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Vaccination schemes and CoronaVac: Are there differences between adults and older adults hospitalized by COVID-19?

Esquemas de vacunación y CoronaVac: ¿Existen diferencias entre adultos y adultos mayores hospitalizados por COVID-19?

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ABSTRACT

Background: Insufficient evidence exists for comparing different COVID-19 vaccination schemes with CoronaVac in the adult and older adult populations. **Methods:** A prospective multicenter study was carried out with patients admitted for hospitalization due to COVID-19. **Results:** A study of 159 COVID-19 patients found that unvaccinated younger patients had a higher risk of oxygen requirement (RR = 1.3, p = 0.041) and dyspnea(p = 0.002). Critical care hospitalizations and the requirement of Invasive Mechanical Ventilation were less frequent across CoronaVac vaccines than in unvaccinated individuals. CanSino and BNT162b2-vaccines patients presented lower levels of D dimer than those vaccinated with CoronaVac. However, vaccinated individuals younger than 60 years old did not have a different risk of death than unvaccinated when presenting severe COVID-19, indicating insufficient vaccine-induced immunity. **Conclusions:** CoronaVac has a better response in older adults than in young people, and vaccination status did not significantly differ in young individuals with severe illness. Future studies should examine the effects of different vaccines on different age groups and their long-term follow-up, which can help countries make informed decisions for older adults' vaccination against COVID-19.

Key words: COVID-19; SARS-CoV-2, vaccines, older persons, mortality.

RESUMEN

Antecedentes: Existe evidencia insuficiente para comparar diferentes esquemas de vacunación COVID-19 con CoronaVac en las poblaciones de adultos y adultos mayores. **Métodos:** Se realizó un estudio multicéntrico prospectivo con pacientes ingresados para hospitalización por COVID-19. **Resultados:** Un estudio de 159 pacientes con COVID-19 encontró que los pacientes más jóvenes no vacunados tenían un mayor riesgo de requerimiento de oxígeno (RR = 1,3, p = 0,041) y disnea (p = 0,002). Las hospitalizaciones en cuidados intensivos y el requisito de ventilación mecánica invasiva fueron menos frecuentes en las vacunas CoronaVac que en las personas no vacunadas. Los pacientes vacunados con CanSino y BNT162b2 presentaron niveles más bajos de dímero D que los vacunados con CoronaVac. Sin embargo, los individuos vacunados menores de 60 años no tuvieron un riesgo de muerte diferente al de los no vacunados al presentar COVID-19 grave, lo que indica una inmunidad inducida por la vacuna insuficiente. **Conclusiones:** CoronaVac tiene una mejor respuesta en adultos mayores que en jóvenes, y el estado de vacunación no difirió, significativamente, en individuos jóvenes con enfermedad grave. Los estudios futuros deberían examinar los efectos de diferentes vacunas en diferentes grupos de edad y su seguimiento a largo plazo, lo que puede ayudar a los países a tomar decisiones informadas para la vacunación de adultos mayores contra COVID-19.

Palabras clave: COVID-19, SARS-CoV-2, Vacunas, personas mayores, Mortalidad.

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Introduction

Up to March 1st 2023, more than 758 million SARS-CoV-2 infections have occurred, while more than 6,8 million people have died because of it. At this time, a total of 13.224.955.795 vaccine doses have been administered[1]. During this crisis, poor and developing countries have suffered most of human and economic loss. For instance, from a worldwide perspective, cumulative cases in the Americas have reached more than 29 percent of reported infections, although their entire population represents less than 15 from total[2]. A clear example of the differences between responses against COVID-19 of industrialized countries and the rest of the world is the investment by the first on experimental vaccine platforms, which were quickly developed and administered within their borders. This, while developing countries had limited access to those first batches of anti-SARS-CoV-2 vaccine platforms, like first-time applied and highly effective, mRNA-based formulations[3]. Notably, conventional vaccines like CoronaVac inactivated SARS-CoV-2 formulation, although conferring lower induction of neutralizing titers than these latter[4], have reported a degree of protection against COVID-19 related deaths[5]. In this regard, Chile, began massive vaccination on February 3, 2021, CoronaVac was the first administrated vaccine, later, BNT162b2, AstraZeneca, and CanSino vaccine platforms were available[6]. Nowadays, Chile has more than 93% of its objective population with a complete vaccine schedule received, while more than 58% have received two additional boost vaccination shots[7]. Notwithstanding that effective herd immunity has been aimed to be achieved through vaccination efforts like this or the natural immunity mounted by convalescents[8], the circulation of SARS-CoV-2 has not stopped[9].

