At Least Three Doses of Leading Vaccines Essential for Neutralisation of SARS-CoV-2 Omicron Variant

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COVID-19
WHO meeting on COVID-19 Vaccines Research

World Health Organization

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Medical Research Future Fund

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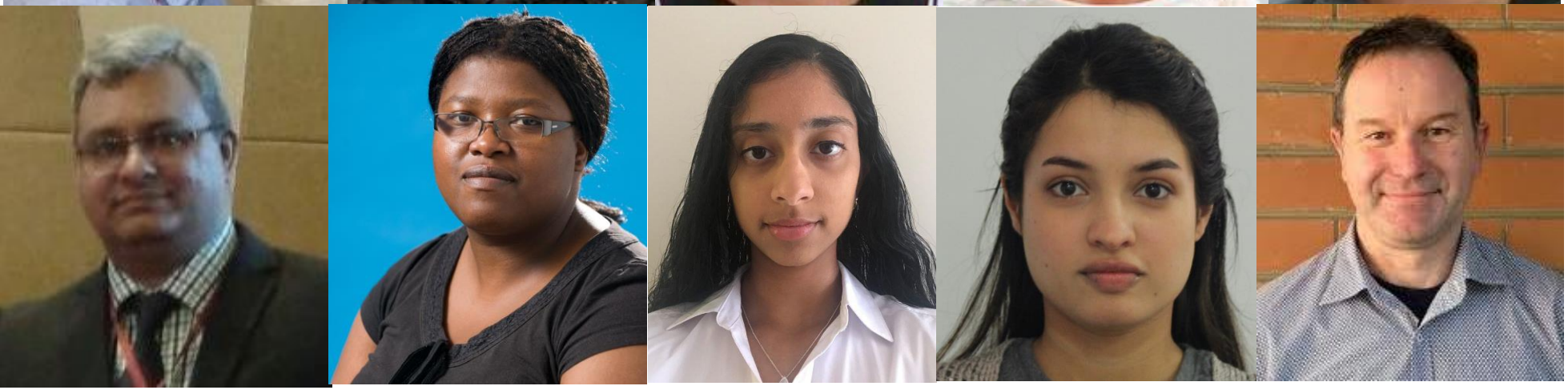
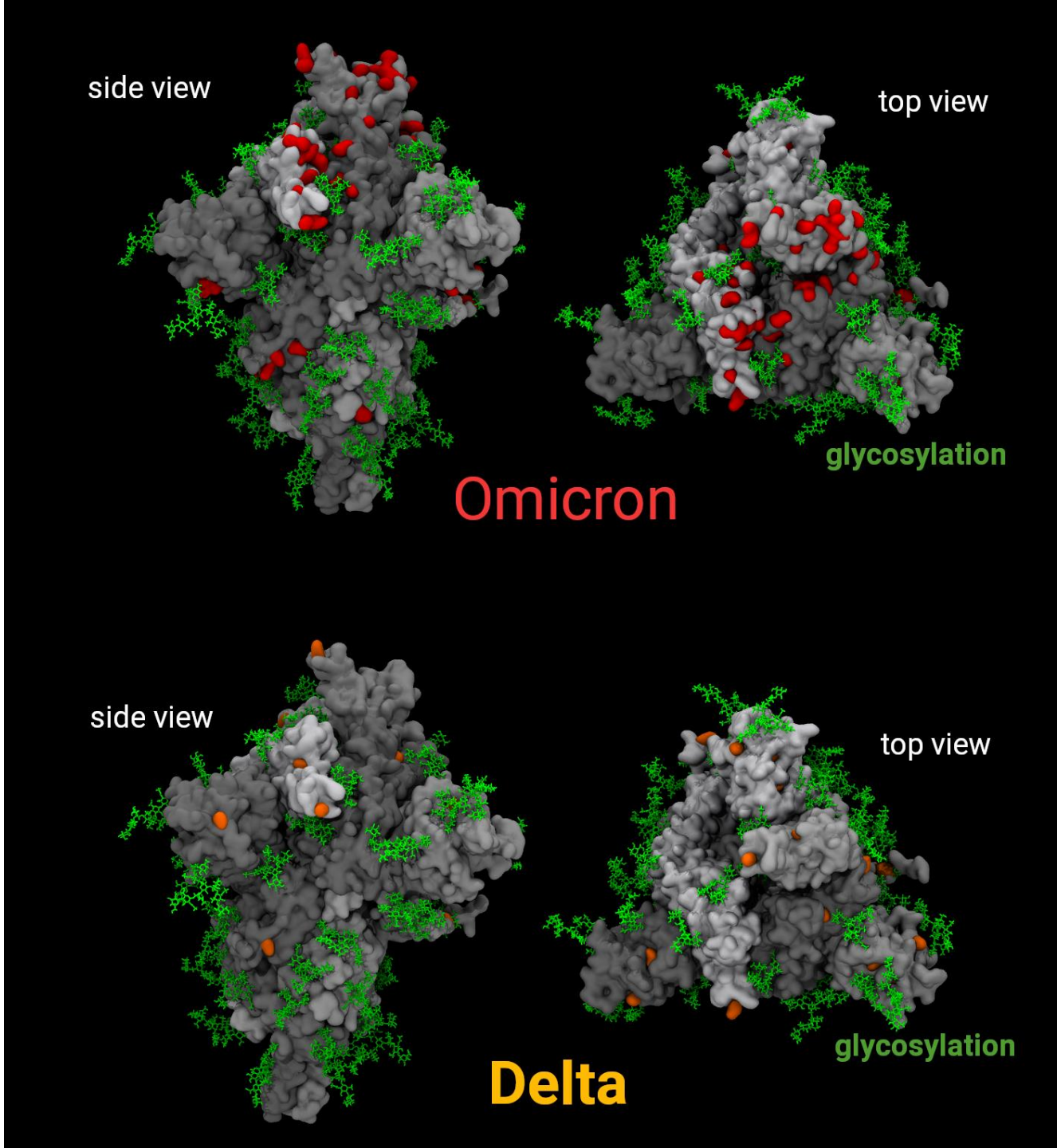
- Doherty Institute
  - Dept of Microbiology and Immunology
  - Victorian Infectious Diseases Reference Laboratory (VIDRL)

