MEDIA RELEASE

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STUDY SHOWS THAT COVID-19 BOOSTER JABS PROVIDE BETTER IMMUNITY AGAINST SARS-CoV-2 VARIANTS IN ELDERLY SINGAPOREANS

*Understanding the impact of age on vaccinations is essential for the design and delivery of safe vaccines against SARS-CoV-2 (Image: A*STAR ID Labs)*

SINGAPORE – Elderly Singaporeans who are above 60 years old develop weaker vaccine-acquired immunity against COVID-19 upon receiving two doses of the Pfizer/BioNTech BNT162b2 vaccine, in comparison to their younger counterparts. These findings are from a new study led by researchers from the A*STAR Infectious Diseases Labs (ID Labs). The study, published online in *Nature Communications*, also demonstrates that a third vaccine dose, or booster jab, alleviates the weak immune response observed in the elderly by increasing the levels of virus-specific antibodies and T cell responses against the ancestral SARS-CoV-2 Wuhan strain, the Delta and Omicron variants.

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The study involved the participation of 312 individuals, including healthcare workers and elderly individuals, who received a primary COVID-19 vaccination regime consisting of two doses of Pfizer/BioNTech BNT162b2 SARS-CoV-2 mRNA vaccine. Researchers conducted a comprehensive analysis of different immune parameters such as SARS-CoV-2-specific antibodies, memory B cell levels and virus-specific T cell responses, to assess the establishment and persistence of vaccine-acquired immunity. It is widely accepted that high antibody and memory B cell levels are essential for protection against infection while strong T cell responses protect against severe disease.

The study revealed that upon the two-dose regime, most vaccinees developed robust antibody, B and T cell responses against the ancestral SARS-CoV-2 Wuhan strain. However, vaccine-induced immunity against the Delta and Omicron variants was less effective, suggesting the possibility of breakthrough infections. Weaning of the antibody and cellular responses was also observed in 30% of the participants after 6 months from their second dose. Importantly, researchers observed that individuals older than 60 years displayed weaker virus-specific antibody responses than younger Singaporeans (<60 years old) and developed vaccine immunity at a slower pace. This trend was alleviated in the elderly upon the administration of a third Pfizer/BioNTech vaccine dose, which strongly boosted their low antibody responses and T cell responses against SARS-CoV-2 variants. These findings highlight the importance of vaccine boosters in the elderly, as recommended by Singapore's Ministry of Health (MOH) guidelines.

This study provides key insight to the kinetics of induction and maintenance of vaccine-acquired immunity in elderly Singaporeans, and shows that it is necessary to evaluate the elderly's immune responsiveness to different vaccination strategies as they are at major risk of developing severe COVID-19 complications. The high prevalence of subpar antibody responses in the elderly is likely a consequence of *immunosenescence*, a natural process leading to immune dysfunction as we get older. In the context of COVID-19 vaccination, weakened immune responses in the elderly population could favour breakthrough infections justifying the need for additional booster doses.

Dr Siew-Wai Fong, Research Scientist at A*STAR ID Labs, and co-author of the study said, "It is crucial for those who have been vaccinated to get boosted, especially the elderly population, to acquire protection against the SARS-CoV-2 variants that are still emerging and spreading among people."

Dr Yun Shan Goh, Senior Research Scientist at A*STAR ID Labs, and co-author of the study, said, "We have observed a proportion of vaccinees with poor T cell responses following three doses of mRNA vaccine, despite a good antibody response. Second generation vaccines, based on new platforms, with better immunogens or adjuvants that

induce a more rapid and efficient T responses may allow us to avoid vaccine fatigue and may be an alternative to offer long-lasting and effective protection."

This research is the result of a collaborative effort involving researchers from A*STAR's ID Labs and Singapore Immunology Network (SIgN), National Centre for Infectious Diseases (NCID), and Duke-NUS Medical School. NCID was involved in the clinical recruitment for the study and its National Public Health Laboratory was involved in antibody response analysis. Together, the researchers performed detailed antibody and cellular immune analyses of the cohort.

Professor Laurent Rénia, Senior Fellow at A*STAR ID Labs and Professor at the Lee Kong Chian School of Medicine, Nanyang Technological University and lead author of the study said, "Vaccines against SARS-CoV-2 have been instrumental in reducing COVID-19 mortality. Understanding the duration of immunity and efficacy against emerging variants is essential for future vaccine implementation and policy."

Associate Professor Barnaby Young, Head of the Singapore Infectious Disease Clinical Research Network at the National Centre for Infectious Diseases (NCID), who led clinical recruitment for this study said, "The COVID-19 vaccines have successfully limited the impact of the Omicron outbreaks and enabled the world to reopen. But some people, particularly older adults, are still getting seriously ill due to COVID-19, and this study has helped demonstrate the importance of boosters to reduce this."

Prof Antonio Bertoletti, from the Emerging Infectious Diseases Programme at Duke-NUS Medical School, said, "It was a pleasure to be involved in this important work that characterised SARS-CoV-2 vaccine-induced humoral and cellular immunity in the elderly. The study adds to the evidence that, also in this vulnerable population, protective antibodies and T cells go hand in hand."

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About A*STAR's Infectious Diseases Labs (ID Labs)

A*STAR Infectious Diseases Labs (ID Labs) was established in April 2021 with a mission to be a leading center of infectious diseases research excellence in antimicrobial resistance, respiratory and vector-borne diseases. ID Labs brings together infectious diseases expertise from across multiple disciplines to drive cutting edge translational infectious diseases research to contribute to Singapore's national preparedness and defence against the threat of emerging infections.

The key research areas in ID Labs include vector-borne infections, respiratory diseases, anti-microbial resistance and epidemic preparedness. Leveraging strong partnerships locally and internationally, ID Labs plays an important role in training and recruiting scientific talents to be future leaders in infectious diseases research.

For more information about ID Labs, please visit https://www.a-star.edu.sg/idlabs

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ANNEX A – NOTES TO EDITOR

Paper published in *Nature Communications* on 08 August 2022.

Lower vaccine-acquired immunity in the elderly population following two-dose BNT162b2 vaccination is alleviated by a third vaccine dose

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