Closely related to this continuous circulation is the occurrence of cumulative mutations in SARS-CoV-2, which have been reported since the still-debated[10],[11] precise beginning of COVID-19 pandemic in Wuhan, China. Mutations in SARS-CoV-2 genomes which can increase their transmissibility, and their associated symptoms or even improve the virus ability to evade vaccine-induced immunity, has challenged our strategies to stop COVID-19 pandemic[12]. Some virus variants have been considered as Variants of Interest (VOI), and Variants of Concern (VOC)[13].

Several SARS-CoV-2 variants have been identified since then [14], like Alpha[15], Beta[16], Gamma[17], and Delta[18] VOCs, Epsilon[19] and Mu[20] VOIs, and more recent Omicron[1] VOC-related viral genomes. These have circulated and replaced ancestral sequences whilst the viral spread continues [9]. Particularly, inherent mutations across VOCs, particularly at spike protein, the immunodominant SARS-CoV-2 glycoprotein and main target of vaccine platforms, have challenged naturally and artificially acquired protection against infection[21],[22],[23].

In Chile, a cohort study was carried out with 10.2 million vaccinated people to evaluate the effectiveness of the CoronaVac vaccine. This study found that the adjusted effectiveness of the vaccine was 65.9% (95% confidence interval [CI], 65.2 to 66.6) for the prevention of COVID-19 and 87.5% (95% CI, 86.7 to 88.2) for prevention of hospitalization[24]. A recent systematic review with meta-analysis that included 51 vaccine effectiveness studies determined that the effectiveness of CoronaVac was 65.7% compared to a BNT162b2 of 91.2% and Moderna of 98.1%[25].

In this study, with the aim of describing comorbidities associated to severe COVID-19 pathology in first vaccinees at southern Chile, we studied, making differences by age, their clinical parameters after being diagnosed and hospitalized due COVID-19 between June and July 2021, while at least Gamma, Delta, Lambda, and Mu SARS-CoV-2 variants were circulating in Chile[7].

Methods

Study design

This multi-center prospective study analyzed 159 hospitalized COVID-19 patients, recruited between June 24th and July 10th, 2021, in southern Chile. A non-probabilistic sampling was carried out by quotes, including 65 patients from Hospital de Osorno (40.9%), 75 patients from Hospital de Puerto Montt (47.2%), and 19 patients from Hospital de Castro, in Los Lagos Region. Their clinical records were analyzed after each informed consent was signed, identifying each vaccination status and related information. Inclusion criteria considered older than 18 years-old patients who received or not any vaccine against SARS-CoV-2 vaccine. To classify patients as vaccinated, they should have received a last shot from their complete vaccination scheme 15 days before recruitment. After considering the situation of Chile during the recruitment period, namely massive vaccination with CoronaVac inactivated SARS-CoV-2 platform was already authorized, considering CanSino clinical assay has had also approved, and that first batches of BNT162b2 mRNA-based platform were already being administered, two comparative groups were generated. Group 1 was created from individuals with complete vaccination schemes of BNT162b2, CanSino, and CoronaVac platforms and compared to unvaccinated individuals, while group 2 was created from CoronaVac vaccinees and compared to unvaccinated individuals.

When available, laboratory tests (C-reactive protein test, D-dimer test, and lymphocyte count) were performed by each recruitment Hospital.

Ethical aspects

This study was approved by the scientific ethics committee on July 7th, 2021, following Beauchamp and Childress, beneficence, no-maleficence, justice, and autonomy principles. Confidentiality and anonymity of patients were ensured. Informed consent was signed by enrolled patients and their legal representatives.