- CSIRO
  - Australian Centre for Disease Preparedness (ACDP) PC4/BSL4 Team
  - Dr Nagendra Singanallur and Dr StellaMay Gwini (Barwon Health) for study design and biostatistics, and Dr Michael Kuiper (Data61) for biomolecular modelling
  - Shruthi, Simran and all collaborators



Omicron vs Delta VOCs



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Study overview – participants

		AstraZeneca	Moderna	Pfizer
Donors		n=6	n=12	n=15
Sex	Male	n=3	n=6	n=5
	Female	n=3	n=6	n=10
Age Median (Range)	Male	58 (57-65)	41.5 (29-70)	31 (29-35)
	Female	57 (31-59)	38.5 (27-47)	33.5 (25-57)
Samples Used	Pre-bleed (Baseline)	n=6 (3M, 3F)	n=12 (6M, 6F)	n=15 (5M, 10F)
	2 weeks Post-2nd Dose	n=6 (3M, 3F)	n=12 (6M, 6F)	n=15 (5M, 10F)
	6 months Post-2nd Dose			n=15 (5M, 10F)
	2 weeks Post-3rd Dose			n=6 (3M, 3F)

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Study overview – fold changes

VIC31 Titre Comparison	AstraZeneca	Moderna	Pfizer
AstraZeneca		7.0-fold higher	7.2-fold higher
Moderna	7.0-fold lower		1.0-fold higher
Pfizer	7.2-fold lower	1.0-fold lower	

Pfizer Timepoint Comparison (VIC31)	6mo Post-2nd Dose	2w Post-3rd Dose
2 weeks Post-2nd Dose	8.2-fold lower	3.2-fold higher
6 months Post-2nd Dose		25.9-fold higher

Pfizer Timepoint Comparison (Delta)	6mo Post-2nd Dose	2w Post-3rd Dose
2 weeks Post-2nd Dose	8.3-fold lower	4.5-fold higher
6 months Post-2nd Dose		37.5-fold higher

Explore role of T cell immunity (in progress)

