

## Characteristics of Vaccinated Healthcare Workers Infected with SARS-CoV-2: Study at Institute “Pedro Kourí”, 2021

Características de la infección por SARS-CoV-2 en trabajadores de salud vacunados: estudio del Instituto “Pedro Kourí”, 2021

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### ABSTRACT

**Objective:** To describe the characteristics of vaccinated and unvaccinated HCWs with SARS-CoV-2 infection, a cross-sectional study was conducted at the Pedro Kourí Tropical Medicine Institute in 2021.

**Methods:** Age, sex, occupation, presence of chronic disease(s), presence of symptoms, date of onset of symptoms, clinical course of illness, and vaccination status were analyzed. The vaccinated and unvaccinated cases were described and compared based on sociodemographic, clinical, and epidemiological characteristics. The data was processed in frequency, ratio, percentages, mean, and prevalence ratio with 95% confidence intervals was estimated.

**Results:** A total of 207 cases (81.15% fully vaccinated, 1.93% partially vaccinated, and 16.90% unvaccinated), were studied. The highest incidence of cases occurred in August, which coincided with the widespread circulation of the Delta variant. The mean age of those infected was 35 years. The infection prevailed in women (77.29%) and support staff (55.55%). Of the cases, 33.81% had previous comorbidities, of which arterial hypertension (55.71%) prevailed. There was higher frequency of mild symptoms (78%) among vaccinated cases compared to unvaccinated cases (49%). Severe symptoms only developed in three (8%) unvaccinated cases, while vaccinated cases did not develop any severe symptoms at any time. No relation was found between vaccination status and symptomatic disease (PR=0.75; IC 0.59-0.95).

**Conclusions:** The symptomatic cases were mild and no severe events or fatalities due to COVID-19 were reported among IPK workers during the study period.

**Keywords:** COVID-19 symptomatic disease; SARS-CoV-2 infection; vaccination; health care workers; Cuba.

## RESUMEN

**Objetivo:** Con el fin de describir las características de los trabajadores de la salud vacunados y no vacunados infectados por SARS-CoV-2, se realizó un estudio transversal en el Instituto de Medicina Tropical Pedro Kourí en el año 2021.

**Métodos:** Se analizaron edad, sexo, ocupación, presencia de enfermedad(es) crónica(s), síntomas, fecha de inicio de síntomas, evolución clínica y estado de vacunación. Se compararon los grupos según características sociodemográficas, clínicas y epidemiológicas. El análisis de los datos incluyó frecuencias, razones, porcentajes, media y razón de prevalencia con intervalos de confianza del 95 %.

**Resultados:** Se incluyeron 207 casos (81,15 % completamente vacunados, el 1,93 % parcialmente vacunados y 16,90 % no vacunados). La mayor incidencia en agosto, coincidiendo con la circulación generalizada de la variante Delta. La edad media fue 35 años. La infección predominó en mujeres (77,29 %) y personal de apoyo (55,55

%). El 33,81 % tenía comorbilidades previas, predominando la hipertensión arterial (55,71 %). Los síntomas leves fueron más frecuentes (78 %) entre los vacunados en comparación con los no vacunados (49 %). Solo tres casos no vacunados desarrollaron (8 %) síntomas graves. No se encontró relación entre el estado de vacunación y la enfermedad sintomática (RP = 0,75; IC 0,59-0,95).

**Conclusiones:** No se reportaron eventos graves ni muertes por COVID-19 entre los trabajadores de IPK durante el período de estudio.

**Palabras clave:** enfermedad sintomática COVID-19; infección por SARS-CoV-2; vacunación; trabajadores de salud; Cuba.

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## Introduction

In the context of the COVID-19 pandemic, healthcare workers (HCWs) have been considered a high-risk group for the SARS-CoV-2 infection because their active role in providing care for patients with COVID-19 in the workplace.<sup>(1,2)</sup> Therefore, they are considered a priority group for vaccination.