SARS-CoV-2 variants determination

The diagnosis of SARS-CoV-2 was made from nasopharyngeal swab samples. For viral RNA extraction, the QIAamp Viral RNA Mini Kit (Qiagen®) was used. For the detection of SARS-CoV-2, the SARS-CoV-2 Allplex Assay Kit (Seegene®) was used.

The detection of mutations Alpha (B.1.1.7 lineages), Beta (B.1.35 lineages), Gamma (P.1 lineages) Delta (B.1.617.2 and AY lineages) Epsilon (B.1.43 and B.1.43) Eta (B.1.52) Iota

(B.1.53) Kappa (B.1.617.1) 1.617.3 Mu (B.1.621, B.1.621.1) Zeta (P.2) was made using Allplex™ kits SARS-CoV-2 Variants I (Seegene®), Assay, Allplex™ SARS-CoV-2 Variants II Assay (Seegene®), Allplex™ SARS-CoV-2 Variants IV Assay (Seegene®) and Allplex™ SARS-CoV- 2 Variants VII Assay (Seegene®). Data were tabulated, analyzed, and correlated with clinical information.

Statistical analysis

Information analysis was carried out through descriptive measures and the construction of frequency tables. Comparations between groups were done with Z test, for proportions differences, respecting cases number by categories (np>5), and the association and relative risk calculation throughout Pearson's Chi-square or Fisher's exact test. Hypotheses were unilaterally evaluated with <0.05 significance. IBM® SPSS Statistic 20,0 SPSS statistical software was used.

Results

159 severe COVID-19 patients were recruited, which were hospitalized across southern Chile.

Of them, 89 were men (56%) and 70 were women (44%). Overall average age was 57.7 ± (17.0) years old, which was similar for men (59.0 ± 16.0 years old) and women (56.0 ± 18.0), p=0.359. The most representative age group was elderly, with a 21.4% of total ranging between 60 and 70 years old, while a 27.7% had more than 70 years old at the time of recruitment. This, and other sociodemographic characteristics, symptoms, co-morbidities, and clinical complications of patients were registered and displayed in Table 1. We found that 39.6% of patients received their complete vaccination scheme of CoronaVac shots, while 3.8% of patients already had a complete vaccination scheme of CanSino or BNT162b2 formulations. On the other hand, 47.2% of patients have not received any vaccine shot against SARS-CoV-2 infection, and 5.7% have received incomplete vaccination schedules.

Regarding symptoms, coughing and dyspnea were the most frequent (100 and 111 individuals, representing 62.9 and 69.8%, respectively). Notably, patients who reported dyspnea were less frequent across CoronaVac vaccines than in unvaccinated individuals (p = 0.002). In respect to co-morbidities, while hypertension, Mellitus diabetes, and obesity were the most frequent, only the first two were more prevalent across CoronaVac vaccines than in the group of unvaccinated individuals, p = 0.002 and p = 0.009, respectively.

Clinical complications at admission were also recorded. While most patients required oxygen support (67.3%), 39.0% were immediately admitted to the Critical Patients Unit (CPU), and 32.7% were supported with a High Flux Nasal Cannula (HNFC). CPU hospitalizations and the requirement of Invasive Mechanical Ventilation (IMV) were less frequent across CoronaVac vaccines than in unvaccinated individuals (p = 0.028 and p = 0.018, respectively) (Table 2).

To evaluate the effect of vaccination, whichever complete formulation scheme was received, age was used to segregate patients. After grouping patients by being older, our younger than 60 years old, unvaccinated individuals of the younger group had a higher risk for oxygen requirement than fully vaccinated individuals (RR=1.3, p=0.041). Among the same age group, IMV requirement risk was almost 4 times higher across unvaccinated individuals than vaccinated (RR=3.7, p=0.042). When the group of individuals older than 60 years old was analyzed, unvaccinated sub-group had a higher risk of death than vaccinated (RR = 2.3; p = 0.042) (Table 2).