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Study overview – statistics

- All analysis performed using R (R Core Team, 2019)
- Variables were declared as follows:
  - Vaccines (Pfizer; Moderna; AstraZeneca)
  - Gender (Male; Female)
  - Age (<35 – Young; 35-60 – Middle; >60 – Senior)
  - Day post-vaccination (Baseline – 0 dpv; 2 weeks post 2nd dose; 6 months post 2nd dose; and with Pfizer alone 2 weeks post 3rd dose
  - Variant (VIC31; Delta; Omicron BA.1.1)
- One way ANOVA performed to compare different variables: vaccines, gender, age, and variants. Post hoc done using Bonferroni correction to obtain adjusted 'p-values' for significant groups.
- Two way ANOVA performed to compare interactions between variables. Post hoc done using Tukey's HSD to obtain adjusted 'p values' for significant groups.
- Linear mixed models with effects were constructed in R using 'lme' library with forward selection of modes using lowest AIC values. AIC=Akaike Information Criterion.
- Codes for statistical significance: <0.001 '***'; 0.01 '**'; 0.05 '*'; 0.1 '.'; 'NS ' >0.05

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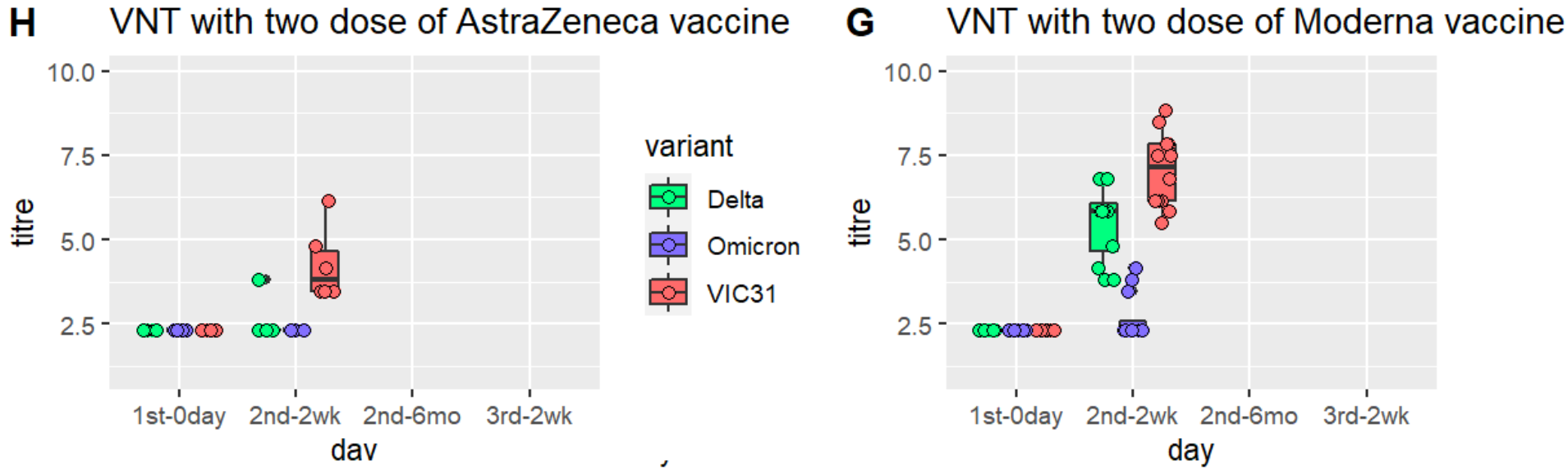
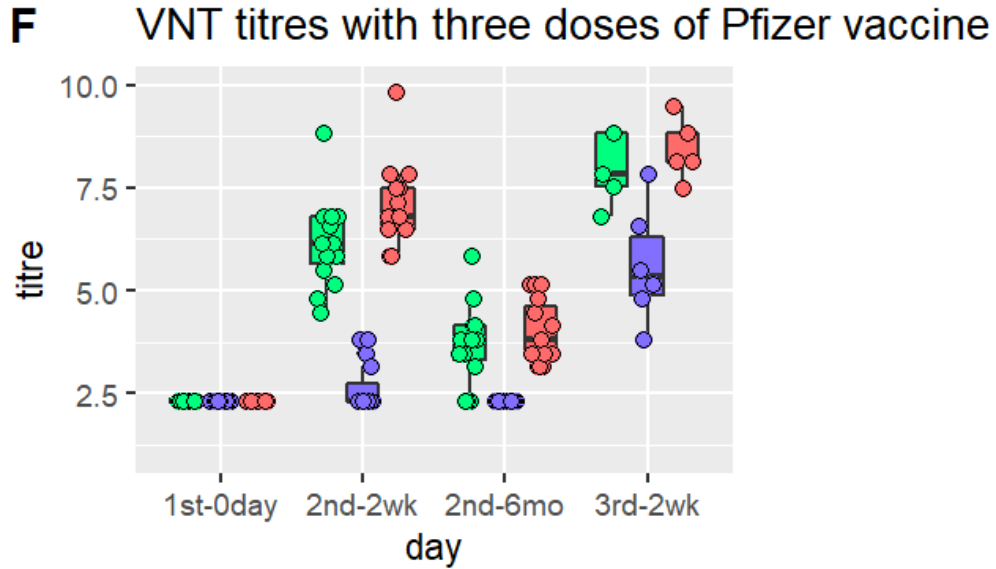
Comparison of VNT titres in human subjects





