Memo

Date:	17 December 2021
To:	Dr Ashley Bloomfield, Director-General of Health
Copy:	Astrid Koornneef, Director of National Immunisation Programme Allison Bennett, Manager, System Enablers, System Strategy and Policy Dr Caroline McElnay, Director of Public Health
From:	Dr Ian Town, Chief Science Advisor
Subject:	COVID-19 booster vaccinations in specific situations: COVID-19 Vaccine Technical Advisory Group (CV TAG) recommendations
For your:	Consideration

Purpose

1. To summarise the COVID-19 Vaccine Technical Advisory Group's (CV TAG) recommendations about booster doses of the Pfizer vaccine.

Context

2. On 8 November 2021 Medsafe updated the provisional approval for the Pfizer vaccine to state: ***"a booster dose of Comirnaty may be administered intramuscularly at least 6 months after completion of the primary course in individuals aged 18 years of age and older".***
3. CV TAG has previously made recommendation about booster vaccinations in the memo "Priority groups for COVID-19 booster vaccinations: COVID-19 Vaccine Technical Advisory Group (CV TAG) recommendations", dated 10 November 2021 (Appendix 1).
4. The COVID Vaccine Immunisation Programme (CVIP) has asked for further information and clarification on CV TAG's recommendations in specific situations:
    a) Use of booster doses at less than 6 months after the completion of the primary vaccination course.
    b) Use of booster doses for those under the age of 18 years who are at high risk of exposure to SARS-CoV-2.
    c) Booster doses for pregnant people.
5. *Antibody waning:* Current evidence shows that antibody levels against SARS-CoV-2 wane over time following the second dose of the Pfizer COVID-19 vaccine. There is a reduction in protection against infection, particularly from 6 months after a primary vaccination course.[1-3] The reduction in protection is similar for Delta and other virus variants.[2, 4] Protection against transmission from vaccinated individuals who are infected also appears to wane over time.[5] However, evidence suggests that protection against severe disease remains high, including for the Delta variant, though follow-up times varied between studies.[1-4, 6-8]

6. *Reactogenicity of a Pfizer booster dose:* Amongst 306 participants aged 18-55 years old receiving a third dose in Pfizer's phase III trial, reactogenicity was largely in line with findings after the second dose, with the exception of lymphadenopathy which occurred at a rate of 5.2% compared to 0.4% post-second dose.[9] Other studies also suggest that the common mild and transient side effects after booster doses are comparable to those following primary vaccine doses.[10-14]
7. *Safety of a Pfizer booster dose:* Data from Israel shows that after more than 2.8 million administered third doses, 19 serious adverse events have been reported, of which 2 have been confirmed as linked, though there is likely underreporting in this data.[15] Only one case of myocarditis has been reported and is under investigation, in a male older than 30 years, however most younger individuals have had limited follow up time.[15] Israeli data suggests that the risk of myocarditis with the booster dose is not increased when compared with the risk after second doses of vaccine.[16] However, there remain limited data on the incidence of myocarditis after second doses of the mRNA vaccines in younger people.[16-22]
8. *Immunogenicity and effectiveness of a Pfizer booster dose:* A COVID-19 vaccine booster dose administered at 6 months or more after completion of the primary vaccine course has been demonstrated to boost the immune response (e.g. neutralising antibody) and is expected to increase protection against infection and disease, particularly in older people where waning appears more marked.[9-12] Data from Israel, where Pfizer booster doses have been administered to large numbers of people, show reductions in all eligible age groups in the rate of infection, as well as severe disease in those aged ≥40 years, and deaths in those ≥60 years, after the booster dose.[16, 23, 24]

