apron (OR=1.179, *p* =0.442), face shield (OR=0.844, *p* =0.656), disposable gloves (OR=1.732, *p* =0.455), disposable shoe/boot protectors (OR=0.672, *p* =0.274), disposable cap (OR=0.941, *p* =0.885), disposable jacket (OR=1.425 , *p* =0.163), disposable pants (OR=1.239, *p* =0.352) and the lack of disposable romper (OR=0.916, *p* =0.697) did not show sufficient evidence to affirm an association with the presence of COVID-19.

Table 3: Association between the availability of Personal Protective Equipment and COVID-19 in health institutions. Peru, 2021

Identification variables and categories	non-COVID		COVID			
	N	%	N	%	*OR*	*p*
There was a lack of PPE in the institution						
Yes	110	50.9	106	49.1	1,137	0.480
No	151	54.1	128	45.9	Ref.	
Lack of N95 respirator						
Yes	82	54.3	69	45.7	0.913	0.641
No	179	52.0	165	48.0	Ref.	
Lack of elastomeric respirator						
Yes	8	40.0	12	60.0	1,709	0.244
No	253	53.3	222	46.7	Ref.	
Lack of surgical mask						
Yes	8	38.1	13	61.9	1,860	0.170
No	253	53.4	221	46.6	Ref.	
Lack of protective goggles						
Yes	15	45.5	18	54.5	1,367	0.386
No	246	53.2	216	46.8	Ref.	
Lack of disposable apron						
Yes	56	49.6	57	50.4	1,179	0.442
No	205	53.7	177	46.3	Ref.	
Lack of face shield						
Yes	17	56.7	13	43.3	0.844	0.656
No	244	52.5	221	47.5	Ref.	
Lack of disposable gloves						
Yes	15	60.0	10	40.0	0.732	0.455
No	246	52.3	224	47.7		
Lack of shoe protector / disposable boots						
Yes	21	61.8	13	38.2	0.672	0.274
No	240	52.1	221	47.9		
Lack of disposable cap						
Yes	13	54.2	11	45.8	0.941	0.885
No	248	52.7	223	47.3		
Lack of disposable jacket						
Yes	33	45.2	40	54.8	1,425	0.163
No	228	54.0	194	46.0		
Lack of disposable pants						
Yes	45	48.4	48	51.6	1,239	0.352
No	216	53.7	186	46.3		
Lack of disposable romper						
Yes	55	54.5	46	45.5	0.916	0.697
No	206	52.3	188	47.7		

Regarding the variables related to health, such as belonging to the risk group (OR=0.802, *p* =0.317), cardiovascular disease (OR=0.661, *p* =0.426), respiratory disease (OR=0.730, *p* =0.410), diabetes (OR=0.805, *p* =0.645), neoplasia (OR=0.472, *p* =0.290), immunosuppressed person by medications (OR=0.730, *p* =0.63), autoimmune disease (OR=0.411, *p* =0.318), pregnancy (OR=1.117, *p* =0.893), being

over than 60 years (OR=0.792, *p* =0.694), being a smoker (OR=0.526, *p* =0.343), obesity (OR=1.120, *p* =0.813), and other risks (OR=1.388, *p* =0.310), all of them did not show sufficient evidence to affirm an association with the presence of COVID-19.

Table 4: Association between the risk factors of nursing personnel and COVID-19 in health institutions. Peru, 2021

