Public Health Ontario | Santé publique Ontario

SYNOPSIS

Review of "Prevention and Attenuation of COVID-19 with the BNT162b2 and mRNA-1273 Vaccines"

07/05/2021

Article citation: Thompson MG, Burgess JL, Naleway A, Tyner H, Yoon SK, Meece J, et al. Prevention and attenuation of COVID-19 with the BNT162b2 and mRNA-1273 vaccines. N Engl J Med. 2021 Jun 30 [Epub ahead of print]. Available from: https://doi.org/10.1056/nejmoa2107058

One-minute summary

- This is a prospective cohort study evaluating the effectiveness of **BNT162b2 (Pfizer/BioNTech)** and **mRNA-1273 (Moderna) vaccines** in preventing and reducing the symptoms of COVID-19.

- Vaccine effectiveness was assessed by weekly severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) testing using reverse transcriptase polymerase chain reaction (RT-PCR) and active surveillance for symptoms of COVID-19 (i.e., fever, chills, cough, shortness of breath, sore throat, diarrhea, muscle aches, or a change in smell or taste). For those infected, symptom-onset, duration, and the number of sick days were captured by patient self-reporting. Vaccine effectiveness was adjusted for a propensity score based on factors affecting vaccination status (e.g. location, occupation, virus circulation in local county).

- The cohort included **3975 healthcare personnel, emergency response and other essential frontline workers** with data collected from December 14, 2020 to April 10, 2021. SARS-CoV-2 was detected in 204 (5%) study participants:
    - 156 were **unvaccinated**.
    - 11 were **partially vaccinated** (≥ 14 days after dose 1 and <14 days after dose 2).
        - **Adjusted vaccine effectiveness 81%** (95% confidence interval (CI): 64 to 90%)
    - 5 were **fully vaccinated** (≥ 14 days after dose 2).
        - **Adjusted vaccine effectiveness 91%** (95% CI: 76 to 97%).

- Among participants who acquired COVID-19, the severity of infection was lower in vaccinated patients. The **risk of febrile symptoms** (fever >38ºC, chills) **was 58% lower** (relative risk (RR): 0.42, 95% CI: 0.18 to 0.98) in vaccinated participants compared to unvaccinated participants. Additionally, vaccinated patients had **6.4 fewer days of symptoms** (95% CI: 0.4 to 12.3) and spent **2.3 fewer sick days in bed** (95% CI: 0.8 to 3.7) compared to those who were not vaccinated.

- In those with COVID-19, **mean viral load was 40% lower** (95% CI: 16-57) in partially or fully vaccinated individuals compared with unvaccinated individuals.

Additional information

- **Study Participants:** were enrolled across six United States (U.S.) states from the HEROES (the Arizona Healthcare, Emergency Response, and Other Essential Workers Surveillance Study) and RECOVER (Research on the Epidemiology of SARS-CoV-2 in Essential Response Personnel) networks. Individuals with previous laboratory documented SARS-CoV-2 infection were excluded.

- **Data Collection:**

    - Participants reported their potential exposure to SARS-CoV-2 and personal protective equipment (PPE) usage monthly.

    - Weekly SARS-CoV-2 testing consisted of a mid-turbinate nasal swab regardless of COVID-19 symptoms. Additional nasal swab and saliva specimens were collected at onset of COVID-19-like illness.

    - Vaccination status was reported by electronic survey, via telephone and via upload of vaccination card images.

- **Analysis:** Unadjusted vaccine effectiveness was calculated using the formula 100% × (1−hazard ratio). Adjusted vaccine effectiveness accounted for potential confounding in vaccination status using an adjustment based on propensity to be vaccinated (e.g., study site, occupation and local county SARS-CoV-2 circulation). After propensity weighting, mean unvaccinated participants for all covariates were well-balanced (mean difference 0.09). Patients partially and fully vaccinated were combined to increase power for the analysis.

- **Patient Characteristics:** The majority of study participants were female (62%), 18 to 49 years of age (72%), white (86%), and did not have chronic medical conditions (69%). The participants included primary health care providers (20%) (e.g., physicians), nurses and other allied health care personnel (33%), first responders (21%), and other essential and frontline workers (26%). Adherence to weekly symptom reporting and specimen collection was high (median, 100%; interquartile range, 82 to 100).