To evaluate the effect of a particular vaccination scheme, CoronaVac, the most representative fully administered formulation, was compared to unvaccinated individuals after age-segregation. Notably, IMV risk was almost 6 times higher for sub-60 years old unvaccinated individuals than CoronaVac vaccines (RR = 5.4, p = 0.044). While the risk of death was also higher for the same group (RR = 2.5, p = 0.036) (Table 2).

Laboratory tests results showed that reactive C protein was increased in every recruited patient, vaccinated or not, displaying only un-significant differences (Kruskal Wallis, p = 0.765) (Table 3). Notably, CanSino and BNT162b2-vaccines patients presented lower levels of D dimer than those vaccinated with CoronaVac, incomplete schemes, or unvaccinated individuals. In addition, every CanSino and BNT162b2 vaccine displayed a lymphocyte count lower than reference threshold (< 1,000 µL). Furthermore, 72.1% of CoronaVac vaccinees and 72.7% of unvaccinated individuals showed similarly low lymphocyte counts. Complementarily, 2.33% of CoronaVac vaccinees, and 3.64% of unvaccinated individuals showed a lymphocyte count over reference threshold (> 4800/µL).

These observations of hospitalized COVID-19 patients were complemented with identified SARS-CoV-2 variants for 77 cases (48.4%). In this sense, only 1 individual was identified to be infected by the Lambda variant (1.3%), 2 by the Mu variant (2.6%), 24 by the Delta variant (31.17%), and 50 by the Gamma variant (64.94%) (Figure 1). Interestingly, when symptom frequencies were summarized according to Delta or Gamma variant infection, fever, cough, and myalgia were more frequent across Gamma-infected individuals. In contrast, dyspnea and anosmia were more frequently reported by Delta-infected individuals. Among Delta-infected individuals, cough, myalgia, dyspnea, and anosmia symptoms were more frequently reported by unvaccinated individuals than by CoronaVac vaccines. Interestingly, fever was more frequently reported by Gamma-infected CoronaVac vaccines than by Gamma-infected unvaccinated individuals, in opposition to the frequency observed for cough, myalgia, dyspnea, and anosmia symptoms (Figure 1 and 2).

Discussion

First, it is important to note that every individual recruited by our study suffered a severe COVID-19 condition and that the proportion of vaccinated and unvaccinated individuals is comparable. In this sense, it resembles a picture of the occupation status of CPU southern Chile, when notwithstanding a massive vaccination program was being applied, health services were challenged. In this sense, the group of CoronaVac vaccinated patients displayed a strong enrichment of Arterial Hypertension and Diabetes Mellitus in respect to unvaccinated individuals, which is in hand with the priority they had to receive first vaccine shots available[7]. On the other hand, during this time window, we found that the sub-set of recruited patients older

Table 1. Characterization of demographics, symptoms, comorbidities, and complications of COVID-19 patients, according to their vaccination status

