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COVID-19 vaccine boosters in the Asia-Pacific region in the context of Omicron

John D Hart,[a,*] Kulkanya Chokephaibulkit,[b] Mayfong Mayxay,[c,d,e] Anna Lisa T Ong-Lim,[f] Salanieta T Saketa,[g] and Fiona M Russell [a,h]

[a]Murdoch Children's Research Institute, Melbourne, Australia
[b]Siriraj Institute of Clinical Research, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand
[c]Institute of Research and Education Development (IRED), Ministry of Health, University of Health Sciences, Vientiane, Laos
[d]Lao-Oxford-Mahosot Hospital-Wellcome Trust Research Unit (LOMWRU), Microbiology Laboratory, Mahosot Hospital, Vientiane, Laos
[e]Centre for Tropical Medicine and Global Health, University of Oxford, United Kingdom
[f]Division of Infectious and Tropical Disease in Pediatrics, College of Medicine, Philippine General Hospital, University of the Philippines Manila, Philippines
[g]Surveillance, Preparedness and Response Programme, Public Health Division, Pacific Community, Suva, Fiji
[h]The University of Melbourne, Parkville, Victoria, Australia

The Lancet Regional Health - Western Pacific 2022;20: 100404
Published online 16 February 2022
https://doi.org/10.1016/j.lanwpc.2022.100404

As the Omicron variant of concern rapidly spreads across the globe, some countries are scaling up their booster programs to help protect against the impending wave of infections. Omicron has mutations that allow it to evade vaccine immunity at least partially. Here we present available data on effectiveness of boosters, including against Omicron, and how this relates to the Asia-Pacific region.

Early data from the UK suggests Pfizer/BioNTech boosters may enhance effectiveness against infection with Omicron from around 35% from 15 weeks after the second dose to over 70% (data not peer-reviewed).[1] In Denmark, boosters increased effectiveness against infection with Omicron from <10% by the third month after two doses to 55%. However, two doses still reduces the risk of hospitalisation by 63% for AstraZeneca, and 74% for Pfizer/BioNTech or Moderna, even if protection against infection has been largely lost against Omicron.[2] Much of the evidence related to boosters pre-Omicron is still relevant for booster policy decisions although timelines may be accelerated due to the new variant, and the primary focus must remain on vaccinating those at high risk of severe outcomes.[3]

Delta is still the predominant variant of COVID-19 worldwide by the 6th January 2022.[4] Two doses of Pfizer/BioNTech, Moderna and AstraZeneca vaccines are highly effective against Delta initially, although this wanes over time. In the UK, effectiveness of both AstraZeneca and Pfizer/BioNTech against infection with Delta decreased 20% beyond 20 weeks after vaccination; and decreased 15% and 8%, respectively, against death (data not peer-reviewed).[5] However, evidence from Scotland and Brazil indicates effectiveness against severe outcomes and death wanes within three months of the second dose of AstraZeneca.[6] In Canada, effectiveness of the mRNA vaccines declined about 10% against infection by the eighth month, and by the fourth month for AstraZeneca, although effectiveness against hospitalisation was maintained (data not peer-reviewed).[7] A Pfizer/BioNTech booster showed 95% efficacy against disease, and 93% and 81% effectiveness in Israel against hospitalisation and death, respectively, compared with those who received two doses at least five months previously.[8]

By reducing infection, boosters can also indirectly help protect the clinically vulnerable and unvaccinated but with Omicron this seems to be quite short-lived.[4] Increasing circulating antibody will inhibit initial viral invasion of cells in the airway, thereby reducing infection and transmission, even if those who have not received boosters are relatively protected against severe disease through delayed B and T cell memory responses. Breakthrough infections have been shown to have lower viral load than infections in unvaccinated individuals, making them less infectious, an effect that also wanes and is restored with boosters.[9] However, these are additional benefits and the focus needs to remain on preventing severe illness in the vulnerable.[3]

WHO recommends a third dose as part of the initial vaccination schedule for the immunocompromised; and a booster dose with either the same or a different vaccine following the inactivated vaccines, Sinovac and Sinopharm, due to lower initial efficacy and more rapid waning. Nearly three-quarters of 1.1 billion doses of Sinopharm and Sinovac distributed worldwide have been in the Asia-Pacific region, where much of the population received two doses and will not be fully protected, especially from Omicron.

In Pacific Island Countries (PICs), boosters will be important regardless of the primary schedule, due to

*Corresponding author.
E-mail address: john.hart@mcri.edu.au (J.D. Hart).

extremely high rates of obesity, diabetes and other conditions predisposing to severe COVID-19. In US-affiliated PICs and French territories, mostly mRNA vaccines and the viral vector vaccine, Johnson & Johnson, have been used. In southern PICs, AstraZeneca and Sinopharm have predominated. Booster administration depends very much on vaccine availability, with about 120,000 boosters administered to date, mainly in US-affiliated PICs.

The optimal vaccine to boost with is still being determined. Mixing and matching boosters using all combinations of Pfizer/BioNTech, Moderna and Johnson & Johnson in the US showed homologous boosters increased antibody titres by 4.2 to 20-fold and heterologous boosters 6.2 to 76-fold (data not peer-reviewed).[10] UK data has shown that boosting with Pfizer/BioNTech, AstraZeneca, Moderna, Johnson & Johnson, Novavax or CureVac, following Pfizer/BioNTech or AstraZeneca primary series, boosts antibody and neutralising responses.[11] AstraZeneca or Pfizer/BioNTech boosters following Sinovac primary series yielded 4 to 8-fold higher neutralizing antibodies than Sinopharm boosters (data not peer-reviewed).[12] Due to surges in Delta infections and severe outcomes following rollout of inactivated vaccines, some countries are offering heterologous boosters: Indonesia is offering Moderna boosters; Thailand, AstraZeneca or Pfizer/BioNTech boosters; Laos and Cambodia, AstraZeneca boosters; Singapore, mRNA vaccine boosters; and the United Arab Emirates, Bahrain and Mongolia, Pfizer/BioNTech boosters.

As countries roll out boosters, and increasingly so in the context of Omicron, this will impact global vaccine supply and create further inequity. To address this, the Coalition for Epidemic Preparedness Innovations is evaluating fractional dose boosters. Fractional doses could potentially reduce side effects as well as provide a dose-stretching and more affordable option, both factors particularly important in the Asia-Pacific region where vaccine supply has been a constraint on rollout. Immunogenicity studies show that half-dose Pfizer/BioNTech or Moderna boosters induce high neutralising antibodies against variants and even lower doses with intradermal administration are showing promising results.

The focus needs to remain on preventing severe outcomes. There is clear evidence that a third dose is needed for the elderly and immunocompromised populations for any variant. Protection against severe outcomes from Omicron as well as Delta appears to be mostly preserved following a primary series of the Pfizer/BioNTech, Moderna and AstraZeneca vaccines.

Nevertheless, alongside efforts to administer boosters, the priority should remain to vaccinate a high proportion of the world's eligible population with two doses of vaccine. Novel administration strategies to reduce the amount of vaccine needed should be explored to mitigate vaccine shortage.

Author contributions

JDH wrote the original draft. All other authors contributed to reviewing and editing the manuscript.

Declaration of interests

All authors declare no conflicts of interest.

Acknowledgements/Funding

No funding was provided for this work.

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