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Reduction in COVID-19 prevalence in healthcare workers in a university hospital in southern Brazil after the start of vaccination

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ABSTRACT

Introduction: The quick spread of SARS-CoV-2 led to the development of vaccines that are capable of reducing infection and the number of more severe COVID-19 cases.

Aim: To assess COVID-19 prevalence among healthcare workers (HCWs) after vaccination against SARS-CoV-2.

Methods: This was a cross-sectional study on the prevalence of COVID-19 diagnosis among 7523 HCWs vaccinated against SARS-CoV-2 with CoronaVac and ChAdOx1 nCoV-19 in a university hospital, in southern Brazil, between January 18 and March 18, 2021.The variables evaluated were: sex, age, work area, role, source of infection, previous diagnosis of COVID-19, date of vaccine administration, type of vaccine, and need for hospitalization. The statistical analysis used Poisson regression and Fisher's exact test with SPSS software version 25, and a level of significance set at 5%.

Results: 813 vaccinated HCWs showed symptoms suggestive of COVID-19, of whom 35.4% (288) had a detectable result after undergoing RT-PCR for SARS-CoV-2. There was a reduction of 62% in new cases of COVID-19 among HCWs in the institution 7 weeks after the start of vaccine rollout. Conclusion: Our data suggest that the vaccines used by the institution reduced the number of COVID-19 cases among healthcare workers, demonstrating the effectiveness of the vaccines.

Introduction

There is evidence that vaccines are able to reduce infection and the number of more severe cases of COVID-19 (Bradley et al., 2021; Keehner et al., 2021; Daniel et al., 2021; Benenson et al., 2021). The P1 variant of SARS-CoV-2 is refractory to multiple neutralizing monoclonal antibodies (Wang et al., 2021). This may lead to antigen alterations that impair vaccine protection, leading to a diagnosis of infection in individuals in whom vaccine efficacy has been demonstrated (Wang et al., 2021).

Methods

A cross-sectional study on the prevalence of COVID-19 diagnosis was conducted among 7523 healthcare workers (HCWs) vaccinated against SARS-CoV-2 with CoronaVac inactivated virus vaccine and ChAdOx1 nCoV-19, using chimpanzee adenovirus as a viral vector for the expression of the SARS-CoV-2 spike protein, in a university hospital in southern Brazil. 4260 HCWs received CoronaVac (3676 with two doses and 584 with only one dose) and 3263 received one dose of ChAdOx1 nCoV-19 between January 18 and March 18, 2021. In total, 813 health professionals with symptoms suggestive

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Table 1

Demographic characteristics of vaccinated HCWs with symptoms suggestive of COVID-19 (N = 813)

Characteristics		RT-PCR result				
		Negative N (%) 525 (64.6)	Positive N (%) 288 (35.4)	PR	p-value	95% CI
Work area	Without patient assistance*	68 (63.6)	39 (36.4)	1		
	Non-COVID patient assistance**	316 (65.6)	166 (34.4)	0.94	0.690	0.71–1.25
	COVID patient assistance***	141 (62.9)	83 (37.1)	1.02	0.915	0.75–1.38
Role	Other health professional****	41 (78.8)	11 (21.2)	1		
	Physician	61 (50.4)	60 (49.6)	2.34	< 0.05	1.35–4.08
	Nurse	261 (66.4)	132 (33.6)	1.59	0.095	0.92–2.73
	Care support	114 (68.3)	53 (31.7)	1.50	0.163	0.85–2.65
	Administration	48 (60)	32 (40)	1.89	< 0.05	1.05–3.41
Origin of contact	No identifiable contact	272 (69)	122 (31)	1		
	External case	21 (63.6)	12 (36.4)	1.17	0.507	0.73–1.89
	Occupational suspicion	117 (65)	65 (35)	1.13	0.332	0.88–1.45
	Family	115 (55.8)	91 (44.2)	1.43	< 0.05	1.15–1.77
COVID-19 confirmed in the past	No	441 (61.5)	276 (38.5)	1		
	Yes	84 (87.5)	12 (12.5)	0.32	< 0.05	0.19–0.56
Vaccine	Coronavac	306 (61.3)	193 (38.7)	1		
	ChAdOx1 nCov-19	219 (69.7)	95 (30.3)	0.78	< 0.05	0.64–0.96