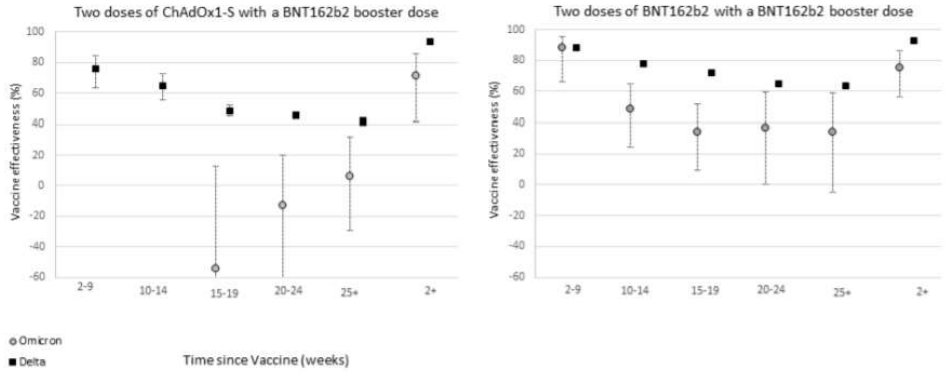
Use of booster doses at less than 6 months after the completion of the primary vaccination course

9. Potential reasons to consider early booster doses include:
    a) to provide potentially higher protection against COVID-19 caused by new variants
    b) to protect people who are close to 6 months post-primary vaccination course who are at risk of severe COVID-19 and/or SARS-CoV-2 exposure.
10. It is not yet clear if Omicron can evade vaccine-induced immunity. The laboratory data on Omicron from antibody neutralisation studies to date is very limited and preliminary [25-27], and cannot be used to infer an impact on vaccine protection in real world settings at this stage. Additional information about these studies is presented in Appendix 2.
11. Very early data about vaccine effectiveness (VE) against **symptomatic** disease caused by Omicron and Delta variants was released by the UK Health Security Agency (UKHSA) on 10th December 2021.[28] This analysis included data from 56,439 Delta cases including 581 Omicron cases. Results are shown in Figure 1 (Figure 7 in original document), below. Data about VE of a Pfizer primary series (weeks "2-9" to "25+") and booster dose (week "2+") against Delta and Omicron variants are shown in the right-hand panel of Figure 1. Confidence intervals for VE estimates for Omicron are extremely wide. However, they do not appear to overlap with confidence intervals for Delta at any point from 9 weeks after the primary course (including after the booster dose). This suggests a lower VE for Omicron than for Delta, but it remains unclear to what extent. The point estimate for VE against Omicron increased to ~76% at >2 weeks after a Pfizer booster dose, from ~35% at 15 to >25 weeks after the Pfizer primary course.

Figure 1: Early UKHSA data on vaccine effectiveness for Delta and Omicron (right panel show Pfizer primary course and booster, with lower effectiveness against Omicron)

Figure 7: Vaccine effectiveness against symptomatic diseases by period after dose 1 and dose 2 for Delta (black squares) and Omicron (grey circles) for (A) recipients of 2 doses of AstraZeneca vaccine as the primary course and a Pfizer as a booster[1] and (B) recipients of 2 doses of Pfizer vaccine as the primary course and a Pfizer as a booster

Supplementary data are not available for this figure.



[1] The early observations for 2 doses of AstraZeneca are particularly likely to be unreliable as they are based on relative small numbers and are likely to reflect an older population and a population with more co-morbidities than those given the Pfizer vaccine, and this may explain the negative point estimates.

12. A press release with data from South Africa during the Omicron wave states that two doses of Pfizer has a VE of **70% against hospitalisation**, and **33% against COVID-19 infection,** though the data does not mention time since vaccination.[29]
13. Other data from South Africa shows that the risk of reinfection has increased in the era of Omicron. [30] This suggests that Omicron could have increased evasion of immunity following prior infection.
14. The Australian Technical Advisory Group on Immunisation (ATAGI) advised on 3rd December 2021 in a statement about SARS-CoV-2 Omicron variant and COVID-19 booster doses, that at that time there was no evidence to suggest that earlier booster doses of current COVID-19 vaccines will augment protection against the Omicron variant. However, ATAGI also said in this statement that in certain circumstances, the routine six-month interval for booster doses may be shortened to five months for logistical reasons, for example:
    a) for patients with a greater risk of severe COVID-19 in outbreak settings;
    b) if an individual is travelling overseas and will be away when their booster dose is due; or
    c) in outreach vaccination programs where access is limited.
15. **On 12th December, ATAGI updated their statement to recommend COVID-19 booster vaccination for anyone aged 18 and older who completed their primary course of COVID-19 vaccination 5 or more months ago.**
16. The UK's Joint Committee on Vaccination and Immunisation (JCVI) have reduced the minimum interval between completion of the primary course and the booster to 3 months, stating that "it may be that higher levels of antibody induced by vaccines directed at the original 'wild type' variant will provide better protection against the Omicron variant, as has been demonstrated in laboratory studies with respect to other variants", and "additional data regarding the Omicron variant will take some time to accrue. Waiting for such data before taking some actions risks a suboptimal delayed response".