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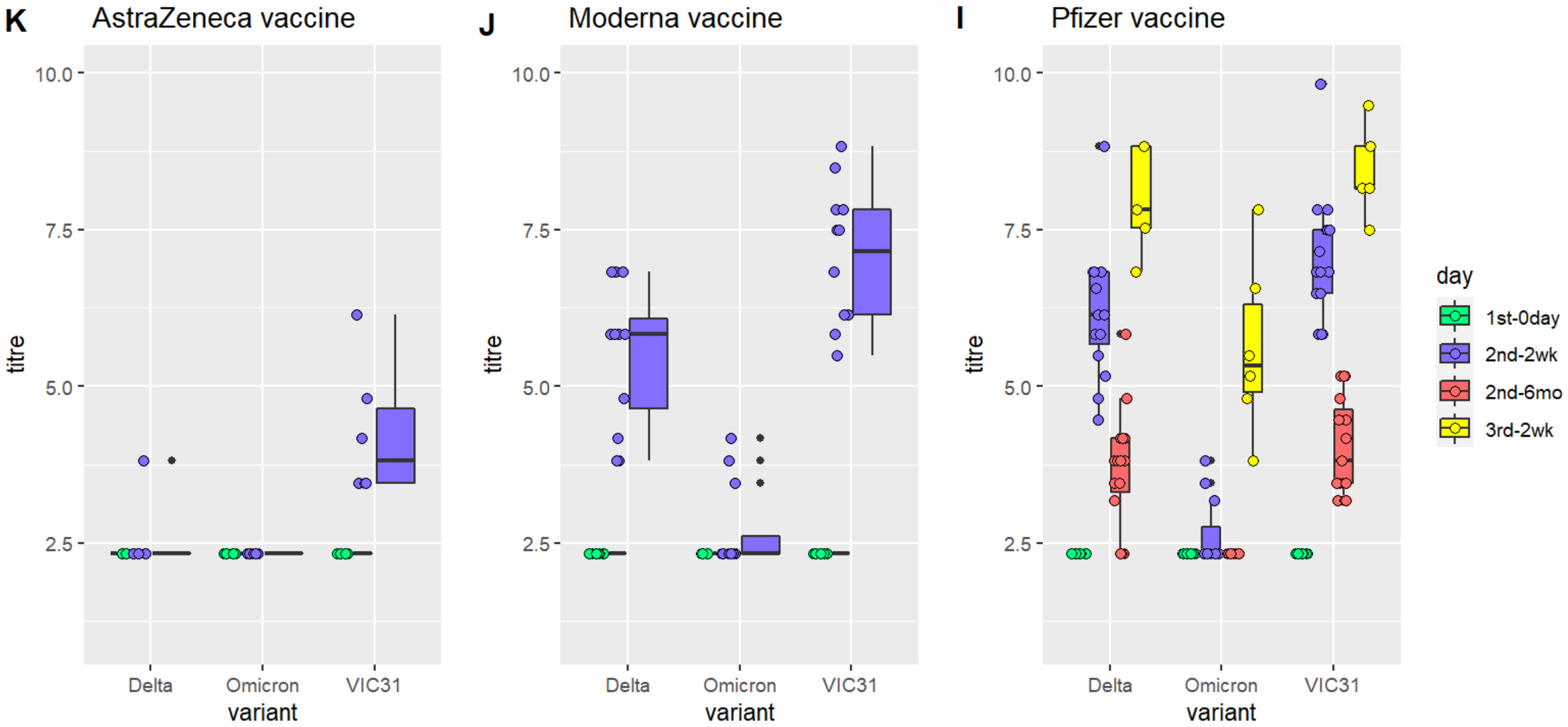
Comparison of VNT titres in human subjects