Characteristics of the patients		Full dose CanSino		Full dose BNT162b2		Full dose CoronaVac		No vaccine		p value *	Incomplete dose		Total	%
		n	%	n	%	n	%	n	%		n	%		
	Total	6	3.8	6	3.8	63	39.6	75	47.2		9	5.7	159	100.0
Sex	Male	4	66.7	4	66.7	37	58.7	38	50.7	0.171	6	66.7	89	56.0
	Female	2	33.3	2	33.3	26	41.3	37	49.3	0.171	3	33.3	70	44.0
Age	< 60 Years	6	100.0	2	33.3	21	33.3	47	62.7	0.000	5	55.6	81	50.9
	≥ 60 Years	0	0.0	4	66.7	42	66.7	28	37.3	0.000	4	44.4	78	49.1
Age Group	20-29	0	0.0	1	16.7	2	3.2	5	6.7	0.168	2	22.2	10	6.3
	30-39	0	0.0	0	0.0	1	1.6	14	18.7	0.000	0	0.0	15	9.4
	40-49	3	50.0	0	0.0	6	9.5	17	22.7	0.015	0	0.0	26	16.4
	50-59	3	50.0	1	16.7	12	19.0	11	14.7	0.247	3	33.3	30	18.9
	60-70	0	0.0	2	33.3	16	25.4	15	20.0	0.226	1	11.1	34	21.4
	>70	0	0.0	2	33.3	26	41.3	13	17.3	0.001	3	33.3	44	27.7
Symptoms	Dyspnea	4	66.7	5	83.3	37	58.7	61	81.3	0.002	4	44.4	111	69.8
	Cough	4	66.7	5	83.3	35	55.6	51	68.0	0.066	5	55.6	100	62.9
	Fever	3	50.0	2	33.3	34	54.0	36	48.0	0.242	3	33.3	78	49.1
	Myalgias	2	33.3	3	50.0	19	30.2	28	37.3	0.186	2	22.2	54	34.0
	Asthenia	1	16.7	1	16.7	19	30.2	21	28.0	0.391	1	11.1	43	27.0
	Headache	1	16.7	1	16.7	19	30.2	16	21.3	0.119	2	22.2	39	24.5
	Diarrhea	1	16.7	3	50.0	12	19.0	11	14.7	0.247	1	11.1	28	17.6
Comorbidity	Hypertension	0	0.0	5	83.3	34	54.0	23	30.7	0.002	1	11.1	63	39.6
	Diabetes Mellitus	1	16.7	2	33.3	25	39.7	16	21.3	0.009	2	22.2	46	28.9
	Obesity	2	33.3	4	66.7	18	28.6	13	17.3	0.059	1	11.1	38	23.9
	Chronic renal disease	0	0.0	1	16.7	7	11.1	5	6.7	0.182	0	0,0	13	8.2
	Chronic liver disease	0	0.0	0	0.0	3	4.8	5	6.7	0.314	0	0.0	8	5.0
	Cancer	0	0.0	0	0.0	2	3.2	5	6.7	0.168	0	0.0	7	4.4
	Oxygen support	3	50.0	4	66.7	40	63.5	57	76.0	0.055	3	33.3	107	67.3
Complications	CPU*	4	66.7	5	83.3	18	28.6	33	44.0	0.028	2	22.2	62	39.0
	HNFC*	3	50.0	4	66.7	16	25.4	27	36.0	0.087	2	22.2	52	32.7
	IMV*	1	16.7	0	0.0	5	7.9	15	20.0	0.018	3	33.3	24	15.1
	Death	0	0.0	1	16.7	7	11.1	12	16.0	0.199	0	0.0	20	12.6

*CPU: Critical Patient Unit; IMV: Invasive Mechanical Ventilation; HNFC: High Flux Nasal Cannula.

than 60 years old were predominantly unvaccinated, whilst they also had a higher risk of death, same as extensively reported[26],[27]. In contrast, when presenting severe COVID-19, vaccinated individuals younger than 60 years old do not have a different risk of death than unvaccinated, suggesting that once suffering from severe COVID-19, previous vaccine-induced immunity is not sufficient to protect them from death. These results coincide with the largest study carried out in Chile on the effectiveness of the CoronaVac vaccine, which determined that it especially conferred greater protection to those over 60 years of age for mortality from COVID-19[24]. Likewise, a study carried out in Brazil for seriously ill or deceased patients with

Table 2: Risk factors according to age and complications for different age and complications subgroups

