Study compares decline in effectiveness for Moderna, Pfizer, Janssen vaccines; and mortality consequences

November 4 2021

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As COVID-19 breakthrough infections continue to emerge in some vaccine recipients and health authorities are developing policies around booster vaccinations, national data on COVID-19 vaccine breakthrough infections is inadequate but urgently needed. Now a study from the Public Health Institute, the Veterans Affairs Medical Center and the University of Texas Health Science Center, published today in the journal *Science*, has analyzed COVID infection by vaccination status among 780,225 Veterans.

Researchers found that protection against any COVID-19 infection declined for all vaccine types, with overall vaccine protection declining from 87.9% in February to 48.1% by October 2021.

- The decline was greatest for the Janssen (Johnson & Johnson) vaccine, with protection against infection declining from 86.4% in March to 13.1% in September
- Declines for PfizerBioNTech were from 86.9% to 43.3%
- Declines for Moderna were 89.2% to 58%.

While most previous studies have focused on the PfizerBioNTech or Moderna vaccines, the *Science* study is the first to compare protection declines across the three main vaccine types, and the first to show the comparably dramatic decline in effectiveness for the Janssen vaccine. Declines were assessed over the period February 1, 2021 to October 1, 2021, reflecting the emergence and dominance of the Delta variant in the U.S. Patterns of breakthrough infection over time were consistent by age, despite rolling vaccine eligibility, implicating the Delta variant as the primary determinant of infection.

Importantly, vaccination of any type was protective against death among individuals who did become infected. The relative benefit of vaccination for protection against death was greater for persons under 65 but was also very strong for persons over 65.

The study showed that the risk of death from COVID infection was highest in unvaccinated Veterans, regardless of age and comorbidities. While some breakthrough infections resulted in death, vaccination remained protective against death in those who became infected during the Delta surge.

For those under 65 years old, vaccines overall were 81.7% effective against death.

- Protection against death was greatest for the Pfizer vaccine, at 84.3%.
- Moderna was the next most effective, at 81.5%.
- Janssen was 73% effective.

For those 65 and over, overall vaccine effectiveness against death was 71.6%.

- Moderna was 75.5% effective.
- Pfizer was 70.1% effective.
- Janssen was 52.2% effective.

"Our study gives researchers, policy makers and others a strong basis for comparing the long-term effectiveness of COVID vaccines, and a lens for making informed decisions around primary vaccination, booster shots, and other multiple layers of protection, including masking mandates, social distancing, testing and other public health interventions to reduce chance of spread," said Dr. Barbara Cohn of PHI, the lead author of the study. "For example, the CDC recommendation for boosters for all Janssen recipients over 18 is supported by our results. And, given the declines in vaccine protection and the dominance of the more infective Delta variant, we urge swift action to promote primary vaccination, boosters and to also encourage masking, social distancing and other layers of protection against infection. This is supported by our finding that breakthrough infections are not benign, but also by the strong evidence that vaccination still protects against death even for persons with breakthrough infections, compared to persons who become infected and are not vaccinated."

The FDA authorized Pfizer boosters for some groups in September and Moderna and Janssen boosters in October, and the CDC has made similar recommendations, including supporting a "mix and match" approach that allows people to choose any of the three vaccine boosters regardless of which they were given initially.

More information: Barbara A. Cohn et al, SARS-CoV-2 vaccine protection and deaths among US veterans during 2021, *Science* (2021).
DOI: 10.1126/science.abm0620

Provided by Public Health Institute