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<xml><?covid-license?></xml>The benefits *[OK?]* of large scale covid-19 vaccination

New evidence confirms that fewer people die in better vaccinated communities

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The first covid-19 vaccines were administered under emergency use authorisation in December 2020, just one year into the pandemic, a "miracle" of pharmaceutical innovation that has saved an estimated million lives or more in the US alone.[1 2] The authorisation was given on the basis of safety and efficacy in randomised controlled trials, which found that immunisation with Pfizer-BioNTech and Moderna mRNA vaccines protected a remarkably high percentage (>90%) of recipients from developing symptomatic infection and, to a lesser extent, from asymptomatic infection too. In other words, when tested against the SARS-CoV-2 variants prevailing in 2020 and early 2021, these novel covid-19 vaccines could stop the great majority of infections from causing illness and help to prevent transmission of SARS-CoV-2. But could vaccination prevent infection and illness on a large scale, outside the controlled environment of clinical trials? A linked study by Suthar and colleagues (doi:10.1136/bmj-2021-069317) adds to the evidence that it can, across the US[at least in the US?].[3]

Given the practical challenges of scaling up immunisation programmes ─ maintaining cold chains, carrying out mass inoculation in busy or makeshift clinics, and accurately reporting both numbers vaccinated and health outcomes ─ real world vaccine effectiveness is typically less than the efficacy achieved in clinical trials. Following reports that effectiveness has remained high for a variety of outcomes (infection, symptomatic illness, visits to emergency departments, hospital admissions, severe illness, and death) in diverse a variety of settings,[4-10] Suthar and colleagues have now investigated the impact of covid-19 vaccination, largely with Pfizer and Moderna vaccines, across 2558 counties in 48 US states, covering nearly 80% of the US population. Their evaluation is based on more than 30 million cases of covid-19 and more than 400 000 deaths linked to covid-19, which were reported during the second year of the pandemic, between December 2020 and December 2021.[3]

They measured effectiveness by comparing reported covid-19 incidence and mortality rates in counties with very low (0-9%), low (10-39%), medium (40-69%), and high (≥70%) percentages of adults (≥18 years) who had received at least one dose of vaccine. During the first half of 2020, when the alpha variant of SARS-CoV-2 was dominant, the covid-19 mortality rate was reduced by 60%, 75%, and 81% in counties with low, medium, and high vaccination coverage, compared with counties that had very low coverage. The corresponding figures for the reduction in case incidence were 57%, 70%, and 80%. The impact on mortality was similar during the second half of 2021 when the delta variant became dominant in the US, with smaller effects on incidence.[3]

Clearly, counties with higher vaccination coverage had fewer covid-19 cases and deaths per head of population, and the measured effectiveness in counties with high vaccine coverage was reassuringly large. More than this, vaccination had a disproportionately large effect in counties with low and medium coverage. For instance, an incremental increase in coverage of only 20% (from very low (median) to low (median) **[correct?]**) and 50% (from very low to medium **[correct?]**) led to reductions in mortality of 60% and 75%, respectively.

Suthar and colleagues argue that vaccination benefits whole communities, and indeed it does when coverage is high.[3] But they did not seek, and their data do not show, any extra effect of herd immunity, whereby vaccinated people prevented the transmission of infection to others in their communities.[11] A more likely explanation for the disproportionately beneficial effect in counties with low and medium coverage is that vaccination campaigns first targeted older people who are at greatest risk of severe illness and death from covid-19. Vaccine rollout in most countries began with older and otherwise vulnerable people and progressively included younger and less vulnerable people. Hong Kong is a notable exception, where high covid-19 death rates in March 2022 were associated with low vaccination rates particularly among the elderly.[12] Unlike Hong Kong, the US has followed the norm: in states that have achieved relatively low vaccination coverage overall, the percentage of older people vaccinated is invariably higher than the population average **[meaning correct here?]**.[13] Suthar and colleagues did not investigate the effect of vaccination by age, but doing this should be possible with existing data available to **[from?]** the US Centers for Disease Control and Prevention.

The findings of this study make it clear that ~~how~~ many more lives could have been saved, and will be saved, by encouraging people to keep up to date with vaccination in the face of

waning immunity and new SARS-CoV-2 variants, and by achieving even higher population coverage. How many lives is a matter for others to explore. Meanwhile, this new study is another confidence booster for covid-19 vaccines.

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