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Occupational COVID-19 at the National Institute of Respiratory Diseases, Mexico City during the pandemic

COVID-19 ocupacional en el Instituto Nacional de Enfermedades Respiratorias, Ciudad de México, durante la pandemia

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ABSTRACT. Introduction: the pandemic caused by the SARS-CoV-2 virus faced Health Care Workers (HCW's) with achallenge like never before. The Ismael Cosío Villegas National Institute of Respiratory Diseases, (INER), of Mexico, became a care center for patients with COVID-19. **Objective:** to publicize the results of a control program, in INER workers, based on frequent tests in oro/nasopharyngeal sampling to determine the presence of the virus, and thus isolate positive cases and detect asymptomatic ones. **Material and methods:** an oro/nasopharyngeal swab was performed for SARS-CoV-2 test by RT-PCR in all de HCWs who attended to Occupational Medicine Service. In case of being positive, he/she isolated him/herself at home for fourteen days. An epidemiological questionnaire was obteined if the acquisition of the disease had been community or nosocomial. A new sample was taken every 14 days until negative. **Results:** 33,780 tests were performed on 4,772 of the HCW's during the period April 2020-June 2023, of these, 4,160 were found to be positive. The months of January and July 2022 were the months with the most cases, (789 and 636, respectively). The nursing staff was the most affected with 1,106 positive cases. **Conclusions:** the application of a care protocol to the HCWs proved to be efficient in protecting with a low infection rate due to the use of PPE, continuous training and frequent control tests to avoid intrahospital transmission with zero mortality.

Keywords: health care workers, SARS-CoV-2 infection, COVID-19.

RESUMEN. Introducción: la pandemia ocasionada por el virus SARS-CoV-2 enfrentó al personal de salud a un reto como nunca antes. El Instituto Nacional de Enfermedades Respiratorias Ismael Cosío Villegas, (INER), de México, se convirtió en un centro de atención para pacientes con COVID-19. **Objetivo:** dar a conocer los resultados de un programa de control, en el personal de salud, con base en pruebas frecuentes en toma de muestras nasofaríngeas para determinar la presencia del virus; y así, aislar a los casos positivos y detectar a los asintomáticos. **Material y métodos:** mediante un protocolo de atención definido se tomaron muestras a todo trabajador que acudía a la coordinación. En caso de ser positivo se aislaba en su domicilio por 14 días; en un cuestionario epidemiológico se definió si la adquisición de la enfermedad había sido comunitaria o nosocomial. Posteriormente, cada 14 días se tomaba nueva muestra hasta negativa. El protocolo se modificó en las diferentes olas que se presentaron. **Resultados:** durante el período abril 2020-junio 2023, se efectuaron 33,780 pruebas a 4,772 trabajadores del personal de salud; de éstas 4,160 resultaron ser positivas. Los meses de enero y julio de 2022 fueron los meses con más casos (789 y 636, respectivamente). El personal de enfermería fue el mayormente afectado con 1,106 casos positivos. **Conclusiones:** la pandemia afectó de manera importante al personal de salud del instituto. Sin embargo, el aislamiento oportuno y las pruebas frecuentes evitaron muertes en los trabajadores. La gran mayoría fue de origen comunitario, tal como se reporta en la literatura.

Palabras clave: personal de salud, COVID-19, infección por SARS-CoV-2.

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INTRODUCTION

17 years after 2003 and the epidemic by severe acute respiratory syndrome (SARS), a new coronavirus, the severe acute respiratory syndrome 2 (SARS-CoV-2) was isolated in the bronchoalveolar lavage in various patients with pneumonia of unknown origin in Wuhan, China,[1] which provoke a big amount of infections and a significant number of deaths, which led the World Health Organization (WHO) to declare the coronavirus disease (COVID-19) as an emergency of concern. By the 20th of February 2020 a total of 81,109 confirmed cases by laboratory had been reported.[2] In addition to the previous, cases of nosocomial spread among healthcare staff were reported, some severe and with high mortality.[3,4] Obviously, the healthcare staff was the first line of response to COVID-19, leaving them in a high risk of acquiring the disease, exposing the same patients and the community.