Use of booster doses in those under the age of 18 years who are at high risk of exposure to SARS-CoV-2

17. In those under 18 years of age, severe COVID-19 is uncommon, and the primary course of COVID-19 vaccines generates a strong immune response. Therefore, the benefit from additional doses of vaccine is thought to be to be small. In addition, there are currently only very limited data on the safety of repeated mRNA vaccine doses in this age group.

18. On 9th December 2021, the U.S. Food and Drug Administration (FDA) amended the emergency use authorization for the Pfizer vaccine, allowing the use of a booster in individuals 16 and 17 years of age at least six months after completion of primary vaccination with Pfizer vaccine.

19. ATAGI does not currently recommended boosters for those aged <18 years.

Booster doses for pregnant people

20. CV TAG recommendations from 10th November (Appendix 1) excluded pregnant people who received a primary course earlier in pregnancy from priority groups, but there was no specific recommendation given about booster vaccination in pregnancy outside of a prioritisation framework. Specifically, there is concern that messaging that those vaccinated in early pregnancy should not receive a booster dose while still pregnant is raising unintended concerns about the safety of vaccination with COVID-19 vaccines while pregnant (both primary and booster doses).

21. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) states that "a booster dose can be considered if you are 18 years or older and had your initial COVID-19 vaccine course (called the primary course) ≥ 6 months ago. Pfizer is the preferred brand for booster doses for all people, including in pregnancy, regardless of the brand used initially". RANZCOG argue "mRNA vaccines are safe and effective for those trying to conceive, pregnant and breastfeeding women. Booster doses have not yet been studied in those who are pregnant but have been shown to be safe and effective in non-pregnant adults. We do know that COVID-19 infection in pregnancy poses a significant risk for mothers and their babies, and RANZCOG recommends that pregnant women receive booster vaccinations in line with the recommendations for the non-pregnant adult population".[31]

Recommendations

22. CV TAG met on 14 December 2021 to consider recommendations regarding COVID-19 booster vaccinations in specific situations.

23. **CV TAG noted that:**

    a) Data are still accumulating about whether early booster doses offer any advantages in protection against the Omicron variant.

    b) There are no long term data available about the safety of early booster doses but short term side effects appear to be modest.

    c) There is insufficient data on the safety profile for booster doses in pregnant people.

    d) Medsafe has authorised boosters only from six months after completion of the primary dose.

24. **CV TAG recommends that:**

    a) A Pfizer booster dose should be offered to adults 18 years or over, 5 months after the completion of the primary vaccination course.

b) Priority should be given to those at high risk of severe disease or exposure to SARS-CoV-2, including:

   i. those aged 65 years and over

   ii. those with comorbidities that put them at higher risk of severe COVID-19

   iii. Māori and Pacific peoples

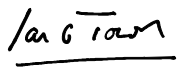
   iv. health care workers and workers in other settings at high-risk of SARS-CoV-2 exposure eg Border Workers and MIQ staff.

c) The COVID-19 Vaccine and Immunisation Programme (CVIP) of the Ministry of Health will need to work with Medsafe to manage access to boosters for the shorter 5-month interval.

d) Booster doses for 16- and 17-year-olds are not currently recommended (including for those working in settings that place them at higher risk of exposure to SARS-CoV-2), in line with the Medsafe authorisation of booster doses.

e) Boosters can be offered to pregnant people who completed their primary vaccination course more than 6 months prior. Those approaching the full-term of their pregnancy 6 months after completing their primary course can choose to receive their booster after the baby is born if preferred.