	Group 1						Group 2				
	No vaccine		with vaccine				No vaccine		CoronaVac		
Complications/age	n	Cases (%)	n	Control (%)	RR (I.C. 95%)	p	n	Cases	n	Control	RR (I.C. 95%)	p
CPU*												
< 60 years	47	23 (48.9)	29	12 (41.4)	1,2 (0.7-2.0)	0.521 ns	47	23 (48.9)	21	6 (28.6)	1.7 (0.8-3,6)	0.117
≥ 60 years	28	10 (35.7)	46	15 (32.6)	1.1 (0.6-2.1)	0.784 ns	28	10 (35.7)	42	12 (28.6)	1.3 (0.6-2.5)	0.528
Oxygen support												
< 60 years	47	39 (83.0)	29	18 (62.1)	1.3 (1-1.8)	0.041 s	47	39 (83)	21	13 (61.9)	1.3 (0,9-1.9)	0,058
≥ 60 years	28	18 (64.3)	46	29 (63.0)	1.0 (0.7-1.5)	0.914 ns	28	18 (64.3)	42	27 (64.3)	1.0 (0.7-1.4)	1.000
IMV*												
< 60 years	47	12 (25.5)	29	2 (6.9)	3.7 (0.9-15.4)	0.042 s	47	12 (25.5)	21	1 (4.8)	5.4 (0.7-38.6)	0.044
≥ 60 years	28	3(10,7)	46	4(8,7)	1,2(0,3-5,1)	0,774 ns	28	3(10,7)	42	4(9,5)	1,1(0,3-4,6)	0,871
HFNC*												
< 60 years	47	19 (40.4)	29	10 (34.5)	1.2 (0.6-2.2)	0.604 ns	47	19 (40.4)	21	5 (23.8)	1.7 (0.7-3.9)	0.185
≥ 60 years	28	8 (28.6)	46	13 (28.3)	1.0 (0.5-2.1)	0.977 ns	28	8 (28.6)	42	11 (26.2)	1.1 (0.5-2.4)	0.826
Death												
< 60 years	47	2 (4.3)	29	1 (3.4)	1.2 (0.1-13)	0.861 ns	47	2 (4.3)	21	1 (4.8)	0.9 (0.1-9.3)	0.925
≥ 60 years	28	10 (35.7)	46	7 (15.2)	2.3 (1.0-5.5)	0.042 s	28	10 (35.7)	42	6 (14.3)	2.5 (1.0-6.1)	0.036

*CPU: Critical Patient Unit; IMV: Invasive Mechanical Ventilation; HNFC: High Flux Nasal Cannula.

COVID-19 highlights mortality (for patients vaccinated with CoronaVac) of younger age, but who were health workers[28].

Furthermore, the critical contribution of vaccine platforms other than CoronaVac to the challenging circumstances of mid-2021, is evident. For instance, although the group of CoronaVac vaccinated (n = 63) did not have a lower risk of requiring oxygen support than unvaccinated individuals, the incorporation of only 6 BNT162b2 and 6 CanSino-vaccines to the analysis allowed to a comparatively and significantly decrease this risk across vaccinated patients.

Also supporting a differential clinical progression between the individuals of our cohort vaccinated with different formulations, laboratory parameters display different mean values between those groups. The most dissimilar parameter analyzed is D-Dimer concentration, for which CoronaVac vaccines show mean levels more than 160 times higher than BNT162b2 or CanSino-vaccinated individuals. D-Dimer is a well-known predictor of COVID-19 severity and mortality[29], so its elevated levels are expected among severe individuals like every patient from our cohort, but notably, CoronaVac vaccines displayed mean levels 1.25 times higher than individuals without any vaccine shot.

Our results also suggest that, despite the evolved nature of SARS-CoV-2 variants in respect to the Wuhan reference genome used in CoronaVac inactivated vaccine formulation, complete vaccination scheme confer protection from death to the elderly.

Limitations of the study

Although this work displays a detailed picture of the vaccination status of severely hospitalized individuals in southern Chile, it is a descriptive study that could have been more informative if more clinical parameters were captured. Nevertheless, its cohort size and balanced composition allowed for obtaining critical information on the vaccine's effects on the most affected individuals during one of the deadliest stages of the COVID-19 pandemic.

Conclusions

Hospitalized patients with COVID-19 in the present study more commonly presented hypertension and Diabetes Mellitus. Patients vaccinated with CoronaVac presented cough, dyspnea, and the need for invasive mechanical ventilation less frequently than unvaccinated patients. The risk of death was lower for people vaccinated with CoronaVac than for those