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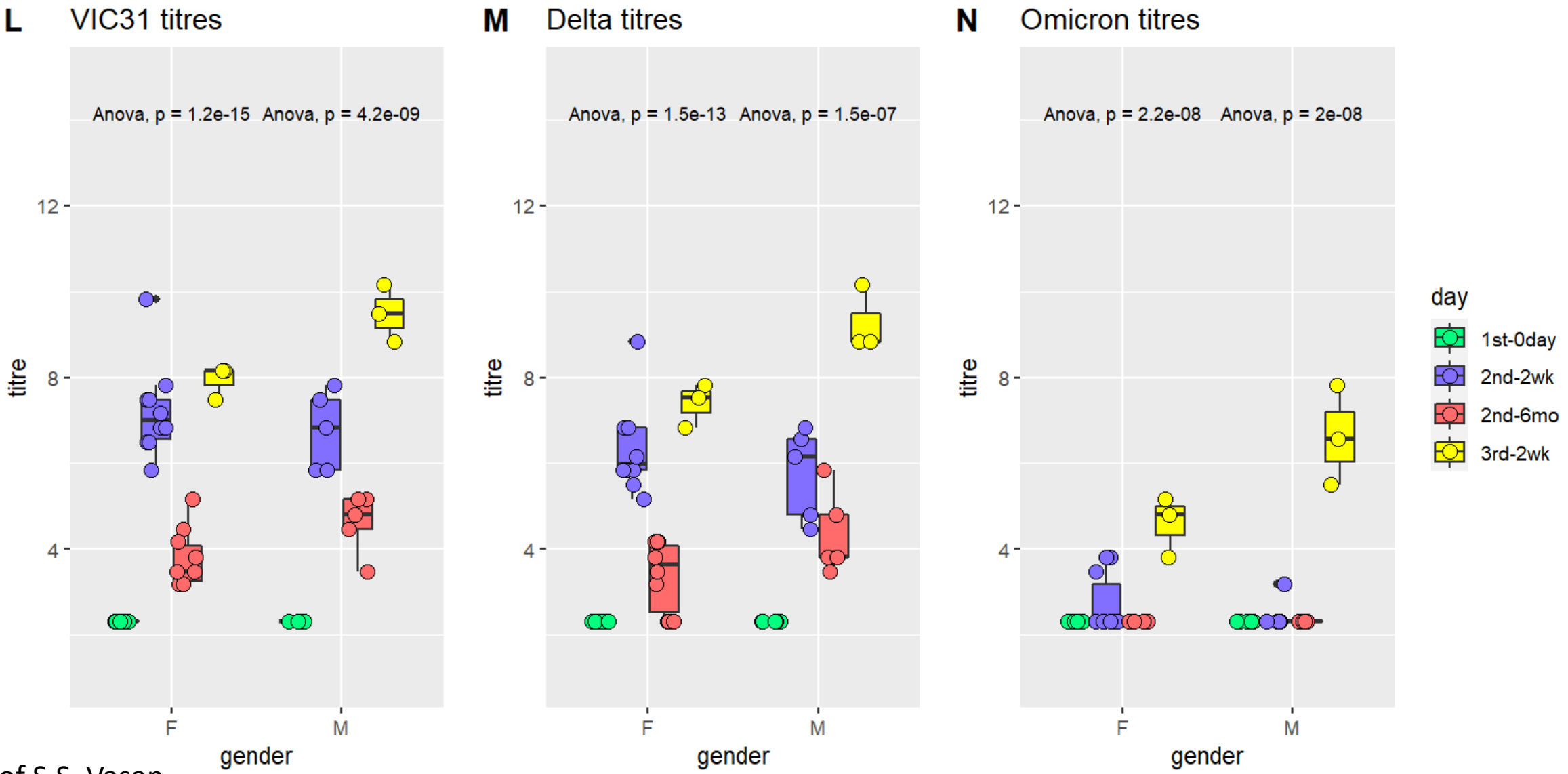
