COVID-19 Vaccination and Asymptomatic Infection

Effect of BNT162b2 mRNA Vaccine on the Incidence of COVID-19 and Duration of Sick Leave Among Healthcare Workers

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Objective: To determine the incidence of COVID-19 and the duration of sick leave among asymptomatic healthcare workers (HCWs) after vaccination with BNT162b2. **Methods:** From October 2020 to March 2021, we determined the incidence of COVID-19 in a cohort of 671 asymptomatic HCWs before and after the vaccination. We also analyzed the days required to obtain a negative RT-PCR result after infection. **Results:** Prior to vaccination 105 (15.6%) HCWs were positive. Positive cases were reduced to 42 (7.5%) after the vaccination period ($P < 0.0001$). A negative RT-PCR was observed at the first control in 80% of vaccinated HCWs and only in 37% before vaccination. **Conclusions:** Even in case of asymptomatic infection, vaccinated HCWs have a reduced incidence and a shorter period of sick leave than before vaccination, suggesting vaccination impacts on the sustainability of the health system and labor costs.

Keywords: COVID-19, healthcare Workers, occupational health, sick leaves, vaccination

The coronavirus disease 2019 (COVID-19) is caused by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which was first recognized in Wuhan, China in December 2019. The current health emergency brought about by the pandemic did not only result in significant mortalities but also, this has affected the social and labor landscape globally. Since the onset of the pandemic, several clusters of COVID-19 have been reported in a variety of occupational settings,[1] and in particular, the healthcare workers (HCWs) are at the greatest risk of COVID-19.[2]

In the first months of pandemic, several studies have evidenced unprecedented increase in total sick leaves in all activity sectors, particularly among health-related workers.[3,4] The British Office for National Statistics (ONS) esteemed that since April 2020, the coronavirus accounted for 14.0% of all occurrences of sickness absence.[5] The pandemic is associated with greater economic burden for companies, both due to the cost associated with sick leaves and the losses in productivity. Recently, in the United States, the Integrated Benefits Institute (IBI) conducted an analysis to estimate lost work time costs; it found that employers spent a total of $50.5 billion for absent workers due to the coronavirus.[6]

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Clinical significance: Asymptomatic COVID-19 infection among vaccinated workers shows a more benign trend (ie, absence of symptoms and shorter duration of sick leave) compared to the natural course of the disease. These data suggest the significant and direct implications of vaccination on the sustainability of the health system and labor costs.

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Italy was one of the hardest-hit areas in Europe during the pandemic in 2020.[7] In response, the COVID-19 vaccination campaign was launched on 27 December 2020, with the first available mRNA vaccine, BNT162b2 (Pfizer/BioNTech's Comirnaty). The efficacy of the vaccine in reducing the incidence of symptomatic infection has been documented. However, it is not yet clear whether the vaccine also prevents asymptomatic infection.[8] Some authors have noted previously vaccinated asymptomatic patients who tested positive on reverse transcription—polymerase chain reaction (RT-PCR) tests.[9,10] In these cases, the duration of infection with positive RT-PCR results is still under investigation.

For this reason, we conducted a retrospective cohort study to determine the incidence of asymptomatic infections caused by SARS CoV-2 virus among HCWs after COVID-19 vaccination and to evaluate if vaccination could reduce the duration of sick leave even among workers without symptoms. Data on sick leaves on asymptomatic subjects could confirm the importance of COVID-19 vaccination to guarantee a quicker return to work for hospital personnel and consequently a better functioning of the health system during pandemic.

METHODS

A retrospective cohort study was done to determine the incidence of COVID-19 and the duration of sick leave in all the population of immunocompetent HCWs, who worked with direct patient contact in a hospital in Northern Italy. From October 2020 to March 2021, we determined the incidence of SARS-CoV-2 infection in the cohort before and after the COVID-19 vaccination with BNT162b2 (Pfizer/BioNTech's Comirnaty). Subjects got the first dose of vaccine between December 2020 and January 2021.

In the examined period, asymptomatic HCWs were screened with RT-PCR for SARS-CoV-2 on nasal swabs every 2 weeks. Internationally, the screening of asymptomatic HCWs is usually activated for frontline staff or health and social care settings when regional incidence levels have reached a certain level.[11–13] We excluded workers who were not vaccinated between December 2020 and January 2021 and subjects who had already suffered from COVID-19 before October 2020. As aforementioned, only asymptomatic infection at the onset were considered.

