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SARS-CoV-2 vaccine for protecting health professionals: Experience of university hospital of Casablanca

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ABSTRACT: *Introduction:* The control and prevention of SARS-COV-2 infection is based on both the respect of individual protection measures and distancing, but also on vaccination.
This work aims to evaluate the impact of vaccination on SARS-CoV-2 infection among health professionals at CHUIR and to correlate with the positivity of screening tests.
Methods: This is a retrospective study conducted over the period from 15 June 2021 to 1 September 2021.
The diagnosis was based on RT-PCR defined and the antigenic test.
The healthcare professionals were divided into 2 groups: G1-vaccinated / G2-non vaccinated.
The comparison concerned the viral load in positive cases by means of the threshold values (Ct) of RT-PCR and the positivity of the antigenic test.
Results: During the study period, 1658 healthcare workers were tested of which 638 were positive, representing a positivity rate of 39%.
Clinical symptoms were present in 99% of all positive cases.
G1: contains 440 health professionals representing 69% of all positive cases.
G2: presents 198 positive non-vaccinated subjects, representing 31%.
The average Cts in vaccinated and non-vaccinated subjects was n=24.
Conclusion: Understanding the determinants of transmission, including human behavior and vaccine efficacy, is essential for the development of prevention strategies.

KEYWORDS: SARS-COV-2, Vaccine, Healthcare workers, RT-PCR, Prevention.

1 INTRODUCTION

Coronaviruses are enveloped large single-stranded RNA viruses, infecting both humans and a wide range of animals. Coronaviruses were first described in 1966 by Tyrell and Bynoe grown from patients with the common cold [1].

On the basis of their morphology as spherical viruses with a central shell and surface projections resembling a solar corona which why they were called coronaviruses (Latin: corona = crown), SARS-CoV-2 belongs to the B lineage of beta-coronaviruses and is closely related to SARS-CoV [2], [3].

The four main structural genes encode nucleocapsid protein (N), spike protein (S), small membrane protein (SM) and membrane glycoprotein (M) with an additional membrane glycoprotein (HE) occurring in HCoVOC43 and HKU1 beta-coronavirus, the SARS-CoV-2 genome is 96% identical to the bat coronavirus genome [4].

SARS-CoV-2 apparently succeeded in passing from animals to humans in the Huanan fruit market in Wuhan, China. However, efforts to identify potential intermediate hosts appear to have been neglected, on 30 January 2020, the WHO Emergency Committee declared a global health emergency based on increasing case notification rates at Chinese and

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international sites. The rate of case detection changes daily, with China bearing the brunt of morbidity and mortality, followed by incidence in other Asian countries, Europe and North America, and Africa.

Hospital workers were on the front line of defense against the SARS-CoV-2 pandemic and were at greater risk of contracting the virus and thus contributing to the spread of the disease.

Although the use of surgical masks, improved hand hygiene and personal protective measures for most direct care of COVID-19 patients protected caregivers and contained the SARS-CoV-2 pandemic among hospital staff, the infection of individuals was community-based.

In Morocco, vaccination against SARS-CoV-2 began in February 2021. Vaccination of health professionals of all categories (doctors, pharmacists, nurses, technicians, administrators) also began in the same period at the CHU Ibn Rochd Casablanca.

This work aims to evaluate the impact of vaccination on SARS-CoV-2 infection, and to describe the correlation between the vaccination status of the health professional and the delay of symptoms with the positivity of the PCR and the antigenic test, in addition to the description of the Cts which reflect the importance of the viral load in the health professional.

2 METHODS

This is a retrospective study of health professionals at the IBN ROCHD University Hospital in Casablanca over the period from June 15, 2021 to September 1, 2021, corresponding to the second wave of the SARS-CoV-2 pandemic.

- The inclusion criteria:
    - Health professionals working at the CHUIR: medical and paramedical staff and administration.
    - Confirmation of SARS-CoV-2 infection by a positive antigenic test and/or RT-PCR during the study period.
- The exclusion criteria:
    - Non-specified vaccination statuts.