25. CV TAG will continue to monitor all relevant information (including vaccine efficacy data against emerging variants of concern and emerging evidence on the duration of immunity) and will update their recommendations as further evidence becomes available.



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Chair, CV TAG

References

1. Chemaitelly, H., et al., *Waning of BNT162b2 Vaccine Protection against SARS-CoV-2 Infection in Qatar*. New England Journal of Medicine, 2021.
2. Tartof, S.Y., et al., *Effectiveness of mRNA BNT162b2 COVID-19 vaccine up to 6 months in a large integrated health system in the USA: a retrospective cohort study*. The Lancet.
3. Goldberg, Y., et al., *Waning Immunity after the BNT162b2 Vaccine in Israel*. N Engl J Med, 2021.
4. Andrews, N., et al., *Vaccine effectiveness and duration of protection of Comirnaty, Vaxzevria and Spikevax against mild and severe COVID-19 in the UK*. medRxiv, 2021: p. 2021.09.15.21263583.
5. Eyre, D.W., et al., *The impact of SARS-CoV-2 vaccination on Alpha and Delta variant transmission*. medRxiv, 2021: p. 2021.09.28.21264260.
6. De Gier, B., et al., *COVID-19 vaccine effectiveness against hospitalizations and ICU admissions in the Netherlands, April- August 2021*. medRxiv, 2021: p. 2021.09.15.21263613.
7. Self, W.H., et al., *Comparative Effectiveness of Moderna, Pfizer-BioNTech, and Janssen (Johnson & Johnson) Vaccines in Preventing COVID-19 Hospitalizations Among Adults Without Immunocompromising Conditions - United States, March-August 2021*. MMWR Morb Mortal Wkly Rep, 2021. **70**(38): p. 1337-1343.
8. Nunes, B., et al. *mRNA vaccines effectiveness against COVID-19 hospitalizations and deaths in older adults: a cohort study based on data-linkage of national health registries in Portugal*. . 2021; Available from: https://www.medrxiv.org/content/10.1101/2021.08.27.21262731v1.full.pdf.
9. Pfizer. *BNT162b2, COMIRNATY (COVID-19 Vaccine, mRNA), Evaluation of a Booster Dose (Third Dose), VACCINES AND RELATED BIOLOGICAL PRODUCTS ADVISORY, COMMITTEE BRIEFING DOCUMENT, MEETING DATE: 17 September 2021*. 2021; Available from: https://www.fda.gov/media/152161/download.
10. Falsey, A.R., et al., *SARS-CoV-2 Neutralization with BNT162b2 Vaccine Dose 3*. N Engl J Med, 2021. **385**(17): p. 1627-1629.
11. Choi, A., et al., *Safety and immunogenicity of SARS-CoV-2 variant mRNA vaccine boosters in healthy adults: an interim analysis*. Nat Med, 2021.
12. Flaxman, A., et al., *Reactogenicity and immunogenicity after a late second dose or a third dose of ChAdOx1 nCoV-19 in the UK: a substudy of two randomised controlled trials (COV001 and COV002)*. Lancet, 2021. **398**(10304): p. 981-990.
13. Hause, A.M., et al., *Safety Monitoring of an Additional Dose of COVID-19 Vaccine - United States, August 12-September 19, 2021*. MMWR Morb Mortal Wkly Rep, 2021. **70**(39): p. 1379-1384.
14. Mofaz, M., et al. *Self-reported and physiological reactions to the third BNT162b2 mRNA COVID-19 (booster) vaccine dose*. 2021 [cited 30 Oct 2021; Available from: https://www.medrxiv.org/content/10.1101/2021.09.15.21263633v3.full.pdf.
15. Alroy-Preis, S. and R. Milo. *Booster protection against confirmed infections and severe disease - data from Israel*. 17th September 2021; Available from: https://www.fda.gov/media/152205/download.
16. Israeli Mnistry Of Health, et al. *Vaccines and Related Biological Products Advisory Committee October 14-15, 2021: Booster protection across ages - data from Israel*. 2021; Available from: https://www.fda.gov/media/153086/download.
17. Simone, A., et al., *Acute Myocarditis Following COVID-19 mRNA Vaccination in Adults Aged 18 Years or Older*. JAMA Internal Medicine, 2021.
18. Larson, K.F., et al., *Myocarditis after BNT162b2 and mRNA-1273 Vaccination*. Circulation, 2021. **0**(0).
19. Mevorach, D., et al., *Myocarditis after BNT162b2 mRNA Vaccine against Covid-19 in Israel*. New England Journal of Medicine, 2021.