Since the start of the COVID-19 vaccination campaign, at the end of December 2020, all HCWs in our hospital were eligible for vaccination. The HCWs were vaccinated with two doses of BNT162b2 (Pfizer/BioNTech's Comirnaty) based on a technical datasheet. We investigated the effect of vaccination on asymptomatic workers by comparing the trend of cases within 90 days before and after the first dose. A case was defined as those with positive RT-PCR results by nasal swab. For each HCW, 90 days of follow-up before and after vaccination were counted from the day of administration of the first vaccine dose.

For cases with positive RT-PCR results, accurate epidemiologic investigations were carried out to identify any close contacts in the workplace. Since the start of the pandemic in 2020, the physicians working in our hospital have also collected all the data about the cases of COVID-19 among our HCWs. We calculated the cumulative incidence curves of COVID-19 among our cohort of HCWs in the examined period, and specifically before and after the vaccination.

We also analyzed whether vaccination influenced the days required to obtain a negative RT-PCR result after testing positive despite vaccination. The health policies of our country recommended a minimum of 10 days before repeating a positive RT-PCR test in accordance with international guidelines.[14,15] If the worker was still symptomatic after 10 days, the time before repeating the test could be prolonged. According to the Italian guidelines, only workers with negative RT-PCR test could return to the work.

The data were analyzed using SAS (SAS Institute, NC) statistical software and GraphPad Prism 9 (GraphPad Software, CA). Data were analyzed using Fisher's exact test and Mann–Whitney *U* test. Statistical significance was set at $P < 0.05$.

RESULTS

Our study included 671 HCWs. Table 1 shows the characteristics of the entire population, of asymptomatic HCWs infected before the introduction of vaccination and of asymptomatic HCWs infected after their vaccination. The median age of HCWs was 39 years (range, 22 to 70 years) comprising mostly women (583, 86%). Similarly, in the group that tested positive on RT-PCR before vaccination, the median age was 38 years (range, 24 to 70 years) and it was composed mostly of women (92, 87%). In the group that tested positive on RT-PCR after vaccination, the median age was 35 years (range, 25 to 70 years) and the majority were women (38, 90%) also. All HCWs received the first (from 27 December 2020 to 24 January 2021) and second dose (from 17 January to 18 February 2021) of the vaccine. The median dose interval was 21 days (range 21 to 24). Differences in times and vaccination schedules were not found, comparing entire population and workers infected after the vaccination.

Figure 1 shows the cumulative incidence of COVID-19 among asymptomatic hospital personnel before and after the vaccination. During the 90-day prior to vaccination 671 HCWs were screened; 105 (15.6%) HCWs were positive on bi-weekly RT-PCR screening. The 90-day post-vaccination follow-up was conducted on a cohort of 564 vaccinated HCWs, excluding 105 HCWs who were infected prior to vaccination. Time zero for each HCW began with the administration of the first dose. During the follow-up period after administration of the first dose of the vaccine, 42 (7.5%) vaccinated HCWs were positive on bi-weekly RT-PCR screening. In our sample, the percentage of asymptomatic HCWs infected by SARS-CoV-2 virus before the introduction of vaccination were significantly higher than after they were vaccinated (P-value < 0.0001). No association was found for gender and age (data not shown).

Finally, the median number of sick leave days was 12 days (range, 10 to 34 days) for unvaccinated HCWs and 11 days (range: 10 to 23 days) for vaccinated HCWs. A negative RT-PCR was observed at the first control between the 10th and 11th day from the first testing in 80% of vaccinated HCWs and in 37% of unvaccinated HCWs. As shown in Figure 2, the difference between sick leave days between before and after the vaccination was statistically significant.