Since the beginning of the pandemic, the Cuban biopharmaceutical industry and the national health system worked together to produce their vaccines against SARS-CoV-2. Soberana 02, Soberana Plus, and Abdala shown to be safe and immunogenic. The efficacy after two doses of Soberana-02 administration was 69.7 % and 92.0 % after completing the heterologous schedule with Soberana-Plus.<sup>(3,4,5)</sup>

Early in January 2020, the National Working Group and the Ministry of Public Health designated the Tropical Medicine Institute (IPK) as the reference center for clinical care and management of the suspected and confirmed cases, and for the confirmation and quality control of the molecular diagnosis of SARS-CoV-2. Therefore, IPK was the first institution to vaccinate its workers, to safeguard themselves and the community they serve.

In this paper, we describe a study in HCWs at IPK, conducted in the context of two epidemic peaks during 2021 associated with the circulation of SARS-CoV-2 different variant.

## **Methods**

### **Study setting**

The study is designed to be conducted at IPK because it is a reference tertiary care center for hospitalization and study of emerging and re-emerging diseases located in Havana city. The first designated for admission and study of cases and outbreaks of COVID-19 in Cuba.

### **Study design**

An observational cross-sectional study was conducted to describe the sociodemographic, clinical, and epidemiological characteristics in vaccinated and unvaccinated cases.

### **Context**

The implementation of genomic surveillance in Cuba allowed identifying the circulation of the different SARS CoV-2 variants. The D614G variant predominated throughout 2020. With the opening of the borders in November 2020 and the entry of Beta variant (B.1.351) and Delta variants (B.1.617.2), the epidemiological scenario became more complex in 2021, with a marked growth in the incidence of cases, severe cases, and deaths. It was necessary to carry out an intervention study in HCWs, with a heterologous scheme: two doses of SOBERANA®02, and one dose of SOBERANA®Plus with 28 days between them. In May, a sanitary intervention in the population was rolled out with Abdala vaccine.<sup>(6,7)</sup> The Omicron variant was detected in December 2021.

### **Study population**

Comprised HCWs from IPK. It employs during the study period a total of 1270 HCWs.

### **Inclusion criteria**

They were included all professional categories of staff working, who were confirmed as positive cases by Reverse Transcriptase-Real Time Polymerase Chain Reaction (RT-PCR) for SARS-CoV-2 <sup>(8)</sup> with or without symptomatology.

### **Exclusion criteria**

HCWs were excluded if no clinical or epidemiological information was available.

### **Study period**

The study period was from January 1<sup>st</sup> to December 31<sup>st</sup>, 2021.

### **Outcome definitions**

The outcome of the study was symptomatic SARS-CoV-2 infection in any participant according to the [National Action Protocol for COVID-19 in Cuba, and the](#) World Health Organization (WHO) recommendations for case definition.<sup>(8,9)</sup>

### **Variables collected from participants**

Age, sex, occupation, presence of chronic disease(s), date of PCR results, date of vaccination, presence of symptoms, date of onset of symptoms, clinical course of illness.

### **Definitions**

- Asymptomatic case: no symptoms or signs at diagnosis.
- Symptomatic case: presence of symptoms or signs at diagnosis,
- Mild disease: fever, cough, sore throat, nasal congestion, headache, malaise, diarrhea, vomiting. Normal radiology. Oxygen saturation above 95%.
- Moderate disease: fever, cough, polypnea, slight changes in Rx or pulmonary ultrasound. Oxygen saturation  $\geq 90\%$
- Severe disease: fever, cough, polypnea, infiltrate/condensation in Rx or pulmonary ultrasound. Oxygen saturation  $< 90\%$  or requires Mechanical

Assisted Ventilation. Critical cases: Acute Respiratory Distress Syndrome, Sepsis or Septic Shock.

