Boosters vital to mitigate impact of omicron, but may lose some effectiveness

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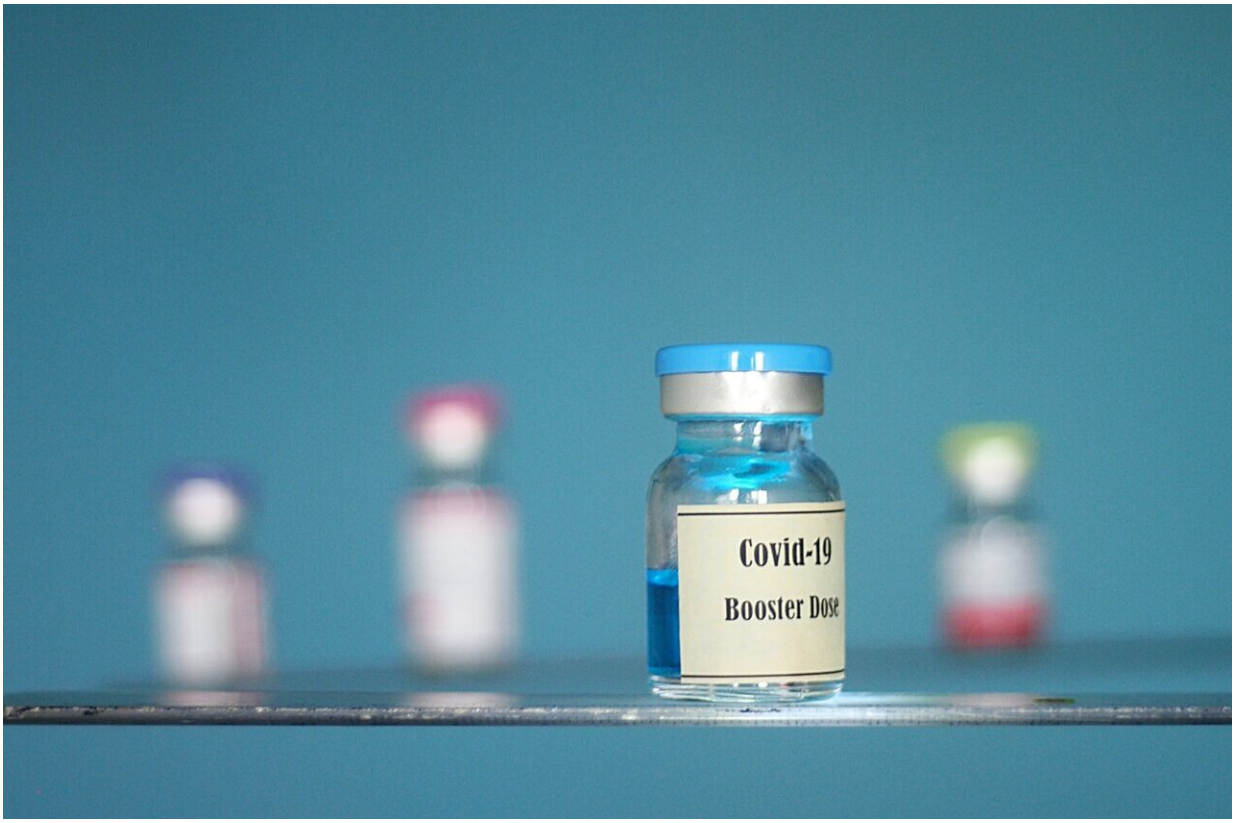

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Levels of neutralizing antibody to prevent omicron infection reduced and vaccine efficacy against severe disease predicted to drop says new report.

Vaccines have played a central role in mitigating severe disease and death from COVID-19 in the past 12 months. However, the emergence of variants of concern has resulted in a loss of vaccine efficacy against mild infection and onward transmission. Whilst the extent of waning against severe disease (i.e. that requiring hospitalization) is less than that against mild disease, even small reductions in protection can result in significant rises in hospitalisations and deaths, particularly in high-risk groups.

Vaccine efficacy

In this latest report by the Imperial College COVID-19 Response Team, researchers fitted an immunological model to population-level vaccine efficacy data to determine vaccine efficacy in the face of the omicron variant.