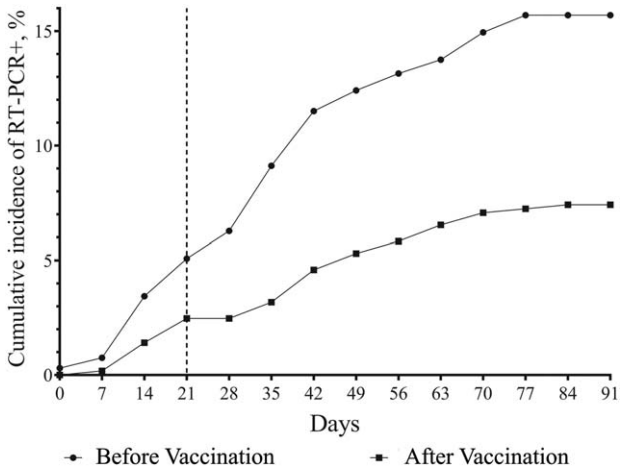

FIGURE 1. Cumulative incidence of COVID-19 before and after Covid-19 vaccination. For the vaccinated group, the dashed line represents the administration of the second dose of vaccine.

DISCUSSION

Our study investigated the effects of COVID-19 vaccination in a cohort of asymptomatic HCWs, confirming that the vaccination with BNT162b2 also reduced the incidence of new cases of COVID-19 without symptoms. However, even after the administration of the first or second vaccine dose, some vaccinated HCWs still tested positive on RT-PCR. All these findings were only identified because a bi-weekly screening was carried out as required by our health policies. All were asymptomatic at the time of testing and during the quarantine period. Our data are consistent with those reported in the literature.[9,10]

Among those vaccinated HCWs who had positive RT-PCR results, a high percentage tested negative at the end of the quarantine period on the 10th day. Vaccinated HCWs have a much shorter period of sick leave than unvaccinated workers. Our study confirmed that the reduction of days of sick leaves was also evidenced in a population of workers with asymptomatic infection and, to the best of our knowledges, it is one of the first studies that analyzed asymptomatic infection at the workplace. These data confirmed the significant and direct implications of vaccination on the sustainability of the health system and labor costs.

Finally, when the study was originally designed, the efficacy of first dose of vaccination was not still clear. Actually, the results unexpectedly revealed a good efficacy of the first dose in the reduction of asymptomatic infection. The clinical significance of asymptomatic infection in vaccinated workers is not yet clear, nor whether they can be considered as contagious. Further studies on this topic are needed to modify policies on return to work of these subjects and to avoid social stigma and discrimination at the workplace.[16,17]

TABLE 1. Characteristics of Population

	Total HCWs	Before Vaccination HCWs with RT-PCR+	After Vaccination HCWs with RT-PCR+
N.	671	105	42
Age, median (range), years	39 (22–70)	38 (24–70)	35 (25–70)
Sex, women, N.	583	92	38
Dosing interval, median (range), days	21 (21–24)	–	21 (21–24)
First dose, median (range), date	Jan 11 (Dec 27–Jan 14)	–	Jan 10 (Dec 31–Jan 20)
Second dose, median (range), date	Feb 1 (Jan 17–Feb 18)		Jan 30 (Jan 21–Feb 11)

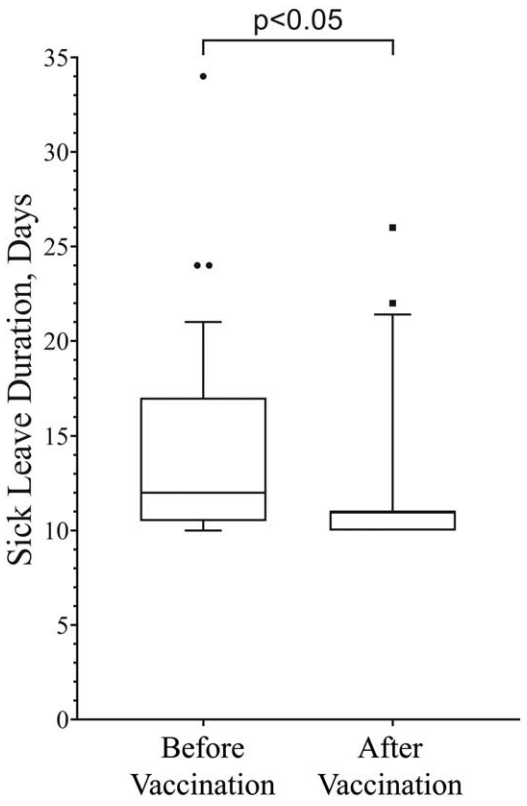

FIGURE 2. Sick leave duration before and after COVID-19 vaccination. The box extends from the 25th to 75th percentiles and the whiskers are drawn down to the 10th percentile and up to the 90th percentile.

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