20. Witberg, G., et al., *Myocarditis after Covid-19 Vaccination in a Large Health Care Organization.* New England Journal of Medicine, 2021.
21. Centers for Disease Control and Prevention (CDC). *Myocarditis and Pericarditis Following mRNA COVID-19 Vaccination*. 2021; Available from: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/myocarditis.html.
22. Public Health Ontario. *Myocarditis and Pericarditis Following Vaccination with COVID-19 mRNA Vaccines in Ontario: December 13, 2020 to August 7, 2021*. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/epi/covid-19-myocarditis-pericarditis-vaccines-epi.pdf?sc_lang=en.
23. Patalon, T., et al. *Short Term Reduction in the Odds of Testing Positive for SARS-CoV-2; a Comparison Between Two Doses and Three doses of the BNT162b2 Vaccine*. 2021; Available from: https://www.medrxiv.org/content/10.1101/2021.08.29.21262792v1.full.pdf.
24. Bar-On, Y.M., et al. *Protection Across Age Groups of BNT162b2 Vaccine Booster against Covid-19. medRxiv 2021:2021.10.07.21264626.* 2021; Available from: https://www.medrxiv.org/content/10.1101/2021.10.07.21264626v1.full.pdf.
25. Cele, S., et al. *SARS-CoV-2 Omicron has extensive but incomplete escape of Pfizer BNT162b2 elicited neutralization and requires ACE2 for infection*. 2021; Available from: https://www.ahri.org/wp-content/uploads/2021/12/MEDRXIV-2021-267417v1-Sigal.pdf.
26. Wilhelm, A., et al., *Reduced Neutralization of SARS-CoV-2 Omicron Variant by Vaccine Sera and monoclonal antibodies.* medRxiv, 2021: p. 2021.12.07.21267432.
27. Pfizer. *Pfizer And BioNTech Provide Update On Omicron Variant*. 08 December 2021; Available from: https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-provide-update-omicron-variant.
28. UK Health Security Agency. *SARS-CoV-2 variants of concern and variants under investigation in England Technical briefing 31*. 10 December 2021; Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1040076/Technical_Briefing_31.pdf.
29. Discovery Health. *Discovery Health, South Africa's largest private health insurance administrator, releases at-scale, real-world analysis of Omicron outbreak based on 211 000 COVID-19 test results in South Africa, including collaboration with the South Africa*. 14 Dec 2021; Available from: https://www.discovery.co.za/corporate/news-room.
30. Pulliam, J.R.C., et al., *Increased risk of SARS-CoV-2 reinfection associated with emergence of the Omicron variant in South Africa.* medRxiv, 2021: p. 2021.11.11.21266068.
31. The Royal Australian and New Zealand College of Obstetricians and Gynocologists (RANZCOG). *Statement on booster vaccinations*. 5 November 2021; Available from: https://ranzcog.edu.au/news/statement-on-booster-vaccinations.
32. Steyn, N., Binny, R. N., Hannah, K., Hendy, S. C., James, A., Lustig, A., Ridings, K., Plank, M. J., Sporle, A., *Māori and Pacific people in New Zealand have a higher risk of hospitalisation for COVID-19.* New Zealand Medical Journal, 2021. **134**(1538).
33. Pfizer. *PFIZER AND BIONTECH PROVIDE UPDATE ON OMICRON VARIANT*. 2021 09 Dec 2021]; Available from: https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-provide-update-omicron-variant.
34. Khoury, D.S., et al., *Neutralizing antibody levels are highly predictive of immune protection from symptomatic SARS-CoV-2 infection.* Nature Medicine, 2021. **27**(7): p. 1205-1211.
35. Cele S, e.a., *SARS-CoV-2 Omicron has extensive but incomplete escape of Pfizer BNT162b2 elicited neutralization and requires ACE2 for infection.* 2021.
36. Wilhelm, A., *Reduced Neutralization of SARS-CoV-2 Omicron Variant by Vaccine Sera and monoclonal antibodies.* 2021.
37. Sheward, D.e.a., *Preliminary Report - Early release, subject to modification. Quantification of the neutralization resistance of the Omicron Variant of Concern.* 2021.