- Fully vaccinated case: It include those 15 days after the third dose.
- Unvaccinated case: It not received any dose of vaccine, and the partially vaccinated cases (15 days after receiving the first dose until 14 days after receiving the third dose).
- Support staff: who had an indirect exposure to the patients or their infectious secretions or materials.

### **Study procedures**

By January 1<sup>st</sup>, 2021, a list of all HCWs of the hospital was obtained. For all participants suspected of COVID-19, a nasopharyngeal sample was collected. The RT-PCR testing was performed by a medical staff, following WHO Laboratory biosafety guidance.<sup>(10)</sup> All positive cases were investigated to collect the data using a questionnaire that included baseline demographic, clinical, and epidemiological characteristics. Who met the requirements were selected and grouped in full vaccinated and unvaccinated cases.

### **Data sources**

Data was collected through the clinical charts review, the IPK databases of hospitalized COVID-19 suspected and confirmed cases and outpatient records. The diagnosis data were extracted from the hospital's electronic system. Vaccination status of vaccination database. For each variable, possible and optimal data sources was identified.

### **Data management and ensuring data confidentiality**

The personal identifiers were included in study databases; it was maintained only by the responsible person(s) in the study site.

### **Statistical analysis**

Data were entered into an Excel spreadsheet and summarized according to frequency, ratio, percentages, mean, standard deviation, and incidence rates. We

used Chi-square test (or Fisher exact test as appropriate) to compare the distribution of full vaccinated cases versus unvaccinated cases. We performed a bivariate analysis through calculation of prevalence ratios with 95% confidence intervals.