In this context, the National Institute for Respiratory Illness Ismael Cosío Villegas (INER), Mexico City, on the imminent arrival of the virus, it started the preparations of hospital conversion for the care of affected patients by COVID-19 with the training on the correct use of the personal protective equipment to the staff, particularly because there was an important hiring of staff to face the contingency.

Due to the concern to maintain the healthcare staff safe and protected from the disease, the Preventive and Occupational Health Care Coordination was created; so, as far as it is possible, being able to control the spreading among the healthcare staff, detect early complications and do not wear down the staff due to the lack of personnel because of isolation.

This report is the result of the prospective patient cohort of which was already published previously by our team and complete the years 2020-2023.[5]

MATERIAL AND METHODS

In April 2020, the control care program to the healthcare staff in the external consultation began. The original staff was a total of 4,772: 2,823 in the frontline (nurses, doctors, stretcher-bearers, custodial staff, laboratory), 1,336 in the second line (administrative staff that is not in contact with patients) and 613 that were other part of the staff or of third line. This were registered in a data base on Microsoft Excel 16.16.27l, the electronic file was also checked. Descriptive data was use in the statistical package SPSS statistics version 25 to calculate median and interquartile age of the evaluated groups.

Consultation care protocol

During the evolution of the pandemic, three processes were implemented: the first was carried out based on the protocol published by Bielicki and collaborators[6] in the «first wave» of cases. This consisted of granting consultation to both symptomatic and asymptomatic patients, in the event that they were contacts of the sick partner. Epidemiological questionnaire (SISVER) and nasopharyngeal sampling for SARS-CoV-2 were performed. Symptomatic patients were clinically assessed based on symptoms, vital signs, oxygen saturation, and chest CT scan. In case of alarm, the probable hospitalization was decided; if not, they were sent to isolation at home until receiving the result of the sample, in case of being positive they were informed by telephone and a questionnaire was carried out to differentiate between community or nosocomial infection. The isolation lasted 14 days, repeating the process until they tested negative to return to work the next day, depending on their symptoms. Contacts were sent to their place of work to wait for results with strict use of personal protective equipment.

The second process, according to the pandemic, was evolving, and due to the massive vaccination of personnel against SARS-CoV-2, as well as the changes in the variants of the virus, it was modified to seven days, based on the modified guidelines of the United States Center for Disease Control (CDC) with a grace of three more, incase of symptoms, in addition to this time a rapid test was carried out for control.[7,8] At the end of June 2023, the five-day policy was adopted in the third process, without a control test.

Laboratory diagnostic tests for SARS-CoV-2

1. Luminex viral panel

RNA extraction. RNA was extracted from 200 μL of oropharyngeal/nasopharyngeal exudate samples contained in universal transport medium, the extraction was done automatically in the BIONEER ExiPrep 96 equipment, using the BIONEER brand ExiPrep 96 Viral DNA/RNA extraction kit (Ref. K-4614), following the manufacturer's specifications.

2. Luminex

Detection of HCoV subtypes was performed by xTAG RVP fast v2 assay. The Luminex assay includes reagents to detect 19 viral types and subtypes, including four HCoV species (HKU1, 229E, OC43, and NL63).

3. RT-PCR

For the viral RNA amplification assay, GeneFinder™ COVID-19 Plus RealAmp Real-Time PCR Kit, Gene Finder brand (Ref. IFMR-45), which amplifies the RNA of the RdRP, N and E genes. For this process, the manufacturer's specifications were followed, the reaction mixture was

made by mixing 10 μL of the master mix and 5 μL of the probe mixture, finally 5 μL of the nucleic acid extract will be added for each sample, to have a final volume of 20 μL. RT-qPCR shall be run in a Quant Studio 5 thermocycler (Applied Biosystems) under the following amplification conditions: 50 °C/20 minutes, 95 °C/5 minutes, followed by 45 cycles of 95 °C/15 seconds and 58 °C/60 seconds.