Identification variables and categories	non-COVID		COVID			
	n	%	N	%	*OR*	*p*
Risk group (Comorbidity)						
No	200	51.5	188	48.5	Ref.	
Yes	61	57.0	46	43.0	0.802	0.317
Cardiovascular Disease						
No	251	52.4	228	47.6	Ref.	0.426
Yes	10	62.5	6	37.5	0.661	
Respiratory Disease						
No	243	52.3	222	47.7	Ref.	0.410
Yes	18	60.0	12	40.0	0.730	
Diabetes						
No	250	52.5	226	47.5	Ref.	0.645
Yes	11	57.9	8	42.1	0.805	
Neoplasia						
No	261	52.8	233	47.2	Ref.	0.290
Yes	0	0.0	1	100.0	0.472	
Medication immunosuppression						
No	259	52.6	233	47.4	Ref.	0.628
Yes	2	66.7	1	33.3	0.556	
Autoimmune disease						
No	256	52.5	232	47.5	Ref.	0.318
Yes	5	71.4	2	28.6	0.441	
Pregnancy						
No	258	52.8	231	47.2	Ref.	0.893
Yes	3	50.0	3	50.0	1,117	
Over than 60						
No	254	52.6	229	47.4	Ref.	0.694
Yes	7	58.3	5	41.7	0.792	
Smoker						
No	260	52.6	234	47.4	Ref.	0.343
Yes	1	100.0	0	0.0	0.526	
Obesity						
No	252	52.8	225	47.2	Ref.	0.813
Yes	9	50.0	9	50.0	1,120	
Other						
No	242	53.4	211	46.6	Ref.	0.310
Yes	19	45.2	23	54.8	1,388	

DISCUSSION

The study identified that the prevalence of COVID-19 infection in nursing personnel was close to half of the study sample. Health professionals have been one of the most susceptible groups to contagion by the coronavirus. With the onset of the disease in Wuhan, the prevalence of infected professionals was from 3.5% to 29%[10]. On the other hand, in Italy, the number of infected during the start of the pandemic was 10.7%[11], in Spain 14%[12] and the United States 19%[13].

Of the nursing personnel who participated in the study, about a third did not receive training to care for patients with COVID-19. Although this characteristic did not show a significant association with the disease, many consider the education and training of

health personnel essential to contribute to the prevention, control, case management, and self-protection[14]. Therefore, training should not be neglected because it is a fundamental mechanism for improving skills[15]. Moreover, it is the responsibility of managers to guarantee it.

The study shows that most nursing personnel travel from home to their workplace by public transportation, with a minority traveling by private car, transportation by application, on foot, or other means. Public transport is the most used means by essential workers, which has been intensified by the crisis and was initially also affected by the established restrictions[16].

Based on the transmission characteristics of SARS-CoV-2 and the nature of public transportation sites, the risk of human infection could be extremely high due to the length of the exposure time window, the routes of transmission, and the structural features during travel or work. Therefore, since the beginning of the pandemic, according to the provisions of the governments of each country, most public transport operators have implemented specific measures so that transit systems offer security against COVID-19 to personnel and passengers[17]. A study showed that public transport operators adopted social distancing policies, mandatory use of masks, temperature screening, contact tracing, sanitation of exposed surfaces, and improvements in ventilation to inhibit transmission of the virus[18]. The strategies implemented sought to mitigate the risk of contagion in closed, crowded spaces and situations of close contact.

Another measure was the establishment of limits on transport capacity; such is the case of the United Kingdom, Colombia[17], and Peru,[19] which reduced to 10%, 35%, and 50%, respectively, of their total capacity.

The study also analyzed the protection of health professionals who work on the front line and was considered essential due to the contagiousness and virulence of the disease[20], identifying that half of the PPE was unavailable among the nursing personnel who fell ill with COVID-19. Although no statistical significance was found, it is essential to highlight the high risk of contagion that these professionals had to COVID-19. These results coincide with the study on working conditions and PPE against COVID-19 in health workers in Peru, in which only 53.9% received PPE each working day; 40.6% never received it; those who work without an employment relationship, sometimes and those under 56 years of age received incomplete equipment. 62.7% reported never receiving an N95 mask, and only 0.5% received an N95 mask per shift. Gloves, aprons, and caps were the most delivered materials [21].