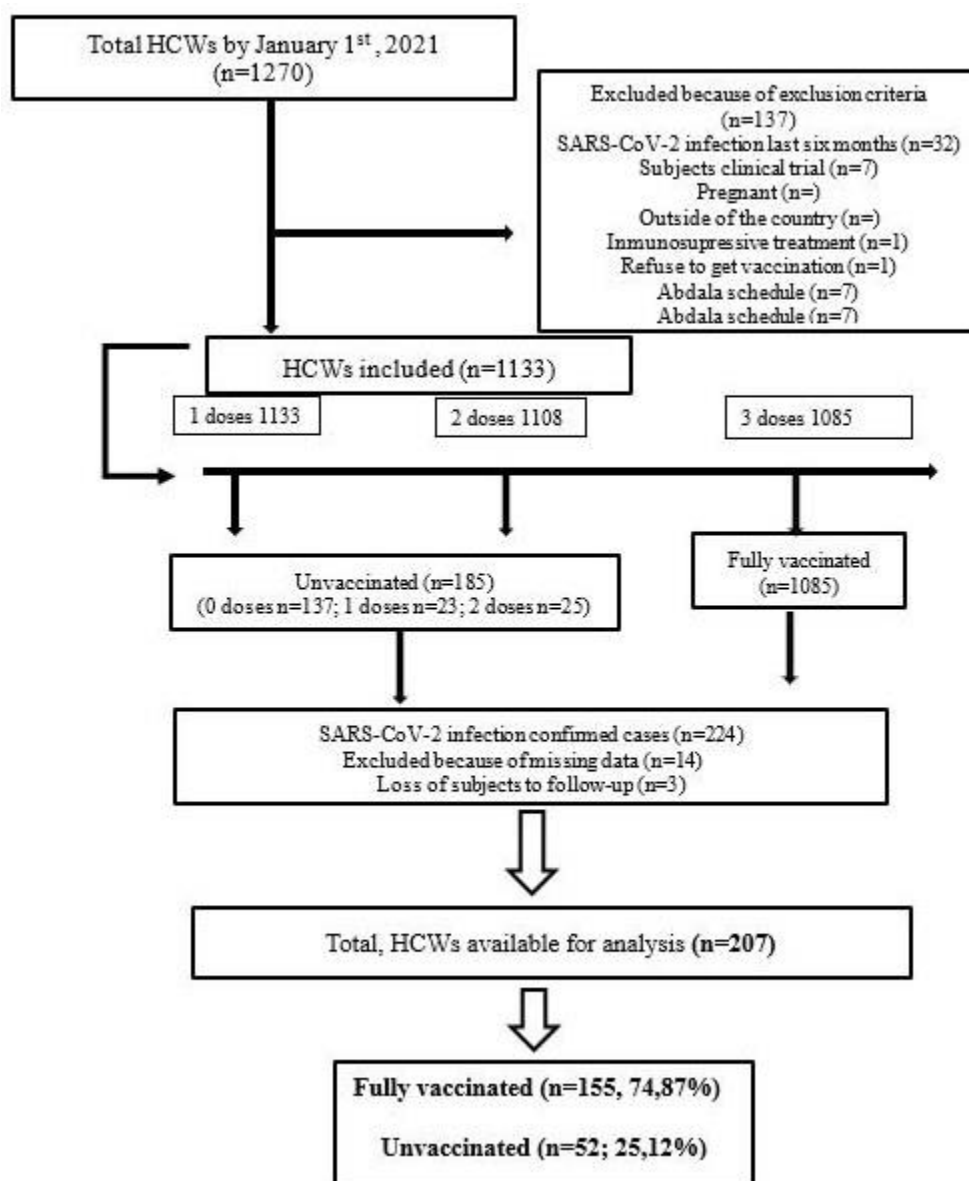
### **Ethical considerations**

The study was approved by the scientific and ethics committee of the IPK and has been performed in accordance with the ethical standards noted in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The confidentiality of the collected and analyzed data was guaranteed. The informed consent was not necessary because we worked with available information.

### **Results**

In March 2021, IPK started the vaccination of its HCWs eligible for vaccination. 137 were not eligible following the exclusion criteria. A first dose was administered to 89.21% (1 133), the second dose to 1 108 (coverage of 97.79% of first dose), and 1 085 (97.92% coverage of the second dose) received the third dose (85.43%), 23 received one dose, and 25 received two doses (figure 1).

In 2021, IPK reported 224 positive SARS-CoV-2 RT-PCR tests in their HCWs, representing 17.63% (224/1270) of staff infected. Of them, 207 met the established requirements, 155 (74.87%) were fully vaccinated, while the remaining 52 (25.12%) were unvaccinated. Specifically, 34 had received 0 doses and 18 had received between 1 and 3 doses within 14 days (fig. 1).



**Fig. 1** - Flow chart of IPK hospital data cleaning.

No significant difference was observed between the fully vaccinated and unvaccinated cases in relation to age groups, sex, and occupation. A significant association ( $p < 0.005$ ) was found between the incidence of SARS-CoV-2 infection in unvaccinated cases with comorbidities compared to vaccinated cases with similar characteristics. Unvaccinated cases were more likely to have severe COVID-19 ( $p = 0.00$ ) than vaccinated cases.

Overall, the highest incidence of SARS-CoV-2 infection was observed in unvaccinated cases ( $28.10 \times 10^3$ ). The mean age of the study subjects was 43 years

(ranging from 19 to 79 years), and the masculinity ratio was 0.29. The highest incidence was reported in the age group of 46 to 55 years ( $45.66 \times 10^3$ ), female ( $125.98 \times 10^3$ ), support staff ( $90.55 \times 10^3$ ), and cases without previous comorbidities ( $108.66 \times 10^3$ ). Regarding the comorbidity's status of healthcare workers, only a third had chronic disease (33.33%), hypertension was the most prevalent condition (56.52%). As for the symptoms, a minority of study subjects did not experience any symptoms ( $41.73 \times 10^3$ ). Among those who had clinical symptoms, mild illness overcome ( $118.11 \times 10^3$ ) and only three severe cases were reported (table 1). No fatalities were reported during the study period.