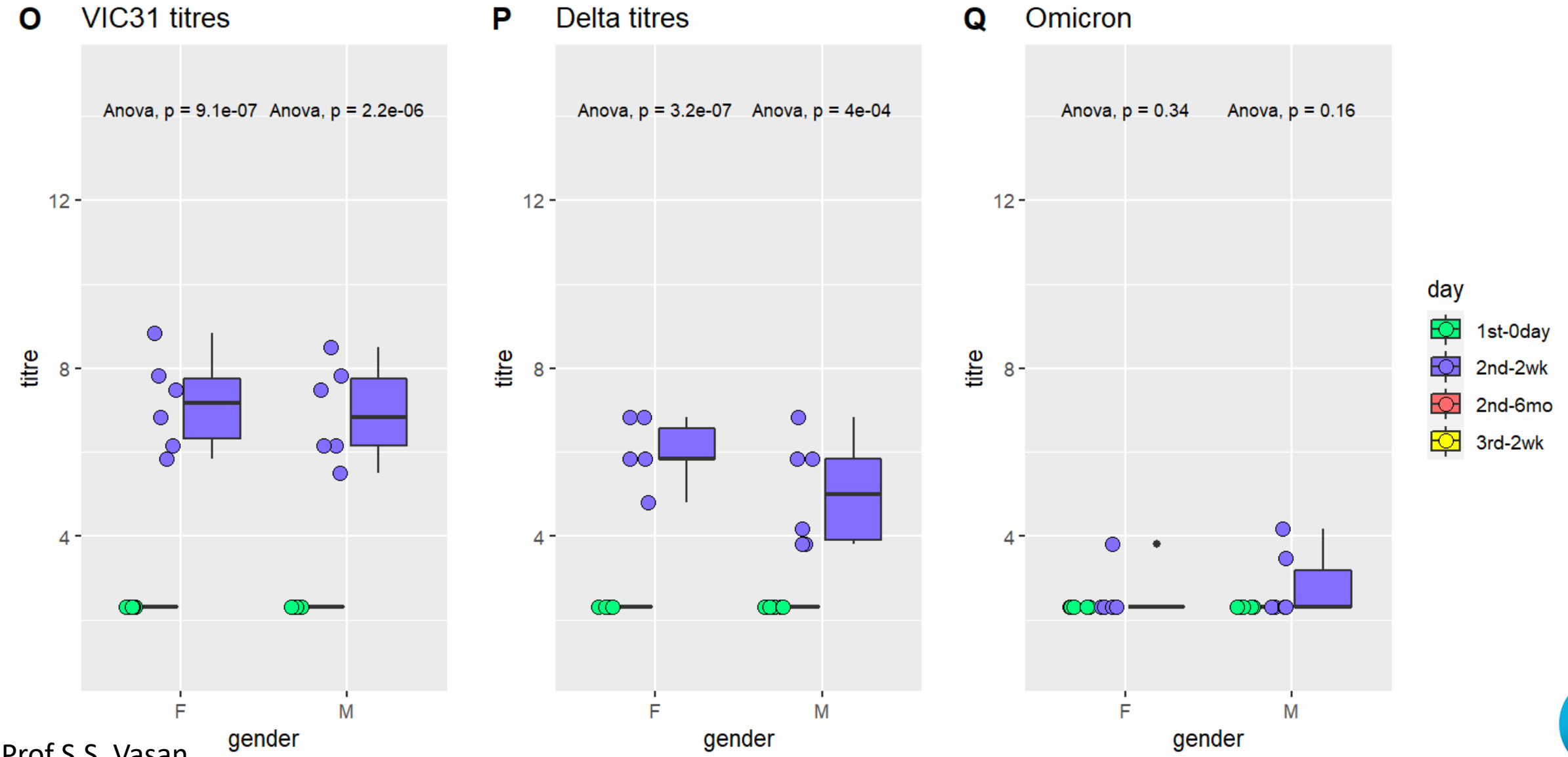