- **Vaccination Status:** Of 3975 patients, 3179 (80%) received at least 1 dose of mRNA vaccine 2686 (84%) received 2 doses and 796 (20%) were unvaccinated. Of the vaccines administered, 67% were BNT162b2, 33% were mRNA-1273 and less than 1% were unspecified mRNA vaccine. Due to low numbers of participants, 39 individuals receiving the Ad26.COV2.S vaccine (Johnson & Johnson–Janssen) were not included in the vaccine group, censored at the time of vaccination and contributed data to the unvaccinated group.

- **Variants of Concern:** Among vaccinated and unvaccinated participants with COVID-19, 81 viruses were genetically sequenced among assessable patients, 10 of which were variants of concern (eight were B.1.429, one B.1.427 [Epsilon], one was B.1.1.7 [Alpha], one was P.2 variant [Zeta]). Looking specifically at vaccinated patients, 10 viruses were genetically sequenced and three of which were variants of concern (all B.1.429 [Epsilon]).

- **Infection Relative to Exposure:** The frequency of infection did not differ based on hours of potential virus exposure or PPE use.

- **Impact on Viral Load:** Duration of viral RNA detection was a mean of 8.9 days in unvaccinated patients with SARS-CoV-2 infection, compared to a mean of 2.7 days in those partially or fully vaccinated (difference of 6.2 days (95% CI: 4.0 to 8.4).

- **Postulated Mechanism:** The authors indicate that the mechanism by which the vaccines attenuate COVID-19 symptoms is largely unknown. However, immunologic memory and more rapid viral clearance are postulated, which has been supported by data with other vaccines (e.g., influenza, pertussis, measles).

PHO reviewer's comments

- These findings echo those of previous studies indicating high vaccine efficacy and effectiveness for the mRNA vaccines in terms of COVID-19 incidence (reference VE WWKSF).[1]

- This study provides additional patient-important outcomes of days of symptoms and sick days spent in bed, which further supports the role of vaccination in not only disease prevention but also in reducing disease severity.

- The impact of vaccination on the reduction of viral load among those with breakthrough infections may be a factor in preventing disease transmission. This is particularly important in healthcare and other essential frontline workers in which there is frequent contact with other individuals.

- The duration of observation for the study is relatively short for partially vaccinated participants (median 22 days). Additionally, this short period for partial vaccination may not be representative of jurisdictions like Ontario where an extended interval between first and second vaccine doses was implemented.

- This study provides minimal data on the impact of vaccines on variants of concern, due to infrequent genetic sequencing and the early time period in which the study took place. More recent data will be necessary to confirm these findings, and compare the distribution of variants between those vaccinated and unvaccinated, particularly in the setting of a greater proportion of circulating variants of concern. Additionally the distribution of circulating variants in Ontario are different than those reported in this study (e.g., in Ontario there is a higher proportion of Alpha and Delta, and lower proportion of Epsilon variant).

- Febrile symptoms and duration of illness data are based on patient self-reported data which are subject to recall and confirmation bias.

- The study provides data on working-age adults; therefore, the majority of participants are young (72% were aged 18-49). As such, these findings may not be generalizable to older patients.

- The majority of patients enrolled were white (86%) and non-Hispanic (83%). Given this non-diverse population, the results may not be generalizable to other populations (e.g., racialized individuals and those experiencing more barriers associated with social determinants of health, e.g., employment instability may impact actual sick days in bed). However, the findings should support the importance of vaccination in all populations given the impact on COVID-19 incidence and duration of symptoms.

References

1. Ontario Agency for Health Protection and Promotion (Public Health Ontario). COVID-19 real-world vaccine effectiveness – what we know so far [Internet]. Toronto, ON: Queen's Printer for Ontario; 2021 [cited 2021 Jul 05]. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/covid-wwksf/2021/04/wwksf-vaccine-effectiveness.pdf?la=en

Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Review of "Prevention and attenuation of COVID-19 with the BNT162b2 and mRNA-1273 vaccines". Toronto, ON: Queen's Printer for Ontario; 2021.

Disclaimer

Public Health Ontario

Public Health Ontario is an agency of the Government of Ontario dedicated to protecting and promoting the health of all Ontarians and reducing inequities in health. Public Health Ontario links public health practitioners, front-line health workers and researchers to the best scientific intelligence and knowledge from around the world.

For more information about PHO, visit publichealthontario.ca.

Ontario