

# Herd immunity may not be achievable even with high vaccine uptake

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The government vaccination program may not be sufficient to achieve herd immunity—even if everyone in the UK is vaccinated—according to new research from the University of East Anglia.

Researchers modeled the effectiveness of UK-wide immunization programs using the Oxford and Pfizer vaccines, taking into account the highly transmissible new COVID-19 variant.

They found that the only way to reach [herd immunity](#) for the UK would be to vaccinate almost everyone—including children—with the more effective Pfizer [vaccine](#).

They say data for the recently licensed Moderna vaccine would be similar to the Pfizer results.

And the study recommends that all health and social care professionals should receive the 95 percent effective Pfizer/Moderna vaccines to prevent asymptomatic spread to patients and [vulnerable people](#).

Due to the rapid-response nature of this research it

has not yet been peer reviewed.

COVID-19 expert Prof Paul Hunter, from UEA's Norwich Medical School, said: "Getting vaccinated has a huge benefit to you personally. It greatly reduces the risk of serious illness and reduces your risk of symptomatic disease by an estimated 70 percent for the Oxford vaccine, or 95 percent for the Pfizer and Moderna vaccines.

"But we wanted to find out whether 'herd immunity' is a realistic outcome of any immunization program with the main vaccines licensed in the UK given that immunization, even though it can reduce illness, may not prevent all infections.

"And importantly, can these vaccines achieve a sufficient level of [population](#) immunity to reduce the reproductive R number to below one in the absence of any non-pharmaceutical interventions?"

The research team used mathematical models of COVID-19 transmission and [vaccine efficacy](#) to predict how well the Oxford and Pfizer vaccines will work to bring the R number down and achieve herd immunity.

They initially found that 69 percent of the population would need to be vaccinated with the Pfizer vaccine, or 93 percent of the population with the Oxford vaccine, to bring the R number below one.

However, when they took into account the new more transmissible COVID-19 variant, they found that vaccinating the entire population with the Oxford vaccine would only reduce the R value to 1.325. Meanwhile the Pfizer vaccine would require 82 percent of the population to be vaccinated to control the spread of the new variant.

Modeller Prof Alastair Grant, from UEA's School of Environmental Sciences, said: "The Oxford vaccine reduces the incidence of serious illness to a greater extent than it reduces symptomatic illness, which is

still common in those who have had this vaccine.

"Its efficacy against the incidence of asymptomatic infections is lower, reducing its efficacy against all infection from 70.4 percent to 52.5 percent for the pooled data.

This means that its overall protection against infection is only partial—around 50 percent.

"Although asymptomatic cases are less infectious, including this in our calculations still raises R values by 20 percent or more, from 1.33 to 1.6 for the new variant with a 100 percent vaccination.

"This combination of relatively low headline efficacy and limited effect on asymptomatic infections means that the Oxford vaccine can't take us to herd immunity, even if the whole population is immunized.

"Vaccinating 82 percent of the population with the Pfizer vaccine would control the spread of the virus—but it isn't licensed for use on under 16s, who make up 19 percent of the population.

"Also, some people will refuse the vaccine, so achieving an 82 percent vaccination rate will likely be impossible. In the absence of vaccination, 'herd immunity' would only occur when 89 percent of the population has had the virus."

Prof Grant added: "We know that a substantial fraction of those who have been vaccinated or have had a natural infection can still become infected and pass the virus on others.

"It is very worrying that vaccinated but asymptotically infected people could still pass COVID-19 on to those who have not been vaccinated, and particularly those who may be immunocompromised.

"For this reason, we recommend that health and social care workers, and others who have lots of contacts with those vulnerable to infection, should receive one of the mRNA vaccines in preference.

"The Oxford vaccine will no doubt be an important control intervention, but unless changes to the dose

regime can increase its efficacy, it is unlikely to fully control the virus or take the UK population to herd immunity."

Prof Hunter added: "If we cannot achieve herd immunity, vulnerable unvaccinated individuals will remain at risk. We do need to consider how best to protect these individuals when social restrictions are eventually relaxed as the result of a successful vaccine roll out program."

**More information:** Alastair Grant et al. Immunisation, asymptomatic infection, herd immunity and the new variants of COVID-19, *Nature* (2021). [DOI: 10.1101/2021.01.16.21249946](https://doi.org/10.1101/2021.01.16.21249946)

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