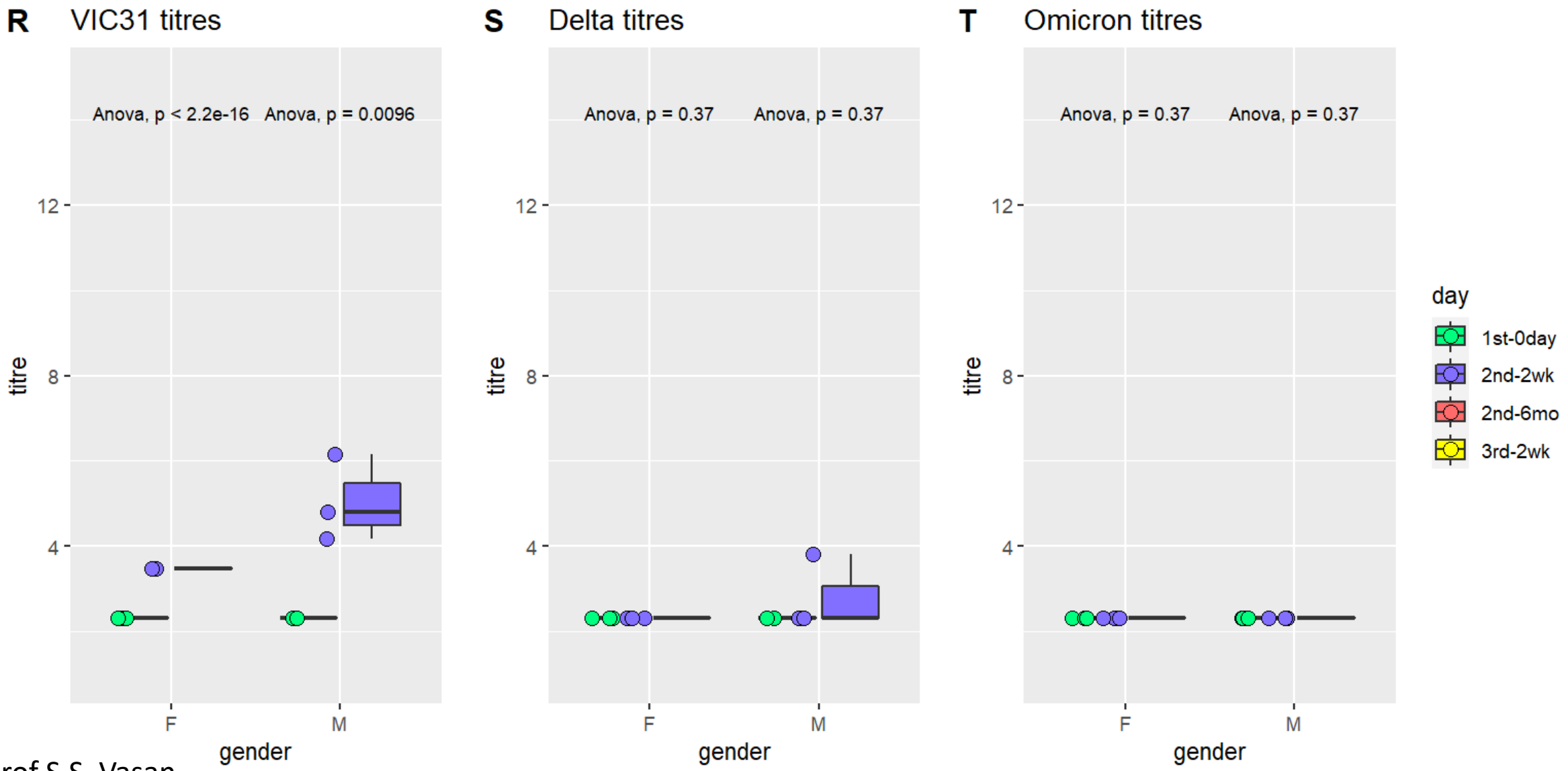
Comparison of VNT titres by gender - Pfizer