* Without patient assistance: jobs that do not require contact with patients (Baptista et al., 2021).
** Non-COVID care: assistance to patients without a diagnosis of COVID-19.
*** COVID-19 care: assistance to patients diagnosed with COVID-19.
**** Other health professionals with higher education.

of COVID-19 performed an RT-PCR (reverse transcriptase reaction followed by a polymerase chain reaction) test for SARS-CoV-2, and had received at least one dose of the SARS-CoV-2 vaccine in the first 9 weeks of the vaccination roll-out.

The variables evaluated were: sex, age, work area, role, source of infection, previous diagnosis of COVID-19, date of vaccine administration, type of vaccine (ChAdOx1 nCoV-19 or CoronaVac), date and result of the RT-PCR assay for SARS-CoV-2, number of professionals diagnosed with COVID-19 after vaccination, need for hospitalization, and admission to the intensive care unit (ICU).

A prevalence ratio (PR) measure with 95% CI, estimated by Poisson regression analysis with robust variance adjustment, was used to verify the factors and the strengths of the associations with the PCR test result in the general sample, stratified by type of vaccine, while Fisher's exact test was used to assess the association of the vaccine with hospitalization and ICU outcomes among the COVID-19 patients. Analyses were performed using the SPSS software version 25, and the level of significance was set at 5%.

The study was approved by the institutional Research Ethics Committee (No. 3080132400005327), and financial support was provided by the Research Incentive Fund (FIPE) of Hospital de Clinicas de Porto Alegre.

Results

The 20–40 and 41–60 years age groups were represented similarly in our sample, accounting for 48% and 48.6%, respectively, of the total HCWs evaluated. 81.7% of the 813 evaluated HCWs were females, and 35.4% (288) of those who underwent RT-PCR for SARS-CoV-2 showed a detectable result (Table 1).

The ChAdOx1 nCoV-19 vaccine decreased the prevalence of infection by 22% (PR: 0.78, 95% CI: 0.64-0.96). Regardless of the type of vaccine, after the first dose, the prevalence of infection decreased by 7% each week (PR: 0.93, 95% CI: 0.89-0.97). A previous diagnosis of COVID-19 reduced the prevalence of new infections by 68% (PR: 0.32, 95% CI: 0.19–0.56).

Among the 314 suspected cases who had received the ChAdOx1 nCoV-19 vaccine, a positive diagnosis for COVID-19 was observed in 30.3%. An important finding was that a previous diagnosis of COVID-19 at least 45 days earlier reduced the prevalence by 71%

(PR: 0.29, 95% CI: 0.11–0.75) among these HCWs. When only HCWs who had received one dose of ChAdOx1 nCoV-19 were considered, prevalence was reduced by 10% each week after vaccination (PR: 0.90, 95% CI: 0.84–0.96) (Table 2).

Among the 399 suspected cases who had received the CoronaVac vaccine, a positive diagnosis for COVID-19 was observed in 38.7%. Physicians showed a 2.25-fold increased prevalence for a positive diagnosis of COVID-19 compared with other HCWs with a higher education (PR: 2.25, 95% CI: 1.08–4.69). A previous diagnosis of COVID-19 reduced prevalence by 65% (PR: 0.35, 95% CI: 0.18–0.67) (Table 2).

A hospitalization outcome was observed in 14 of the 288 COVID-19 patients. However, no cases with positive RT-PCR died after the administration of both vaccines during the period under study.

Discussion

Our data suggest that, after the first dose, the prevalence of infection decreased every week, regardless of the type of vaccine. Within our population, ChAdOx1 nCoV-19 seemed to provide better protection in relation to COVID-19, and further studies are needed to identify the cause of this difference.

The higher prevalence among physicians, identified in our population, may be associated with the prevalence of double working hours, with different levels of exposure and protection against COVID-19.

The different levels of protection against COVID-19, such as the use of personal protective equipment, may be associated with a lower prevalence of positive cases in the occupational environment when compared with other environments. However, more studies are needed in this area.