Following two initial doses and a booster vaccine with an mRNA vaccine (Pfizer BioNTech or Moderna), neutralizing antibodies (which prevent infection) are estimated to increase 1.6-fold (95 percent credible interval, CrI 1.4–1.9) compared to levels following dose 2 of the Pfizer-BioNTech vaccine and 3.3-fold (95 percent CrI 2.5–4.7) compared to their levels following dose 2 of the Oxford-AstraZeneca vaccine. However, the researchers estimate that when the immune system encounters a variant, the levels of neutralizing antibodies produced against omicron could be 4.5-fold (95 percent CrI 3.1–7.1) lower than those produced against the delta variant.

Booster doses crucial

The researchers also find that this reduction in neutralizing antibodies could impact vaccine efficacy against severe disease. In a worst-case scenario where the decay rate after a booster dose is the same as that

observed after the first two doses, the study predicts that vaccine efficacy against severe disease (hospitalization) may drop from 96.5 percent (95 percent CrI 96.1 percent–96.8 percent) against delta to 80.1 percent (76.3 percent–83.02) against omicron by 60 days after the primary vaccine course followed by a booster of the Pfizer-BioNTech vaccine if antibodies decay at the same rate following the booster as observed following the primary vaccine course. If this rate of decay is half that rate, the drop is estimated to be from 97.6 percent (95 percent CrI 97.4 percent-97.9 percent) against delta to 85.9 percent (95 percent CrI 83.1 percent-88.3 percent) against omicron. However, this could be further moderated by the increased longevity of T cell-mediated immunity.

The researchers say that whilst these numbers are currently associated with a high degree of uncertainty, they indicate that omicron-variant specific vaccines and/or further boosters are likely to be needed to restore protection.

Global vaccine distribution

The report integrates this immunological model with a SARS-CoV-2 virus transmission model to consider how booster doses should best be deployed given the current state of the global pandemic. The researchers model three scenarios—one for countries that have substantial past transmission (and infection-induced immunity) and a high level of access to vaccines, one for countries with substantial past transmission but limited access to vaccines, and one for so-called "zero-COVID" countries with limited past transmission.

Their findings demonstrate that booster doses will be critical to mitigate the impact of future omicron waves in countries with high levels of circulating virus.

Booster doses will also be needed in "zero-COVID" countries to prevent new waves of infection and in order to open-up safely.

Where vaccine supply is limited or vaccine roll-out delayed, targeting booster doses to the highest risk groups to ensure continued high protection in the face of waning immunity is of greater benefit than giving these doses as primary vaccination to younger age-groups.

The researchers note that we still do not know how severe the disease caused by the omicron variant is compared to disease caused by previous variants.

Prof Azra Ghani from Imperial College London said: "Given the rapid spread of the omicron variant to date, it is now highly likely that this will replace the circulating delta variant globally in the coming weeks. Emerging immunogenicity data clearly point to substantial reductions in neutralizing antibodies whilst preliminary vaccine efficacy estimates demonstrate a substantial reduction in protection from mild disease. Our estimates suggest that this is likely to translate into small but important reductions in efficacy against severe disease and death. One remaining uncertainty is how severe the disease caused by the omicron variant is compared to disease caused by previous variants. Whilst it may take several weeks to fully understand this, governments will need to put in place plans now to mitigate any potential impact. Our results demonstrate the importance of delivering booster doses as part of the wider public health response. Prioritizing these boosters to high-risk populations over primary vaccination in younger age-groups should be part of this response in countries where dose supply is limited."

Dr. Alexandra Hogan from Imperial College London said: "While data are still emerging, the rapid spread of the omicron variant is highly concerning. Substantial increases in infections and cases are predicted in the coming weeks, both in countries with ongoing virus circulation, and

in those settings that have previously suppressed transmission and are now lifting restrictions. Our study provides further evidence for the importance of delivering booster doses as an immediate priority, particularly in older, high-risk, and priority populations. While we are yet to fully understand the implications of omicron in terms of disease severity, boosters will be a key part of the policy response for reducing hospitalisations and deaths, and to prevent health systems from becoming overburdened."

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