RESULTS

From April 2020 to June 3, 2023, 33,780 tests were performed on 4,772 workers; of these, 2,977 were women and 1,795 men, median age 36 years (interquartile range [IQR] 28.00-45.00). In total, of the 33,780 tests performed there were 4,160 positive cases during these years. In the four years, the number of infected cases was: 2020, 737; 2021, 464; 2022, 2,421 (in this year, due to the Omicron variant of the virus, the months of January and July were the ones with the highest number of cases); and 2023, until June 30, 538 cases *(Table 1)*.

Table 2 separates by lines of care the total staff at that time, and the cases of infection among them, where the first line was the one with the highest number of cases; the staff most affected was nursing (out of a total of 1,420, there were 1,106 positive [77.88%]), followed by doctors (out of a total of 814, there were 574 [70.51%]). The above probably because this staff was the one with the largest number.

The results of the epidemiological questionnaire evaluated whether the acquisition of the infection had been in the community or in the hospital. The result was 4,023 community-acquired and 137 hospital-acquired, for a prevalence of 3% of hospital-acquired cases. *Figure 1* shows the positivity index in the different waves of the pandemic, in the fourth, a higher index is noted because, due to the characteristics of the pandemic, the tests were only carried out on symptomatic personnel, since when different viruses appeared they caused respiratory disease.

In a work published by us,[5] we reported in a period of six months a prevalence of 3.8% in nosocomial acquisition. Of the hospitalized health staff there were 30 cases, of these there were two deaths, contingency personnel, with multiple comorbidities who unfortunately died within the institute and who acquired the infection in the community.

DISCUSSION

Healthcare staff has experienced a significant burden in the fight against SARS-CoV-2 infection. The first reports indicated a high morbidity and mortality among health personnel;[3,9] but there were no conclusive results that could separate community infection from nosocomial infection. Hunter et al. concluded that the positivity rates in the clinical team of a hospital in England were not consistent with nosocomial infection[10] and that it had previously been reported in China.[11] In our healthcare staff we reported a prevalence of nosocomial infection at the beginning of the pandemic of 3.8%,[5] and as of June 30, 2023 this decreased to 0.7%. The use of personal protective equipment, the use of appropriate high-efficiency face masks and infection control training has been of great help, greatly reducing the risk of nosocomial transmission.[12,13]

Table 1: Breakdown by month and year of positive cases.

Month	2020	2021	2022	2023	Total
January		139	789	194	1,122
February		14	176	122	312
March		20	31	135	186
April	44	5	9	42	100
May	90	6	41	36	173
June	70	8	351	9	438
July	64	94	636		794
August	48	84	101		233
September	95	37	23		155
October	65	11	16		92
November	102	7	30		139
December	159	39	218		416
Total	737	464	2,421	538	4,160

Table 2: General table of workers divided into the three lines and breakdown of positive cases by sex and episodes of infection.

Cases April 2020-June 2023							
Variable	**Women**			**Men**			
Line	**First**	**Second**	**Third**	**First**	**Second**	**Third**	**Overall total of staff**
Number	1,801	792	384	1,022	544	229	4,772
Years of age Median Interquartile range	32 28.00-40.00	43 32.00-52.00	26 24.00-29.00	32 28.00-39.50	41 32.00-53.00	27 24.00-37.00	36 28.00-45.00
Total attention given 33,780							
Positive cases	2,659			1,501			4,160
Cases by number of infection episodes							
1 time positive	1,690			941			2,631
First line	1,150			613			1,763
Second line	382			237			619
Third line	158			91			249
2 time positive	881			501			1,382
First line	655			358			1,013
Second line	215			130			345
Third line	11			13			24
3 time positive	88			59			147
First line	70			44			114
Second line	17			13			30
Third line	1			2			3
Overall total	2,659			1,501			4,160

