COVID-19 mRNA vaccine effectiveness in asymptomatic healthcare workers

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Introduction:

The protection offered by the BNT162b2 vaccine (Pfizer–BioNTech) and the mRNA-1273 vaccine (Moderna) to prevent COVID-19 disease has been well documented during phase III trials \(^1\) \(^2\) and subsequent observational studies using real-world data \(^3\). Healthcare workers (HCWs) have been included in the initial target group to be vaccinated due to their exposure \(^4\), role in transmission\(^5\), and as an essential part of the fight against COVID-19. However, there is little evidence regarding after-vaccination SARS-CoV-2 asymptomatic infection.

Fully understanding the vaccination effect is essential to improve the handling of the pandemic within healthcare facilities, and it can also reduce the psychological burden on HCWs. We present the effect of mRNA vaccination on subsequent polymerase chain reaction (PCR) tests positivity of COVID-19 in asymptomatic HCWs.

Methods:

This analysis included front-line HCWs of Hospital del Mar in Barcelona, Spain, routinely screened every two weeks for COVID-19 with PCRs. HCWs were contacted by the occupational health service of the hospital through mobile text messages and had a nasal swab taken by trained personnel. The sample was analyzed in situ in the hospital laboratory. The vaccination started on January 5th, 2021. The screening continued throughout and after the vaccination.

We analyzed 2,462 HCWs screened at Hospital del Mar starting on December 1st, 2020, and followed-up until April 20\(^{th}\), 2021: a total of 141 days. We excluded HCWs that had a positive test before December 1st. We included only PCR tests performed to asymptomatic HCWs without a known close contact with an infected person within the hospital. Participant’s age, gender, workplace, and type and dates of vaccine received were obtained from the Hospital administrative database. The mean age of the sample was 38.9 (SD: 12.4), and approximately three-quarters were females (75.5%). Participants were unevenly distributed amongst different types of care units, the most common being in non-COVID-19 wards (44.6%). Most participants were vaccinated with Pfizer–BioNTech (73.5%). A total of 314 (12.8%) HCW were not vaccinated by April 20\(^{th}\), 2021. Although the screenings were periodically scheduled, adherence varied amongst HCWs: 45.0% had eight or more tests, 39.0% had between three and eight, and 16.0% had one or two.
Results:

We present the PCR positivity rates grouped by vaccination state. A total of 16,723 PCRs were performed. Test positivity decreased from 1.39% (95% CI: 1.11-1.67) for non-vaccinated HCW to 0.13% (95% CI: 0.03;0.22) one week after second vaccine dose, resulting in a 90.6% vaccine effectivity. The PCR tests positivity between two weeks after the first dose and one week after the second was 0.81% (95% CI: 0.45;1.17), resulting in a 41.7% effectivity (Table 1).

Discussion:

One week after the second dose, vaccination with mRNA vaccines substantially reduced the COVID-19 test positivity and incidence amongst asymptomatic HCWs. These results are consistent with previous studies regarding mRNA vaccination protection from COVID-19 in healthcare settings 6. The protective effect of vaccination two weeks after the first dose was weaker than reported by phase III trials of the vaccines and other studies conducted in healthcare settings, even when including asymptomatic testing 7. The discrepancy might be a consequence of the focus on asymptomatic non-suspicious cases, which might have gone undetected in previous studies. Previous studies highlight the importance of keeping the guard up in the first days after the first dose vaccination 8. Our findings suggest that vaccine recipients should be aware that the risk of infection is not reduced until at least one week after the second dose of the vaccine.

Two main limitations should be noted. First, the small number of positives in the vaccinated groups – especially two weeks after the second dose – limited our ability to obtain narrower confidence intervals. Second, the rapidly changing dynamics of COVID-19 incidence in the general population might be influencing our results. However, the population incidence stayed relatively stable during the study.

Similarly, several strengths should be noted. First, trained professionals performed the sample gathering, and the samples were analyzed in the hospital laboratory, ensuring high-quality sampling and reducing problems derived from sample handling and transportation. Second, the mandatory proactive screening of asymptomatic HCWs combined with the exclusion of COVID-19 tests to suspected cases among HCWs allows a very refined view of the vaccine effect on asymptomatic infection. Finally, the follow-up of up to 3 months after the first dose of vaccination allowed us to see the effects beyond immediate post-vaccination.
While the results of this study are promising, similar studies should be repeated over time as two concerns remain: the effectiveness against rising variants of concern (VoC) and the period through which the vaccines offer protection, both still unknown.
References


Table 1: Percent positivity according to vaccination state.

<table>
<thead>
<tr>
<th>Screening moment</th>
<th>Number of screening s</th>
<th>Number of positive s</th>
<th>% positivity</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unvaccinated</td>
<td>6,767</td>
<td>94</td>
<td>1.39%</td>
<td>[1.11;1.67]</td>
</tr>
<tr>
<td>From vaccination until 14 days after 1st dose</td>
<td>2,076</td>
<td>32</td>
<td>1.54%</td>
<td>[1.01;2.07]</td>
</tr>
<tr>
<td>&gt;14 days after 1st dose until 7 days after 2nd dose</td>
<td>2,350</td>
<td>19</td>
<td>0.81%</td>
<td>[0.45;1.17]</td>
</tr>
<tr>
<td>&gt;7 days after 2nd dose</td>
<td>5,530</td>
<td>7</td>
<td>0.13%</td>
<td>[0.03;0.22]</td>
</tr>
</tbody>
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