The presence of a previous diagnosis of COVID-19 was a protective factor against new SARS-CoV-2 infections. In agreement with our data, studies carried out in Denmark and Qatar indicated that the presence of a previous diagnosis of COVID-19 infection can provide protection against a new infection of up to 78.8% and 95%, respectively (Hansen et al., 2021; Abu-Raddad et al., 2021).

Our data are also in agreement with those of a study conducted in Israel in evidencing a decline in cases of COVID-19 and in se-

Table 2

Factors associated with the diagnosis of COVID-19 — vaccinated with CoronaVac and ChAdOx1 nCov-19

Characteristics		RT-PCR result		ChAdOx1 nCov-19			RT-PCR result		CoronaVac		
		Negative N (%) 219 (70)	Positive N (%) 95 (30)	PR	p-value	95% CI	Negative N (%) 306 (61)	Positive N (%) 193 (39)	PR	p-value	95% CI
Work area	Without patient assistance*	33 (66)	39 (36.4)	1			35 (61.4)	22 (38.6)	1		
	Non-COVID patient assistance**	23 (63.9)	13 (36.1)	0.84	0.430	(0.54–1.9)	153 (60.2)	70 (37.2)	0.96	0.871	0.72–1.48
	COVID patient assistance***	163 (71.5)	65 (28.5)	1.06	0.839	(0.59–1.3)	118 (62.8)	101 (39.8)	1.03	0.852	0.66–1.41
Role	Other health professional****	20 (80)	5 (20)	1			21 (77.8)	6 (22.2)	1		
	Physician	15 (51.6)	15 (48.4)	2.42	**< 0.05**	(1.02–5.74)	45 (50)	45 (50)	**2.25**	**< 0.05**	1.08–4.69
	Nurse	101 (73.2)	37 (26.8)	1.34	0.489	(0.58–3.08)	160 (62.7)	95 (37.3)	1.68	0.162	0.81–3.46
	Care support	61 (71.8)	24 (28.2)	1.41	0.429	(0.60–3.32)	53 (64.6)	29 (35.4)	1.59	0.233	0.74–3.42
	Administration	21 (60)	14 (40)	2.00	0.124	(0.83–4.84)	27 (60)	18 (40)	1.8	0.145	0.82–3.97
Origin of contact	No identifiable contact	123 (45)	41 (25)	1			149 (64.8)	81 (35.2)	1		
	External case	7 (70)	3 (30)	1.2	0.716	(0.45–3.21)	14 (60.9)	9 (39.1)	1.11	0.702	0.65–1.9
	Occupational suspicion	40 (74.01)	14 (25.9)	1.04	0.892	(0.61–1.75)	77 (61.1)	49 (38.9)	1.10	0.488	0.83–1.46
	Family	49 (57)	37 (43)	1.72	**< 0.05**	(1.2–2.47)	66 (55)	54 (45)	1.28	0.069	0.98–1.66
COVID-19 confirmed in the past	No	182 (66.7)	91 (33.3)	1			259 (58.3)	185 (41.7)	1		
	Yes	37 (90.02)	4 (9.8)	0.29	**< 0.05**	(0.11–0.75)	47 (85.5)	8 (14.5)	**0.35**	**< 0.05**	0.18–0.67

* Without patient assistance: jobs that do not require contact with patients.

** Non-COVID patient assistance: assistance to patients without a diagnosis of COVID-19.

*** COVID patient assistance: assistance to patients diagnosed with COVID-19.

**** Other health professionals with higher education.

vere forms of the disease following the start of vaccine rollout (Rossman et al., 2021).

Conclusion

Our data suggest that the vaccines used by the institution reduced the number of COVID-19 cases among HCWs, and protected against severe forms of the disease.

Analysis of the cases with SARS-CoV-2-positive RT-PCR showed that there was a possibility of infection after the administration of a COVID-19 vaccine. Further studies are needed to confirm this in the medium and long term, taking into account the types of virus in circulation in the country, and also the types of vaccine administered.

Declaration of Competing Interest

The researchers declare that they have no conflicts of interest.

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