

Table 3. Summary of results of bivalent and multivalent vaccine studies using neutralisation assay

Vaccine target	Vaccine regimen	Population	Test target	Result ^a	Reference
Delta-Omicron bivalent	2-dose primary series taken 2 weeks apart	Mice	Ancestral	Neutralising	70
			Beta	Neutralising	
			Delta	Neutralising	
			Omicron	Neutralising	
Ancestral-Omicron bivalent	Three doses of the same vaccine in 2-week intervals	Mice	Ancestral	Neutralising	73
			Alpha	Neutralising	
			Beta	Neutralising	
			Gamma	Neutralising	
			Delta	Neutralising	
			BA.1	Neutralising	
BA.2	Neutralising				
Ancestral-Omicron bivalent	Second booster taken ~134–136 days (median) since first booster, 2-dose primary series and first booster are all mRNA-1273	Humans (Excludes those with SARS-CoV-2 infection within 3 months)	Ancestral	Non-inferior boosting to mRNA-1273 booster	76 COVE (NCT04927065)
			Alpha	Significantly higher boosting to mRNA-1273 booster	
			Beta	Significantly higher boosting to mRNA-1273 booster	
			Gamma	Significantly higher boosting to mRNA-1273 booster	
			Delta	Significantly higher boosting to mRNA-1273 booster	
			BA.1	Superior boosting to mRNA-1273 booster	
BA.4/BA.5	Successfully boosted				
Ancestral-Beta bivalent	First booster taken ~8.8–9.8 months since 2-dose primary mRNA-1273 series	Humans (Excludes those with prior SARS-CoV-2 infection)	Ancestral	Superior boosting to mRNA-1273 booster	77 COVE (NCT04927065)
			Beta	Superior boosting to mRNA-1273 booster	
			Delta	Superior boosting to mRNA-1273 booster	
Ancestral	2-dose primary series taken 3 weeks apart	Mice	Ancestral	Neutralising	74
			Beta	Low neutralisation	
			Delta	Neutralising	

Table 3. Summary of results of bivalent and multivalent vaccine studies using neutralisation assay (Cont'd)

Vaccine target	Vaccine regimen	Population	Test target	Result ^a	Reference
Ancestral-Delta bivalent			Ancestral	Neutralising	
			Beta	Neutralising	
			Delta	Neutralising	
			BA.1	Low neutralisation	
Ancestral-Beta-Delta trivalent			Ancestral	Neutralising	
			Beta	Neutralising	
			Delta	Neutralising	
Ancestral-BA.1 bivalent			Ancestral	Neutralising	
			Beta	Neutralising	
			Delta	Neutralising	
			BA.1	Neutralising	
Ancestral-Delta-BA.1 trivalent			Ancestral	Neutralising	
			Beta	Neutralising	
			Delta	Neutralising	
			BA.1	Neutralising	
Ancestral-Beta-Delta-BA.1 tetravalent			Ancestral	Neutralising	
			Beta	Neutralising	
			Delta	Neutralising	
			BA.1	Neutralising	
Ancestral	2-dose primary series taken 3 weeks apart	Mice	Ancestral	Neutralising	75
			Beta	Low neutralisation	
			Delta	Neutralising	
			Omicron	Failed to neutralise	
Delta			Ancestral	Low neutralisation	
			Beta	Low neutralisation	
			Delta	Neutralising	
			Omicron	Low neutralisation	
Ancestral-Delta bivalent			Ancestral	Neutralising	
			Beta	Low neutralisation	
			Delta	Neutralising	
Ancestral-Beta-Delta trivalent			Ancestral	Neutralising	
			Beta	Low neutralisation	
			Omicron	Low neutralisation	

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Vaccine target	Vaccine regimen	Population	Test target	Result ^a	Reference
			Beta	Neutralising	
			Delta	Neutralising	
			Omicron	Neutralising	
Ancestral-Beta-Gamma-Delta tetravalent			Ancestral	Neutralising	
			Beta	Neutralising	
			Delta	Neutralising	
			Omicron	Neutralising	
Ancestral-BA.1 bivalent	2-dose primary series taken 3 weeks apart	Mice	Ancestral	Neutralising	⁷⁸
			Beta	Neutralising	
			Delta	Neutralising	
			BA.1	Neutralising	
			BA.4/5	Neutralising	
Ancestral-BA.1 bivalent	First booster taken 1 month since 2-dose primary BNT162b2		Ancestral	Successfully boosted	
			BA.1	Less boosting compared to ancestral target	
			BA.4/5	Less boosting compared to BA.1 target	
Ancestral	Second booster taken ~6.3 months (median) since first booster, 2-dose primary series and first booster are all BNT162b2	Humans	BA.1	Successfully boosted	
			BA.4/5	Less boosting compared to BA.1 target	
Ancestral-BA.1 bivalent			BA.1	Superior boosting to BNT162b2 booster	
			BA.4/5	Less boosting compared to BA.1 target	
Ancestral-BA.4/5 bivalent	First booster taken 104 days since 2-dose primary BNT162b2	Mice	Ancestral	Successfully boosted	
			BA.1	Successfully boosted	
			BA.2	Successfully boosted	
			BA.2.12.1	Successfully boosted	
			BA.4/5	Successfully boosted	

^a Neutralisation levels refer to ID₅₀ values against target variant. Boosting levels mean neutralisation levels to target variant were compared before and after boosting. If another vaccine is mentioned, it means that vaccine was used as a comparator. Superiority and non-inferiority mentioned here refers to pre-specified analysis as part of a clinical trial.

Superscript reference numbers: Refer to REFERENCES