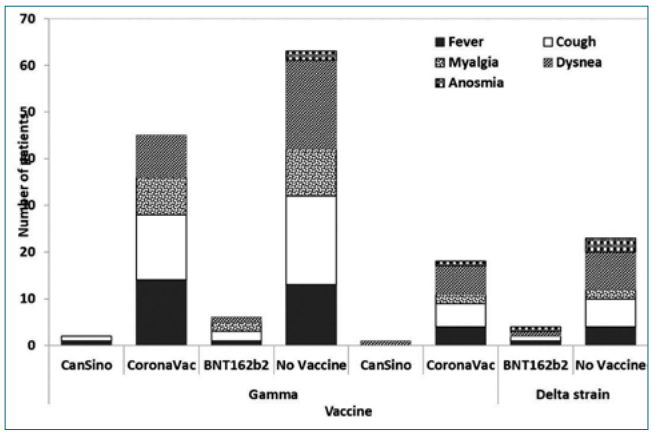

Figure 1. Reported symptoms of COVID-19 individuals infected with an identified SARS-CoV-2 variant of concern.

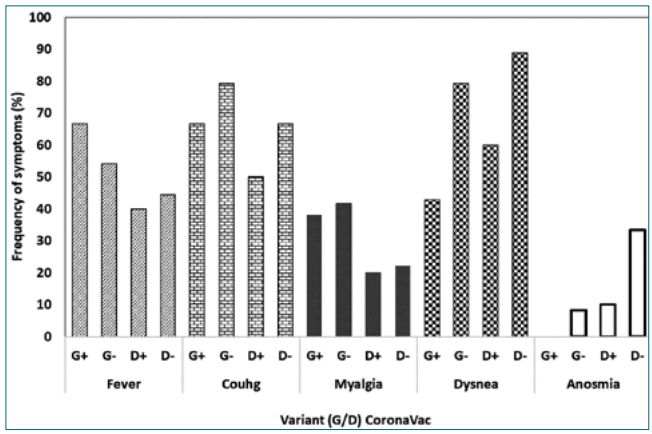

Figure 2. Symptom frequency according to SARS-CoV-2 variant.

Table 3. Laboratory tests results of COVID-19 patients, according to their vaccination status

Statistics	CanSino	BNT162b2	CoronaVac	Incomplete dose	No vaccine	P
C Reactive Protein (PCR) (mg/l)						
[0.00 - 0.50] mg/dL						
n	5	5	49	7	62	
Median	163.0	107.0	145.5	102.0	116.2	0.765
% Over range	100.0	80.0	98.0	100.0	100.0	
First quartile	136.0	6.1	71.1	89.4	54.6	
Third quartile	190.2	202.1	200.0	191.7	201.3	
interquartile range	54.2	196.0	128.9	102.3	146.7	
Min.	94.0	0.3	0.4	75.1	0.6	
Max.	238.8	252.2	3493.0	363.0	821.0	
D Dimer (pg/mL)						
< 0.5 micrograms per milliliter						
n	4	5	30	5	48	
Median	0.9	0.8	145.5	102.0	116.2	0.655
% Under range	25.0	20.0	23.3	40.0	37.5	
First quartile	0.6	45.8	71.1	89.4	54.6	
Third quartile	1.0	143.5	200.0	191.7	201.3	
interquartile range	0.4	97.7	128.9	102.3	146.7	
Min.	0.2	0.2	0.4	75.1	0.6	
Max.	1.1	3493.0	3493.0	363.0	821.0	
Lymphocytes						
1,000 - 4,800 (pL)						
n	5	5	43	6	55	
Median	405.0	506.0	770.0	729.0	672.0	0.361
% Under 1.000	100.0	100.0	72.1	50.0	72.7	
% Over 4.800	0.00	0.00	2.33	0.00	3.64	
First quartile	1.4	4.7	7.7	97.9	29.5	
Third quartile	451.0	630.0	1032.5	1113.8	1005.5	
interquartile range	449.6	625.3	1024.8	1015.9	976.0	
Min.	0.4	2.4	0.4	0.5	0.4	
Max.	759.0	631.0	26900.0	1641.0	9100.0	

not vaccinated, but only for people older than 60 years, while the risk of needing intensive mechanical ventilation or oxygen was significantly lower only for people vaccinated with CoronaVac younger 60 years old.

It is necessary to identify worldwide the effects of the different vaccines by age and their follow-up over the next few years. Future studies can help countries in decision-making in vaccination schemes for what will be the endemic of COVID-19

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