Appendix 1

Priority groups for COVID-19 booster vaccinations: COVID-19 Vaccine Technical Advisory Group (CV TAG) recommendations

Memo dated 10 November 2021

Recommendations

26. CV TAG met on 2 and 9 November 2021 to consider recommendations regarding priority groups for COVID-19 booster vaccinations.

27. **CV TAG noted that:**

    a) Data are still accumulating about waning of protective vaccination effects after primary vaccination and the benefits of a booster dose.

    b) The goal of offering booster doses in New Zealand is to prevent severe disease caused by SARS-CoV-2, to reduce burden on hospitals and other healthcare providers, and to protect those at high occupational risk of exposure.

    c) The current situation in New Zealand is different to the situation at the start of vaccine roll-out (starting in late February 2021, priority groups listed in Appendix 1). There is now greater availability of Pfizer vaccine and effective infrastructure for administering the vaccine, but there is also a higher risk of healthcare workers being exposed to SARS-CoV-2 with the virus now in the community in New Zealand, especially in Auckland.

    d) There is limited data on the safety profile for booster doses in people younger than 30 years of age from the published trials. Concern was noted around vaccine mandates requiring booster doses in this age group before further data are available

    e) There is insufficient data on the safety profile for booster doses in pregnant people.

    f) Māori and Pacific People are at an increased risk of severe disease and hospitalisation,[32] and therefore having a universal age-criteria for prioritisation is inequitable. A lower age band for Māori and Pacific People would be needed to provide equitable protection.

    g) It is now approximately 8 months since the first doses of COVID-19 vaccine were administered in New Zealand.

28. **CV TAG recommends that:**

    a) Increasing the vaccination coverage of first and second doses, particularly for Māori and Pacific People, should remain the first priority of the COVID-19 vaccination programme in New Zealand.

    b) The Pfizer vaccine is recommended as a single booster dose.

    c) COVID-19 vaccine booster doses should be offered to those 18 years of age and older, who have completed their full primary vaccination course 6 or more months prior.

    d) Those aged over 18 who are immunocompromised and have received a third primary dose of a COVID-19 vaccine as described in previous CV TAG recommendations, should

only receive a booster dose 6 months after completion of their primary course (i.e., 6 months after their third dose).

e) Any future vaccine mandates should not require booster doses in younger age groups (<30 years) until further data are available.

f) When considering prioritisation, priority groups for a booster dose (at least 6 months after completion of the primary course) are those most at risk of exposure to SARS-CoV-2, and those most at risk from serious COVID-19 disease. In particular, these are:

   i. Frontline healthcare workers, particularly in regions where there is COVID-19 in the community (or regions that are at high risk of further spread of COVID-19),

   ii. All those who are aged 65 years or over,

   iii. Māori and Pacific People aged 50 years and over,

   iv. Anyone over the age of 18 with comorbidities, as specified in Group 3 listed below, with the exception of pregnant people, who completed a full primary course of vaccination in early pregnancy.

g) AstraZeneca can also be used as a booster dose if available for specific situations including if an individual has had a significant adverse reaction after a previous Pfizer vaccine dose (e.g., anaphylaxis, myocarditis), and if AstraZeneca is not contraindicated.