In China, a study showed that the infection of health workers was directly related to the availability of adequate PPE[10]. Another study in the United States and the United Kingdom showed that the lack of availability, inappropriate use, and reuse of PPE increases the risk of contracting COVID-19 in front-line health workers[22]. These facts show the high vulnerability of health personnel to get sick and die from COVID-19. In this sense, the WHO urges governments and authorities to guarantee the health and life of front-line health workers, thus preserving that of patients[23].

Regarding risk factors, the study identified that, among the nursing personnel, 234 presented some risk factors; of them, 43% fell ill with COVID-19. Although no

statistical significance was found, these professionals' risk was notable. These findings reinforce the need for health institutions to invest in workers' health.

The literature shows that different risk factors increase the possibility of presenting serious complications and causing death. Among the risk factors for developing the disease is advanced age (being an older adult), being male, having a smoking habit, suffering from chronic diseases such as high blood pressure, diabetes mellitus, tuberculosis, Chronic Obstructive Pulmonary Disease (COPD), cardiovascular diseases, cerebral vascular accident, and alteration in blood markers[24], obesity, which can predispose people to present more severe symptoms explained by inflammation, altered physiology, and immune dysfunction[25]. Diabetes mellitus causes a low-grade chronic inflammatory state in the body, increasing the risk of becoming ill[26].

At the level of blood markers, poor T cell function and increased interleukin 6 are factors that increase the risk and severity of SARS-CoV-2 infection[27]. Finally, the interaction of SARS-CoV-2 and the renin-angiotensin-aldosterone system could contribute to the overrepresentation of hypertension among patients with severe COVID-19[28].

Finally, the statistical significance between the level of education and COVID-19 in the nursing personnel shows a 1.5 times greater risk of getting sick in the group of people with higher education than those with postgraduate studies. This result is consistent with what was reported in the National Health and Nutrition Survey on COVID-19 developed in Mexico, where the highest prevalences were found in people with secondary and upper secondary education, lower in people with higher education[29]. Additional support that would reinforce those mentioned above is observed in comparing the percentage amounts in the group that received training where there is a difference of 8% between the group of people who contracted and those who did not contract the disease.

Among the study's limitations is that the data collection was carried out in the middle of the pandemic, when the personnel was overloaded and tired, which could have limited the number of participants. Likewise, the information collection took place from November 2020 to February 2021, at the end of the year and holidays.

The study contributes to the field of practice, research, and teaching. The field of practice presents the working and health conditions of the workers of three public hospitals in Lima-Peru, which were declared benchmarks in the care of COVID-19; highlights the need to invest in the health of workers, in personal protective equipment, and continuing education.

The research opens the possibility of more profound studies on the potential causes of contracting COVID-19 among higher-level professionals and on the experiences of these professionals in such a unique and challenging period in the history of professional practice in health care of people with COVID-19, in addition to the meanings of having the disease and dealing with loss and pain. To conclude, in the teaching field, it encourages the need to rethink the study plans of higher educational institutions to prepare young people who will enter the labor world to lead the new challenges that will arise. The pandemic is an indication that the world is undergoing changes and that it is necessary to take care of the planet.

CONCLUSION

Of the 567 professionals who responded to the web survey, the prevalence of COVID-19 in nursing professionals was 47.3%. The education variable was the only one that showed a significant association with the mentioned disease, presenting a probability of having COVID-19, 1.5 times greater than those with higher education compared to those with postgraduate studies.

No significant association to COVID-19 was identified between demographic characteristics such as gender, marital status, age, and the number of people living at home. There was also no evidence of association with variables related to work as a professional category; salary; have received training; work in exclusive COVID-19 area; lack of PPE; working time; travel by public transport, by private car, by application transport, walking or using another type of transport.

Regarding the variables related to health, they did not show sufficient evidence to affirm an association with the presence of COVID-19 belonging to the risk group; have cardiovascular, respiratory, and autoimmune disease, diabetes, neoplasia; immunocompromised person due to medications; pregnancy; being over 60 years; being a smoker, obesity, and other risks.

This research makes significant contributions to nursing practice, research, and teaching.

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