Proceeding Paper

Seroprevalence of SARS-CoV-2 among Health Care Personnel in Portugal †

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Abstract: Health care personnel (HCP) might be highly exposed to SARS-CoV-2 infection. This study aims to determine the seroprevalence of SARS-CoV-2 among HCP in Portugal. A cross-sectional study was conducted between 1 June and 19 July 2020, following the first wave of COVID-19 in the country, with a convenience sample of HCP from different Portuguese health care units, geographically distributed at the national level. Diagnosis of COVID-19 was an exclusion criterion. HCP were tested for IgG antibodies against SARS-CoV-2. Data regarding participants' demographic characteristics, medical history, COVID-19 symptoms, previous clinical testing for acute SARS-CoV-2 infection and Personal Protective Equipment (PPE) practices while caring for patients in areas with COVID-19 patients were also recorded. A total of 1802 HCP were screened (80.9% women), of which 55 (3.1%) had positive test results for SARS-CoV-2 antibodies. Factors such as geographical distribution ($p = 0.002$), profession ($p = 0.018$), having had a family member with COVID-19 ($p < 0.001$) and having had contact with family members with COVID-19 ($p = 0.003$) were found to be associated with infection. Adjusting for gender, age group, regional health administration and size of the household, health care assistants have an increased risk of having a positive SARS-CoV-2 test result in comparison to nurses. Understanding the prevalence of and factors associated with SARS-CoV-2 infection among HCP is important for developing effective strategies to protect them and their patients.

Keywords: COVID-19; SARS-CoV-2 seroprevalence; first wave; health care personnel; health administrative regions; Portugal

1. Introduction

COVID-19, the disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has already caused more than one million deaths worldwide, with more than eighty-two million confirmed cases, and counting, according to recent data from the World Health Organization [1]. On the frontline in combatting against the disease, due to close contact with patients with COVID-19 or insufficient access to Personal Protective Equipment (PPE), health care personnel (HCP) are at high risk for contracting SARS-CoV-2 [2–5].

Of the European countries, Italy and Spain were the first and most severely hit by COVID-19, with limited time to prepare the health care sector and to take precautions to

reduce the spread of the infection to HCP [6,7]. In other countries, like Denmark, with more time for preparation, the prevalence of HCP with antibodies against SARS-CoV-2 was low [2]. In Portugal, there is a lack of evidence regarding the real situation in the health care setting. There is an absence of studies specifically targeting this population. However, it has been pointed out that there is a large percentage of asymptomatic cases which may account for up to four-fifths of all SARS-CoV-2 cases [8].

In this context, the surveillance of the proportion of seropositive HCP is important to monitor the spread of the virus [2]. Moreover, understanding the prevalence of and factors associated with SARS-CoV-2 infection among HCP are important for developing effective strategies to protect them and their patients [9].

This study aims to characterize the seroprevalence of SARS-CoV-2 among HCP in Portugal and to identify potential factors associated with the infection in this population.

2. Methods

A cross-sectional study was conducted between 1 June and 19 July 2020, following the first wave of COVID-19 in the country. A convenience sample of HCP working in different Portuguese health units, both from the community and clinical settings, geographically distributed at the national level (mainland Portugal) was included. Participants were recruited in hospital based-units, primary health care centers, nursing homes, long-term care facilities and public health units. Inclusion criteria were HCP (nurses, doctors, health care assistants and technicians) working in one of the recruiting sites who considered themselves to have had any contact with patients in relation to their work. Diagnosis of COVID-19 was an exclusion criterion of the study.

Participants were tested for antibodies to SARS-CoV-2 with a chemiluminescence immunoassay that detect and quantify SARS-CoV-2 antibodies anti-IgG. Information on demographic characteristics, medical history, COVID-19 symptoms, previous clinical testing for acute SARS-CoV-2 infection and PPE practices while caring for patients in areas with COVID-19 patients were also obtained from the participants.

Descriptive statistics were used to report the relative and absolute frequencies of each categorical variable and mean and standard deviation were used for continuous variables. Bivariable analyses were performed using chi-square and Fisher exact tests for categorical variables and the *t*-test test (or the equivalent non-parametric Mann-Whitney test) for numeric variables. The association between SARS-CoV-2 seropositivity (primary outcome) and profession was studied through logistic regression modeling. Crude and adjusted odds ratios (OR) with a 95% confidence interval were calculated; the model was adjusted for gender, age group, health administrative regions and size of the household. Statistical analyses were performed with IBM SPSS® Statistics for Windows (version 25.0) (IBM Corp., Armonk, NY, USA). Results were based on two-sided tests and statistical significance was considered when *p*-value < 0.05.

The study followed the Declaration of Helsinki principles [10]. The study was approved by the National Ethical and Deontological Committee of the Portuguese Medical Association (Conselho Nacional de Ética e Deontologia da Ordem dos Médicos). Only HCP who agreed to participate and gave oral informed consent took part in the study.

3. Results

A total of 1802 HCP participated in the study. Among all participants, 55 (3.1%) had positive test results for SARS-CoV-2 antibodies.

Table 1 provides a characterization of the sample (i.e., individuals who had a negative versus individuals with a positive test result for the SARS-CoV-2 serological test) for main sociodemographic variables. In total, 80.9% of the participants were women; no differences were found between groups regarding gender. The sample included HCP from all health administrative regions of mainland Portugal; a higher proportion of individuals with a negative serologic SARS-CoV-2 test in all considered regions was observed. Almost half of the participants (48.1%) were nurses and 29.6% were doctors.

