Early rate reductions of SARS-CoV-2 infection and COVID-19 in BNT162b2 vaccine recipients

In December, 2020, the Israeli Government approved the BNT162b2 COVID-19 vaccine and initiated a national immunisation campaign prioritising health-care workers (HCWs), as in other countries.[1] This campaign coincided with a third wave of COVID-19, peaking at 10 116 daily new cases by mid-January, 2021. The Sheba Medical Centre, Israel's largest hospital with 9647 HCWs, began staff vaccination on Dec 19, 2020. All HCWs, excluding those with previous SARS-CoV-2 infection, were eligible for vaccination. Clinical trial data of BNT162b2 vaccine estimated an early vaccine efficacy in preventing COVID-19 of 52·4% before dose two, and 90.5% on days 2–7 after dose two.[2] A recent analysis of BNT162b2 vaccine data estimated vaccine efficacy of 89–91% during days 15–28 after the first dose.[3] We examined early reductions in SARS-CoV-2 infection and COVID-19 rates in vaccinated HCWs.

To assess vaccine-associated rate reductions we analysed a retrospective cohort of 9109 vaccine-eligible HCWs, comparing vaccinated versus unvaccinated. Active daily symptom reporting and immediate same-day testing allowed for prompt (<24h) detection and investigation of exposed or symptomatic HCWs.[4] We defined all HCWs with positive SARS-CoV-2 PCR at Sheba Medical Centre or in the community as cases of SARS-CoV-2 infection. All SARS-CoV-2-infected HCWs were contacted by infection control staff and requested to respond to a contact tracing questionnaire and a clinical questionnaire specifically regarding COVID-19 symptoms. Symptomatic HCWs were defined as COVID-19 cases. We used the number of days each HCW was unvaccinated or days after the first dose as follow-up time. Rate ratios and 95% CIs associated with time after first-dose administration were adjusted for community exposure, using the distribution of probability of a positive contact by means of Poisson regression (appendix). The adjusted estimates were subtracted from 1 to obtain rate reductions.

By Jan 24, 2021, of the 9109 eligible staff, 7214 (79%) had received a first dose and 6037 (66%) had received the second dose. 5505 (91%) fully vaccinated HCWs received the second dose on days 21 or 22 after the first dose. 6818 (95%) HCWs were vaccinated at Sheba Medical Centre. All employees vaccinated in the community (n=396) were required to report dates of first and second dose to the Human Resources department at Sheba Medical Centre.

Overall, there were 170 SARS-CoV-2 infections among HCWs in the period between Dec 19, 2020, and Jan 24, 2021, of which 99 (58%) HCWs reported symptoms and were designated as COVID-19 cases. Of the 170 HCWs who became infected, 89 (52%) were unvaccinated, 78 (46%) tested positive after the first dose, and three (2%) tested positive after the second dose. Among the 125 infections that could be traced, 87 (70%) were community acquired and there were no nosocomial clusters.[4]

Compared with a SARS-CoV-2 infection rate of 7·4 per 10 000 person-days in unvaccinated HCWs, infection rates were 5·5 per 10 000 person-days and 3·0 per 10 000 person-days on days 1–14 and 15-28 after the first dose of the vaccine, respectively. Adjusted rate reductions of SARS-CoV-2 infections were 30% (95% CI 2–50) and 75% (72–84) for days 1–14 and days 15–28 after the first dose, respectively (table; appendix).

Compared with a symptomatic COVID-19 rate of 5·0 per 10 000 person-days in unvaccinated HCWs, disease rates were 2·8 and 1·2 per 10 000 person-days on days 1–14 and days 15–28 after the first dose of the vaccine, respectively. Adjusted rate reductions of COVID-19 disease were 47% (95% CI 17–66) and 85% (71–92) for days 1–14 and days 15–28 after the first dose, respectively.

	Unvaccinated	Vaccinated	
		1–14 days after first dose	15–28 days after first dose
All SARS-CoV-2 positive			
Number of cases	89	55	26
Number of exposure days	120 575	100 433	88 126
Rate per 10 000 person-days	7·4	5·5	3·0
Rate reduction compared with unvaccinated (95% CI)	..	26% (–4 to 47)	60% (38 to 74)
Adjusted rate reduction compared with unvaccinated (95% CI)*	..	30% (2 to 50)	75% (72 to 84)
Symptomatic COVID-19			
Number of cases	60	28	11
Number of exposure days	120 575	100 433	88 126
Rate per 10 000 person-days	5·0	2·8	1·2
Rate reduction compared with unvaccinated (95% CI)	..	44% (12 to 64)	75% (52 to 87)
Adjusted rate reduction compared with unvaccinated (95% CI)*	..	47% (17 to 66)	85% (71 to 92)

SARS-CoV-2 positivity was determined by PCR. *Rate ratios of new cases in vaccinated compared with unvaccinated health-care workers each day were adjusted for community exposure rates using Poisson regression (appendix). The adjusted estimates were subtracted from 1 to obtain rate reductions.

Table: **Rate reductions of SARS-CoV-2 infections and COVID-19 cases in health-care workers at the Sheba Medical Centre, Israel, from December, 2020, to January, 2021**

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See **Online** for appendix

The limitations of this study include the observational nature of the study design. Lack of active laboratory surveillance in the cohort might have resulted in an underestimation of asymptomatic cases. Data on vaccine efficacy in preventing asymptomatic SARS-CoV-2 infection are scarce, and our results of rate reductions in SARS-CoV-2 infections, which include asymptomatic HCWs, need further validation through active surveillance and sampling of vaccinated people and unvaccinated controls to ascertain the actual reduction of asymptomatic infection in vaccinated individuals. The early rate reductions seen in HCWs might differ from vaccine efficacy reported in the general population due to their higher exposure risk or due to exposure to more virulent or infectious strains.

Our data show substantial early reductions in SARS-CoV-2 infection and symptomatic COVID-19 rates following first vaccine dose administration. Early reductions of COVID-19 rates provide support of delaying the second dose in countries facing vaccine shortages and scarce resources, so as to allow higher population coverage with a single dose. Longer follow-up to assess long-term effectiveness of a single dose is needed to inform a second dose delay policy.

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