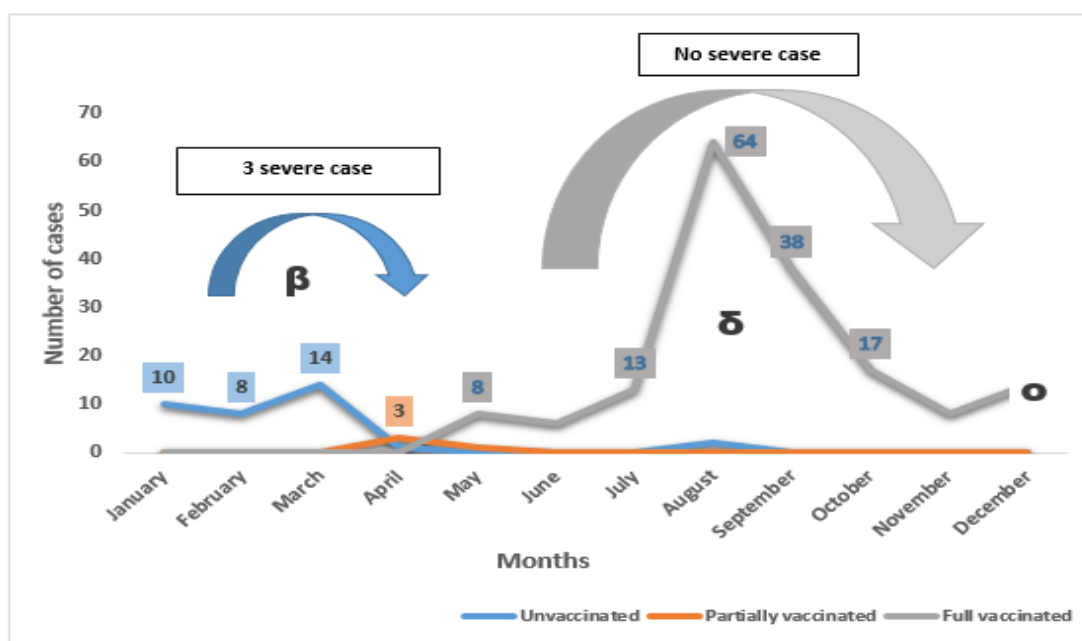
**Table 1** - Incidence of SARS-CoV-2 infection in unvaccinated and vaccinated HCWs according to demographic and clinical characteristics

| Characteristics              | Unvaccinated<br>(n=185)             | Vaccinated<br>(n=1085)              | Total<br>(n=1270)                   | P value <sup>\$\$</sup> |
|------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------|
|                              | Cases<br>(incidence <sup>\$</sup> ) | Cases<br>(incidence <sup>\$</sup> ) | Cases<br>(incidence <sup>\$</sup> ) |                         |
| All cases                    | 52 (28.10)                          | 155 (14.28)                         | 207 (16.29)                         | -                       |
| <b>Ages groups</b>           |                                     |                                     |                                     |                         |
| <26 years                    | 10 (54.05)                          | 18 (16.58)                          | 28 (22.04)                          | 0.78                    |
| 26-35 years                  | 7 (37.83)                           | 37 (34.10)                          | 44 (34.64)                          | 0.06                    |
| 36-45 years                  | 6 (32.43)                           | 28 (25.80)                          | 34 (26.77)                          | 0.13                    |
| 46-55 years                  | 15 (81.08)                          | 43 (39.63)                          | 58 (45.66)                          | 0.46                    |
| >55 years                    | 14 (75.67)                          | 29 (26.72)                          | 43 (33.85)                          | Reference               |
| <b>Sex</b>                   |                                     |                                     |                                     |                         |
| Male                         | 12 (64.86)                          | 35 (32.25)                          | 47 (37.00)                          | Reference               |
| Female                       | 40 (216.21)                         | 120 (110.59)                        | 160 (125.98)                        | 0.94                    |
| <b>Occupational category</b> |                                     |                                     |                                     |                         |
| Doctors                      | 6 (32.43)                           | 9 (8.29)                            | 15 (11.81)                          | Reference               |
| Nurses                       | 9 (48.64)                           | 24 (22.11)                          | 33 (25.98)                          | 0.37                    |
| Support staff                | 27 (145.94)                         | 88 (81.10)                          | 115 (90.55)                         | 0.16                    |