Table 1. Sociodemographic characteristics of the participants by SARS-CoV-2 serology results (*n* = 1802).

	No.	IgG− (<15 U/mL)	IgG+ (≥15 U/mL)	*p*-Value
		No. (%)	No. (%)	
Gender				
Female	1459	1412 (96.8)	47 (3.2)	0.492
Male	343	335 (97.7)	8 (2.3)	
Health administrative region				
South (Alentejo/Algarve)	173	167 (96.5)	6 (3.5)	
Center	219	209 (95.4)	10 (4.6)	0.002
Lisbon and Tagus Valley	1135	1112 (98.0)	23 (2.0)	
North	258	242 (93.8)	16 (6.2)	
Profession				
Healthcare Assistants	175	164 (93.7)	11 (6.3)	
Nurse	867	847 (97.7)	20 (2.3)	
Doctor	534	517 (96.8)	17 (3.2)	0.018
Technician	117	116 (99.1)	1 (0.9)	
Other [a]	109	103 (94.5)	6 (5.5)	

[a] The 'other' group refers to general services employers.

From the participating HCP, 55 (3.6%) reported having had a person in the family with COVID-19; a difference between the two groups under analysis was observed. Likewise, 51 of the participants (4.1%) had contact with family members with COVID-1; within this sub-group, though, 11.8% had a positive test result for SARS-CoV-2. Although not statistically significant, the majority of the HCP who indicated always using PPE had a SARS-CoV-2 negative test (96.8%) and only 3.2% were found to be infected by the virus (Table 2).

Table 2. Previous symptoms of COVID-19, testing for acute SARS-CoV-2 infection and use of PPE by SARS-CoV-2 serology results (*n* = 1802).

	No.	IgG− (<15 U/mL)	IgG+ (≥15 U/mL)	*p*-Value
		No. (%)	No. (%)	
Family member with COVID-19				
No	1488	1447 (97.2)	41 (2.8)	<0.001
Yes	55	46 (83.6)	9 (16.4)	
Contact with family members with COVID-19				
No	1197	1160 (96.9)	37 (3.1)	0.003
Yes	51	45 (88.2)	6 (11.8)	
Use of PPE				
Sometimes/Never	333	325 (97.6)	8 (2.4)	0.547
Always	1461	1414 (96.8)	47 (3.2)	

Results of logistic regression assessing profession as a predictor of SARS-CoV-2 serology are provided in Table 3. Adjusting for gender, age group, health administrative region and size of the household, health care assistants have a 3.08 odds ratio of having a positive SARS-CoV-2 test result in comparison to nurses.

Table 3. Assessing profession as predictor of SARS-CoV-2 serology result (*n* = 1802).

	Non-Adjusted OR (CI 95%)	**Adjusted OR (CI 95%)**
Nurse	1	1
Health care assistants	2.84 (1.29, 5.94)	3.08 (1.38, 6.58)
Doctor	1.39 (0.71, 2.68)	1.68 (0.85, 3.30)
Technician	0.37 (0.02, 1.78)	0.31 (0.02, 1.53)
Other [a]	2.47 (0.89, 5.94)	2.53 (0.88, 6.38)

[a] The 'other' group refers to general services employers.

4. Discussion

This was the first study in Portugal targeting HCP which aimed to determine the seroprevalence of SARS-CoV-2 and factors associated with the infection in this population. A prevalence of 3.1% of SARS-CoV-2 infection among HCP was found, a lower rate than what has been estimated by the Portuguese health authorities for this group [11] and what has been reported for the general public [12]. This, however, can be worrisome as the infection might be unrecognized because without regular testing many HCP working in the forefront can have only mild symptoms of SARS-CoV-2 infection or be asymptomatic [9].

Another relevant finding was the increased risk of infection found both in the health care assistants and in the other group (though a result not statistically significant in the latest). In fact, health workers can acquire COVID-19 infection in the community and in the workplace. The risk of infection in the community depends on housing conditions. Operational assistants and general services employers are at the base of the health care workers' socioeconomic pyramid. A significant number of them are migrants and share small housing spaces with people from different families and different ages, including school aged children. At the workplace, the operational assistants are in direct contact with the patients and with the patients' environment, such as eating utensils and contaminated lines. On the other hand, they lack familiarity with PPE, or the time required for the infection prevention and control (IPC) policies. Doctors and nurses are already familiar with IPC and mandatory comprehensive SARS-CoV-2 related PPE training [13].

Against this background, frequent testing of HCP is pivotal in order to monitor the spread of the virus [2]. Moreover, although our results did not enable us to find a positive association, the provision of PPE in health care settings is an important measure that can contribute to the reduction of the transmission of SARS-CoV-2. Additional protection measures include frequent hand hygiene (before and after using PPE, and when in contact with potentially contaminated objects with respiratory secretions), regular disinfection of surfaces, especially those with which patients were in contact and ventilate the work rooms [14].

Our study also showed that contacts outside work, for example, with household contacts, can also be a source of SARS-CoV-2 infection. In the future, more information about these contacts and what the impact is on the self, namely, if the professional developed COVID-19 symptoms and adopted measures as a result.

5. Conclusions

Understanding the prevalence of SARS-CoV-2 infection among HCP and which professional groups have an increased risk of being infected is important to develop effective strategies to protect them and the patients with whom they are in close contact.

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