

# COVID-19 vaccine protects people of all body weights from hospitalization and death, shows study of 9 million adults

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COVID-19 vaccines have greatly reduced the number of cases of severe COVID-19 disease for everyone regardless of their body size, according

to a new study published in *The Lancet Diabetes & Endocrinology*. Vaccine effectiveness was similar for those with a higher BMI and of a healthy weight, but slightly lower in the underweight group, who were also the least likely to have been vaccinated.

In a further analysis of vaccinated people only, among the fewer COVID-19 cases recorded, people of very low and very high BMI were more likely to experience severe disease than vaccinated healthy-weight people. This replicates the findings seen in a previous analysis before the vaccination program commenced.

Obesity was pinpointed as a risk factor for severe COVID-19 early in the pandemic, reflected in the UK [vaccine](#) rollout in 2021, which prioritized people with a BMI of over 40 as a high-risk group. However, little was known until now about the effectiveness of the COVID-19 vaccines for people with [obesity](#). Previous work has shown that people with obesity are less likely to take seasonal flu vaccines and have modestly reduced benefits from flu vaccinations, although the reasons for this are not well understood.

"Our findings provide further evidence that COVID-19 vaccines save lives for people of all sizes. Our results provide reassurance to people with obesity that COVID-19 vaccines are equally as effective for them as for people with a lower BMI, and that vaccination substantially reduces their risk of severe illness if they are infected with COVID-19. These data also highlight the need for targeted efforts to increase vaccine uptake in people with a low BMI, where uptake is currently lower than for people with a higher BMI," says lead author Dr. Carmen Piernas of the Nuffield Department of Primary Care Health Sciences, University of Oxford, UK.

Researchers searched anonymized health records from more than 12 million patients across 1,738 GP practices in England taking part in

QResearch—a secure database of healthcare information available to verified researchers. Of these, 9,171,524 patients who were over 18 years old, had BMI data, and had not previously been infected with SARS-CoV-2 were included in the study.

People were grouped based on their BMI according to four World Health Organization definitions of 18.5-24.9kg/m<sup>2</sup> for healthy weight; below 18.5 for underweight; 25-29.9 for overweight; and 30 and over as obesity with levels adjusted for Asian people to reflect the higher health risks at lower BMI levels in this group. Characteristics such as age, sex, smoking status, and social deprivation were also accounted for in the analyses.

Of over 9 million people included in the study, 566,461 tested positive for SARS-CoV-2 during the study from 8 December 2020 (date of the first vaccine given in the UK) to 17 November 2021. Of those, 32,808 were admitted to [hospital](#) and 14,389 died.

At the end of the study period, 23.3% of the healthy weight group (817,741 of 3,509,231 people), 32.6% of the underweight group (104,488 of 320,737 people), 16.8% of the overweight group (513,570 of 3,062,925 people) and 14.2% of the group with obesity (322,890 of 2,278,649 people) had had no doses of any COVID-19 vaccine.

To understand vaccine effectiveness, the researchers compared risk of severe disease in vaccinated versus non-vaccinated people at least 14 days after a second dose. They found that being vaccinated offered high protection across all BMI groups, but that the effect was slightly lower in underweight people. Underweight vaccinated people had around half the likelihood of being hospitalized or dying compared with unvaccinated people of the same BMI.

In comparison, people in the healthy and high BMI groups who were

vaccinated were around 70% less likely to be hospitalized than unvaccinated people. People with a healthy or a higher BMI were also around two-thirds less likely to die than their unvaccinated counterparts two weeks after a second dose.

By looking at data from vaccinated people only (among whom the number of COVID-19 cases were greatly reduced), the researchers found that following two doses of vaccine there was a significantly higher risk of severe disease at low and at high BMI compared with a healthy BMI. For example, a BMI of 17 was linked to a 50% increase in risk of hospitalization compared with a healthy BMI of 23, and a very high BMI of 44 had three times the risk of hospitalization compared with a healthy BMI.

The cause of the increased risk among people with obesity is unknown. It is consistent with the higher rate of seasonal flu infections in people with a higher BMI. The authors speculate that their findings may be explained, in part, by an altered immune response in heavier weight individuals. The reduced effectiveness of COVID-19 vaccines among people with a low BMI may also reflect a reduced immune response as a consequence of frailty or other conditions associated with low body weight. Further research is needed to explore the relationship between BMI and immune responses.

The authors acknowledge several limitations to the study, in particular, that some measurements of BMI were based on self-reporting, or on data recorded in GP records before the study onset that could be outdated. Furthermore, the limited numbers of people who had had three doses by the study close meant that the effects of booster jabs could not be investigated, and data did not allow for researchers to investigate between and among Pfizer, AstraZeneca or Moderna vaccines, nor virus variants.

Writing in a linked comment, Professor Annelies Wilder-Smith and Professor Annika Frahsa of the Institute of Social and Preventive Medicine, University of Berne, Switzerland (who were not involved in the study) note, "There was a higher vaccine uptake by persons with obesity. Conversely, underweight persons were less likely to be vaccinated, which may be an unintended result of public messaging that overweight persons have a higher risk of severe COVID-19 further corroborated by the UK risk-based strategy to vaccine rollout. These findings should prompt a shift towards more targeted and differentiated public health messaging to also address underweight persons who may perceive themselves at lower risk in order to enhance vaccine uptake in this group."

**More information:** Associations of BMI with COVID-19 vaccine uptake, vaccine effectiveness, and risk of severe COVID-19 outcomes after vaccination in England: a population-based cohort study, *The Lancet Diabetes & Endocrinology* (2022).

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