The study population was divided into 2 groups:

- G1: health professional who has received the 2 doses of vaccine.
- G2: non-vaccinated health professional.

The comparison of the two groups concerned the viral load of the positive cases through the threshold values (Ct) of the real-time reverse transcription-polymerase chain reaction (RT-PCR) and the positivity of the antigenic test which, if positive, reflects a high viral load.

The collection of epidemiological and clinical data by means of an investigation form and entered on KALISIL (platform for computerizing data), this form mainly concerns:

- Identity, age, address, national identity number, service of assignment and telephone number.
- Timing and types of symptoms.
- Vaccination status with type and date of second dose.

3 RESULTS

During the study period, 1658 healthcare workers were tested with a combined RT-PCR and antigen test simultaneously.

The results of the tests came back positive in 649 people practicing at the CHU ibn Rochd of which 11 people among them were excluded from the study because they had no known vaccination status, so a total of 638 people were retained for the rest of the study.

The female sex represents a percentage of 74% (N=474) of the total population against a male percentage of 26% with a sex ratio of 0.34.A calculated average age of 35 years and an interquartile range of [18-72 years].

The symptomatic persons represented a total of 636 persons representing 99%, whose symptomatic delay was different, a percentage of 73% (G1) versus 76% (G2) of the consultants in less than 5 days of appearance of the symptoms and 22% (G1) versus 22% (G2) who consulted between 5 and 9 days and 1.5% (G1) versus 1,5% (G2) consulted late in more than 10 days and less than 2% did not specify the delay of the symptoms.

Table 1. Description of health professionals according to symptom delay and vaccination status

Duration of symptoms	Asymptomatic	-5 days	5 days-9 days	+10 days	Not specified
Vaccinated personnel (G1)	2 (0,3%)	323 (73%)	99 (22,5%)	9 (1,7%)	7 (1,5%)
Non-vaccinated personnel (G2)	0	151 (76%)	44 (22%)	1 (0,5%)	2 (1,5%)
Total	2 (0,3%)	474 (74,5%)	143 (22,2%)	10 (1,5%)	9 (1,5%)

The number of people tested positive and vaccinated (G1) was (440/638 or 69%), of which 233 had a positive antigenic test in addition to the RT-PCR, in a rate of 53%. Thus 229 people belonging to the G1 group had Cts<25 as in 52% of the cases, compared with 48% of cases with Cts>25.

The (G2) represents a total of 198 patients confirmed positive but not vaccinated, in a rate of 31%, of which (119/198 or 60%) persons had a positive antigenic test plus RT-PCR, and 111 persons had Cts<25 in a rate of 56%, and (87/198 or 54%) had Cts>25 (Table 2 and 3)

The average Cts in vaccinated and unvaccinated individuals was n=24 with confidence intervals 95% [23,83 - 24,17]

Table 2. Description of health professionals according to positivity (antigen test and RT-PCR) and vaccination status

	Positifs	RT-PCR and Ag Test	RT-PCR
Vaccinated personnel	440 (soit 69%)	233 (soit 53%)	207 (soit 47%)
Non-vaccinated personnel	198 (soit 31%)	119 (soit 60%)	79 (soit 40%)

Table 3. Description of the viral load of infected healthcare workers according to the Cts in parallel to the vaccination status

	Ct<25	Ct≥25
Vaccinated personnel	229 (soit 52%)	211 (soit 48%)
Non-vaccinated personnel	111 (soit 56%)	87 (soit 54%)

4 DISCUSSION

In our study, the main objective is to compare two populations according to their vaccination status in order to draw a conclusion regarding the role of the vaccine in the protection of health care workers, is the vaccine alone able to provide a safety barrier for this at-risk population? And is it able to reduce viral transmission?

We discuss 2 salient problems with the study parameters in the efficacy trials of the COVID-19 vaccine in our population.

First, we propose a general set of clinical and biological endpoints to facilitate a harmonised assessment and comparison of vaccine efficacy, overall and between relevant subgroups.