|                              |             |              |              |           |
|------------------------------|-------------|--------------|--------------|-----------|
| General services             | 10 (54.05)  | 34 (31.33)   | 44 (34.64)   | 0.19      |
| <b>Co-morbidities</b>        |             |              |              |           |
| No                           | 42 (227.02) | 96 (88.47)   | 138 (108.66) | 0.01      |
| Yes                          | 10 (54.05)  | 59 (54.37)   | 69 (54.33)   | Reference |
| <b>Clinical presentation</b> |             |              |              |           |
| Asymptomatic                 | 21 (113.51) | 32 (29.49)   | 53 (41.73)   | 0.16      |
| Mild disease                 | 28 (151.35) | 122 (112.44) | 150 (118.11) | 0.00      |
| Moderate                     | -           | 1 (0.92)     | 1 (0.78)     | 0.54      |
| Severe                       | 3 (16.21)   | -            | 3 (2.36)     | Reference |

Legend: § Incidence x 10<sup>3</sup>. §§ Chi-Square or Exact Fisher tests.

The highest incidence of SARS-COV-2 infection in HCWs occurred in August, coinciding with the epidemic peak associated to the Delta variant in Cuba. The analysis of the number of severe cases in relation to vaccination status shows that between February and April, when the Beta variant was predominant in the country, one severe case was reported each month in unvaccinated HCWs. No other severe cases were reported during the circulation of the Delta variant. The vaccinated cases did not develop severe symptoms at any time (fig. 2).



**Fig. 2** - SARS-CoV-2 variant circulation and COVID-19 cases in HCWs according to severity and vaccination status.

As is shown in table 2, the symptomatic infection was most common in vaccinated individuals, while unvaccinated cases were more likely to be symptomatic disease (PR = 0.75; IC 0.59-0.95). However, the cases were mild and no severe events or fatalities occurred in this group.

**Table 2** - Occurrence of any COVID-19 clinical presentation according to the vaccination status (IPK, 2021)

| Clinical presentation | Symptomatic<br>n (%) | Asymptomatic<br>n (%) | Total<br>n (%) | PR   | CI (95%) |      |
|-----------------------|----------------------|-----------------------|----------------|------|----------|------|
|                       |                      |                       |                |      | LL       | UL   |
| Unvaccinated          | 31 (59.61)           | 21 (40.38)            | 52             | 0.75 | 0.59     | 0.95 |
| Vaccinated            | 123 (79.35)          | 32 (20.64)            | 155            |      |          |      |

Legend: Abbreviations: PR: Prevalence ratio, CI: Confidence interval, LL: Lower limit, UL: Upper limit.

## Discussion

HCWs have been the most affected group during the COVID-19 pandemic. Therefore, their protection through vaccination is very important to avert serious cases and deaths.<sup>(11,12)</sup>

By June 25th, 2021, a high proportion (85.43%) of HCWs at IPK had completed the full 3-dose COVID-19 vaccination schedule, similar to other HCWs in Cuba,<sup>(13)</sup> and in Albania.<sup>(14)</sup> Contrary, in Somalia the vaccination coverage among HCWs was 38%.<sup>(15)</sup>

The incidence of SARS-CoV-2 infection was higher among unvaccinated cases ( $28.10 \times 10^3$ ) and severe disease was reported only in this group ( $16.21 \times 10^3$ ). This results are lower compared to Hospital in Hungary (41%), and India (45 %).<sup>(16,17)</sup>