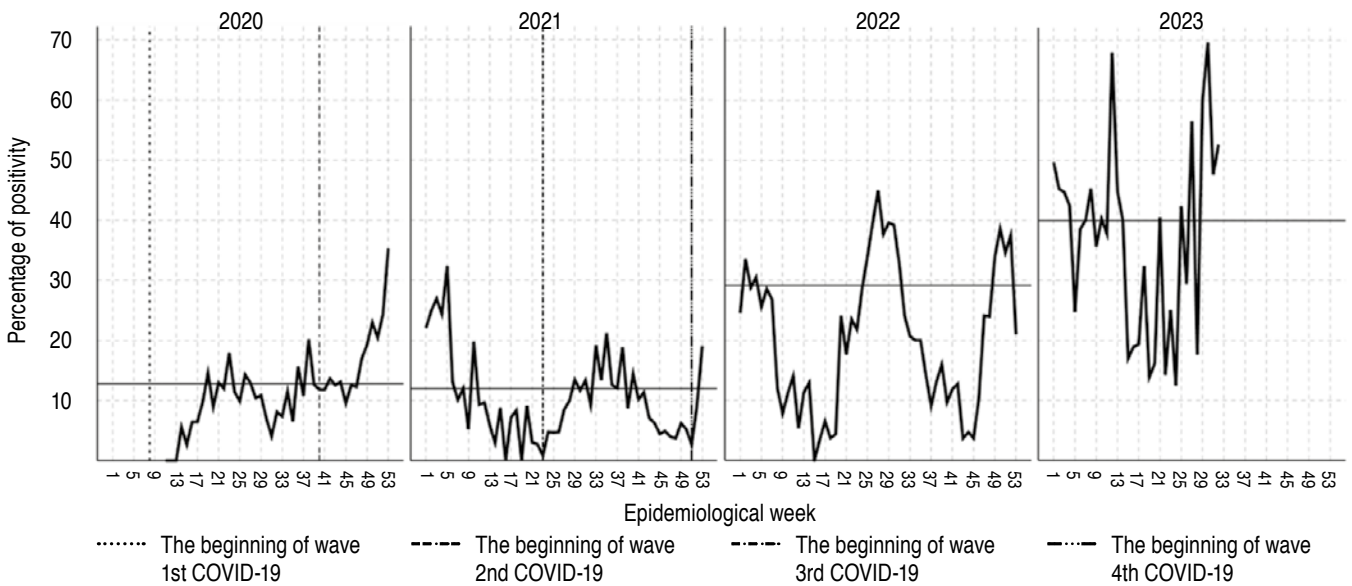

Figure 1: Percentage of positivity according to the epidemiological week, each column corresponds to a different year. The gray line of the X axis corresponds to the median of the percentage of annual positivity (2020: 12.82%; 2021: 11.96%; 2022: 29.17%; 2023: 39.93%).

In this context, the Occupational Health Coordination implemented a protocol to carry out frequent diagnostic tests and post-contact monitoring of symptomatic patients and their contacts in order to avoid high infection rates and a decrease in personnel due to multiple isolations. Oster et al. reported in Israel a low rate of positivity among health personnel, with nursing staff and the doctor being mostly affected,[14] this approach of testing asymptomatic contacts early allowed detecting cases without symptoms or slightly symptomatic, which led to early isolation and avoid outbreaks in the services.

Of the 33,780 tests carried out on 4,772 active workers, 4,160 were positive, which meant 12.31% of all tests carried out. The staff with the highest number of positives was the first line (1,106 nursing), which has been reported in other studies;[15-17] however, the above may be due to the fact that it was the one with the highest number of members. Fortunately, the cases presented with mild to moderate symptoms, probably due to the fact that they were young health personnel and the vast majority had no comorbidities.

When a proactive epidemiological questionnaire was applied, it resulted in the majority of infections being acquired in the community. The highest number of cases occurred in January and July 2022, due to the appearance of the omicron variant of the SARS-CoV-2 virus, which occurred in December 2021 and caused high levels of cases from that date, having its highest peaks in the community in those months. This was reported by the United States CDC.[18]

In total there were only 30 hospitalized workers, three of them with multiple comorbidities, who died at the beginning of the pandemic. All three acquired the infection in the community and arrived at the hospital in a very serious way.

CONCLUSIONS

The results of this project, protecting the health and well-being of health personnel, were successful; it should be noted that the number of infections was low, the vast majority being a product of community transmission. Personal protective equipment, training, and testing were consistently shown to be effective in protecting workers within the hospital.

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Conflict of interests: the authors declare that they have no conflict of interests.