Secondly, we discuss the advantages and disadvantages of various criteria used as primary endpoints.

If we consider the following evaluation criteria:

- Confirmed symptomatic SARS-CoV-2 infection regardless of symptom severity.
- Delayed onset of symptoms.
- Viral load: Ct<25.
- Positive antigenic test in conjunction with PCR.

The conclusions of this report are subject to at least three limitations. First, the data in this report are insufficient to draw conclusions about the effectiveness of COVID-19 vaccines against SARS-CoV-2 during this epidemic, as population-level vaccination coverage increases and particularly in the health sector, the case of our sample where 69% of staff are vaccinated, so vaccinated individuals are likely to account for a larger proportion of COVID-19 cases.

Secondly, asymptomatic breakthrough infections may be under-represented as due to selection bias, our scientific committee has required that testing can only be done if the patient has clinical signs, so in this study asymptomatic patients are around 0.3%.

Third, the demographics of the cases reflect those of a targeted and limited population of health professionals; further study is desirable to identify other characteristics, such as additional demographics and underlying health problems, the evolution of positive cases and major complications.

The Chinese vaccine SINOPHARM was majority in 97% of cases, while the ASTRA ZENECA vaccine represented only 3% of those vaccinated.

Vaccination coverage was able to cover 69% of the health workers, a figure absolutely equal to the vaccination coverage of a study population conducted in the city of Massachusetts in the USA [5].

Females were dominant in our study, with almost three quarters of the staff tested being female (74%) compared to a male majority in the Massachusetts population of 81% [5].

The average age was almost close with an average of 35 years in our study and 42 years in the comparison population.

Symptomatic patients were in the majority in our study representing a percentage of 99% compared to 79% in the Massachusetts population, this difference is probably due to the screening strategy which differs between the study populations, in Massachusetts, people were called for screening after the increase in the number of positive cases due to gatherings, whereas the healthcare professionals in our hospital facility only come for screening after the onset of symptoms suitable for COVID 19 and not after contact with a positive patient.

Cycle threshold (Ct) is a value that emerges in real-time reverse transcription polymerase chain reaction (RT-PCR) testing and is considered a benchmark for the detection of SARS-CoV-2, the Ct value refers to the number of cycles required to detect the virus, the lower number of cycles taken implies a higher viral load and vice versa, and a high viral load (Ct score <30) is taken to correlate with increased ineffectiveness and severity of the disease [6].

However, there is still no conclusive evidence of a direct correlation between Ct values and the severity and contagiousness of the disease.

The real-time RT-PCR Ct values in our sample of 440 fully vaccinated patients (mean = 24.23) were similar to those of 198 patients who were not vaccinated (mean = 24.03) and this is the case in the Massachusetts City comparison population where the mean is almost comparable at mean =22.77 for the fully vaccinated group and a mean of mean =21.34 for the non-vaccinated group. This was also the case in a study conducted at the University of California involving 2 demographically different populations where there were no statistically significant differences in the mean Ct values of the vaccinated Unidos en Salud population mean = 23.1; Mission District of San Francisco and Healthy Yolo Together population mean= 25.5 compared to the unvaccinated samples (Unidos en Salud population mean = 23.4; Mission District of San Francisco and Healthy Yolo Together population mean= 25.4) [7].

In our study, more than half of the two groups G1 and G2 with respectively 52% and 56% of the persons had Cts lower than 25, thus in an Indian study (Raju Vaishya) carried out on 118 pre-vaccinated health professionals, 72.9% of them had Ct values <30 [6].

For the viral load reflected by the positivity of the RT-PCR as well as the Antigenic test the G1 showed a slightly lower percentage at 53% versus 60% for the G2.

5 CONCLUSION

Understanding the determinants of transmission, including human behavior and vaccine efficacy, is essential for the development of prevention strategies. Multifaceted prevention strategies are needed to reduce morbidity and mortality related to COVID-19, hence the need to broaden statistical studies and assess several concomitant parameters in order to draw appropriate conclusions to protect the population and particularly personal health workers who have been and will always be in the first line of defense.

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