29. CV TAG will continue to monitor all relevant information (including vaccine efficacy data against emerging variants of concern and emerging evidence on the duration of immunity) and will update their recommendations as further evidence becomes available.

Groups for initial vaccine rollout (for reference)

Group 1

Group 1 includes people working at the border or in MIQ, and the people they live with (household contacts).

Group 2

The Government is expanding the list of Alert Level 4 workers who can get early access to a COVID-19 vaccination. These people will be included in Group 2.

Group 2 will now also include frontline staff who interact with customers and transport and logistic services directly supporting the vaccination programme.

You are also in Group 2 if you:

- are a high-risk frontline healthcare worker (public or private)
- work in a long-term residential environment
- live in long-term residential care and are 12 or over
- are an older Māori or Pacific person being cared for by whānau
- live with or care for an older Māori or Pacific person
- live in the Counties Manukau DHB area and are 65 or over, have an underlying health condition or disability, are pregnant, or are in a custodial setting.

Group 3

People who are at risk of getting very sick from COVID-19. You are in this group if you:

- are aged 65 or over
- are eligible for a publicly funded influenza vaccine
- are pregnant
- are disabled, or are caring for a person with a disability
- are severely obese (defined as a BMI ≥40)
- have high blood pressure requiring 2 or more medications for control
- are an adult in a custodial setting
- have been diagnosed with a severe mental illness (which includes schizophrenia, major depressive disorder, bipolar disorder or schizoaffective disorder, and adults currently accessing secondary and tertiary mental health and addiction services).

Group 4

Everyone aged 12 and over

Appendix 2

Effectiveness of Booster doses of Pfizer Vaccine against Omicron variant

Date:	09 December 2021
To:	Ashley Bloomfield, Director General, Ministry of Health
Copy to:	Ian Town, Chief Science Advisor, Ministry of Health
From:	Fiona Callaghan, Lead Science Advisor, Ministry of Health Jeremy Tuohy, Principal Advisor, Ministry of Health
For your:	Information

Purpose of report

1. This report provides a rapid update about the effect of booster doses on the vaccine efficacy of the Pfizer BioNTech COVID-19 vaccine against the Omicron variant.

Background and context

2. The Omicron variant contains multiple mutations in coding for the spike protein which may result in decreased vaccine efficacy.
3. Rapid analysis of *in vitro* immunology studies has been undertaken by Pfizer BioNTech.

Results

4. Pfizer has reported that based on a series of in-vitro antibody neutralisation studies, the third 'booster' shot , or previous infection plus vaccination would be predicted to offer good levels of protection against Omicron.[33]
5. Similar levels of antibody neutralisation were achieved in the lab for Delta and Omicron after 3 doses (Figure 1). As has been demonstrated in several clinical and 'real-world' studies, the Pfizer vaccine offers good clinical protection against Delta (mild and severe disease). The antibody neutralisation data are a good early indication that a third dose of Pfizer may offer similar protection against Omicron. It should be noted that data is available as a media release only, and not in a peer-reviewed publication, as of 09 December 2021.
6. In addition, as with all laboratory studies, it remains to be seen how this will translate into clinical protection and vaccine effectiveness. However, strong laboratory data is promising and there is evidence that neutralising antibody data does correlate with protection from symptomatic disease [34].