The circulation of the Beta and Delta variants, increased the incidence of cases, reduced the asymptomatic people (8-10%), symptoms start earlier and often progress towards severity and critical status.<sup>(6,7)</sup>

In this study, a higher incidence ( $121.25 \times 10^3$ ) of symptomatic cases was observed, and the clinical course of COVID-19 was mostly mild ( $118.11 \times 10^3$ ), similar to was reported in other studies,<sup>(18,19)</sup> and different to was reported in another hospitals in Holguín and Havana.<sup>(16,20)</sup>

Unvaccinated cases were more likely to have severe COVID-19 in relation to vaccinated cases, and no fatalities by COVID-19 were informed. It is noteworthy that health personnel in other countries in the Americas (1.94%).<sup>(21)</sup>

The literature shows a greater effect on middle age people, while sex predominance has varied depending on the time frame studied.<sup>(22)</sup> The mean age of 44 years, and female predominance of  $125.98 \times 10^3$  found could be explained by the fact that during the epidemic, the workers who remained in service were mainly young, while vulnerable older adults stayed at home. Regarding sex, the majority of the workforce in this sector in all are women, reality from which IPK does not escape (74% female).

In our country, the policy was to guarantee the training of the health personnel, whether they would be directly treating positive cases in the red zone or not, as well as the application of strict compliance of biosecurity protocols, to avoid high morbidity and mortality in this group.

In our study, the infection was more frequently in among support staff ( $90.55 \times 10^3$ ), who were not directly involved in patient care inside the red zone. It is presumed, based on the type of contacts and investigated chains of transmission, that the workers acquired the infection in the community rather than in the hospital setting.

Other contexts identified a greater involvement of physicians and nurses working directly with COVID-19 cases,<sup>(23)</sup> and the main source of infection varies between institutions, and other social relationships in or outside the workplace.<sup>(23,24)</sup>

The results exhibited at IPK demonstrate the institution and its workers' decisive role in the early national training prior to the confirmation of the first cases in Cuba. IPK probably ensured better preparation and protection of doctors, nurses, and laboratory staff. Unlike other context, where the availability and proper use of personal protective equipment have been a concern. According to a study of health personnel from 13 Latin American countries, 30.6 % of participants reported not having received training on COVID-19, the correct use of personal protective equipment, or how to identify suspected or confirmed case hotlines.<sup>(25)</sup>

Based on our experiences in handling and tracing contacts, it can be said that, in a context of sustained community transmission, such as the one that occurred in Cuba in 2021, it is difficult to separate the risks associated with each specific contact, both those generated by direct patient care and other contacts at the workplace or in the community.

A systematic review and meta-analysis on the comorbidities and clinical severity of COVID-19 reported arterial hypertension as the second risk factor associated with COVID-19, with risk increase of more than 3.5 times.<sup>(26)</sup>

Vaccination is not 100 % effective in preventing infections as some vaccinated people still get infected but tend to suffer less severe symptoms than unvaccinated individuals.<sup>(27)</sup> In our study, symptomatic cases were mild and no severe events or fatalities occurred.

In the authors' view, in the management of confirmed and severe cases of IPK workers, the extensive expertise of medical and nursing personnel acquired over many years, played a decisive role.

The present study has several limitations. It should be noted that it was conducted in a single tertiary center with around 1000 workers, and the findings may not be representative of all HCWs. Important data may have been omitted at the time of diagnosis since the retrospective information was collected by different personnel. The vaccination campaign in HCWs was implemented in a short period of time and achieved high coverage, which limits the possibility of having a concurrent comparison group of unvaccinated people. The effectiveness of the vaccines in preventing fatal and severe events could not be studied, because zero or very low numbers was observed in the study period.

In conclusion, the progression of the COVID-19 in vaccinated HCWs was mild and no severe events or fatalities occurred.

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### Conflict of interests

The authors state that there is no conflict of interests.

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