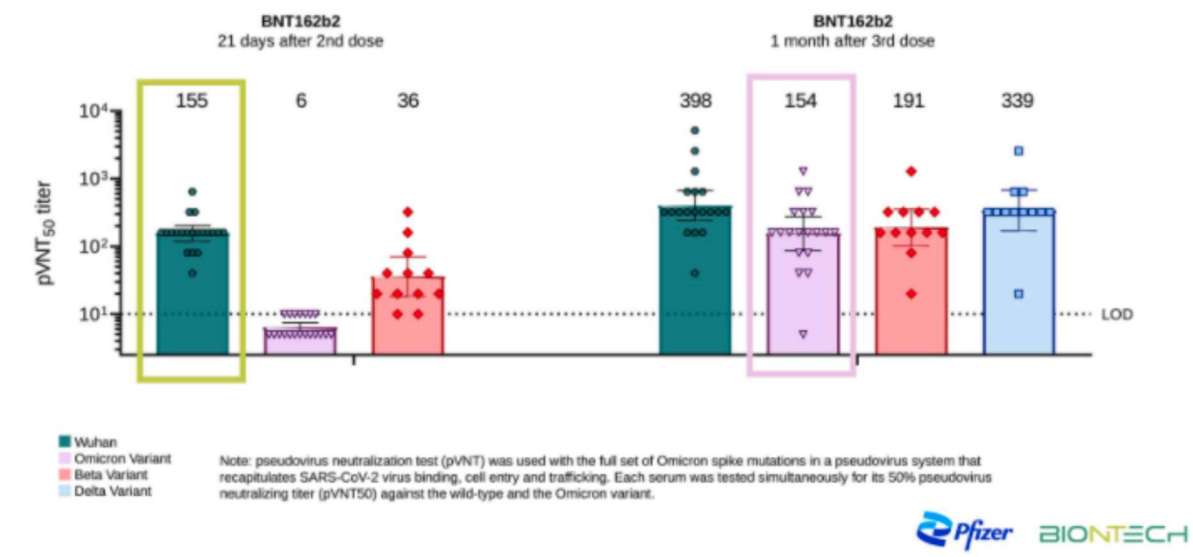

Figure 2 The neutralisation after 2 and 3 doses of Pfizer, of the early 'Wuhan' strain (green); Omicron (purple); the variant that had previously demonstrated the greatest degree of immune escape, Beta (red); and Delta (blue). Omicron shows substantial reduction in neutralisation after 2 doses compared to Beta and Wuhan; however, Omicron has similar neutralisation to other variants after 3 doses.

7. In addition to neutralising antibodies, Pfizer also considered how another arm of the immune response, the cellular response (memory T-cells), performed against Omicron. T-cell responses appeared to be largely unaffected by Omicron.

8. Pfizer also presented neutralisation data on the 'variant-specific' vaccines that they have been developing to date. The lab data for the Pfizer 'Alpha'- and 'Delta'-specific vaccines suggests that those vaccines could offer even better protection against Omicron, because they are able to neutralise Omicron more effectively than the original Pfizer vaccine.

9. In addition, there have been three other preliminary neutralisation studies that have were reported on 08 and 09 December 2021. [35-37]

10. A Swedish study of sera from healthcare workers and blood donors, all of whom had had previous infection, found that the neutralisation of the Omicron variant by Pfizer sera was similar to Delta (both in people with prior infection and as a result of vaccination).[37] Vaccination plus prior infection provided the greatest benefit.

11. Studies from South Africa and Germany found similar results: there was a substantial reduction in neutralisation by Pfizer with Omicron compared to an earlier strain and Delta, but potentially greater protection for people who were vaccinated and had prior infection.[35, 36]

Disease Severity

12. With respect to disease severity for Omicron, there is currently no evidence that the Omicron variant causes more severe disease. Evidence on disease severity takes time to emerge.

13. The media has reported on the "stealth Omicron variant", which is a variant (sub-lineage) that is missing one of the mutations usually found on Omicron, which gives a different

result with some diagnostic tests. This does not have any practical significance for the testing undertaken in New Zealand as all positive COVID-19 samples will be analysed using whole genome sequencing (see https://www.theguardian.com/world/2021/dec/07/scientists-find-stealth-version-of-omicron-not-identifiable-with-pcr-test-covid-variant)

Comment

14. This emerging data is reassuring for our COVID-19 vaccine programme, and potentially highlights the importance of the booster rollout.

15. The potential vaccine efficacy of Pfizer against Omicron will be discussed at CV TAG on 14 December 2021.

16. It should be emphasised that the data is preliminary, and all studies are based on small sample sizes. This data needs to be confirmed by larger, peer-reviewed, clinical or real-world studies in order to determine the impact on clinical outcomes.

References

(see reference list, above)