Comparison of VNT titres by gender - Moderna



Comparison of VNT titres by gender - AstraZeneca



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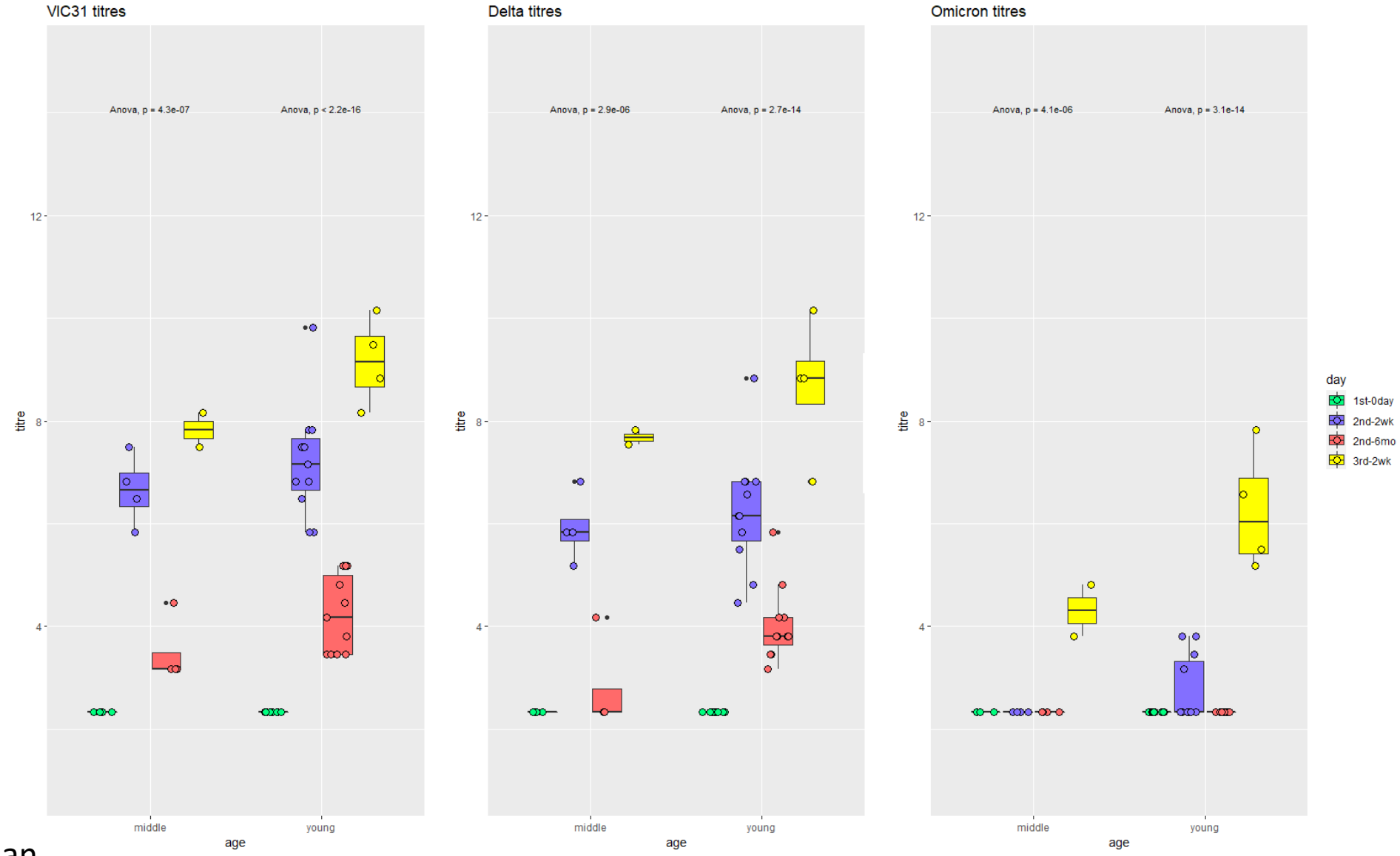
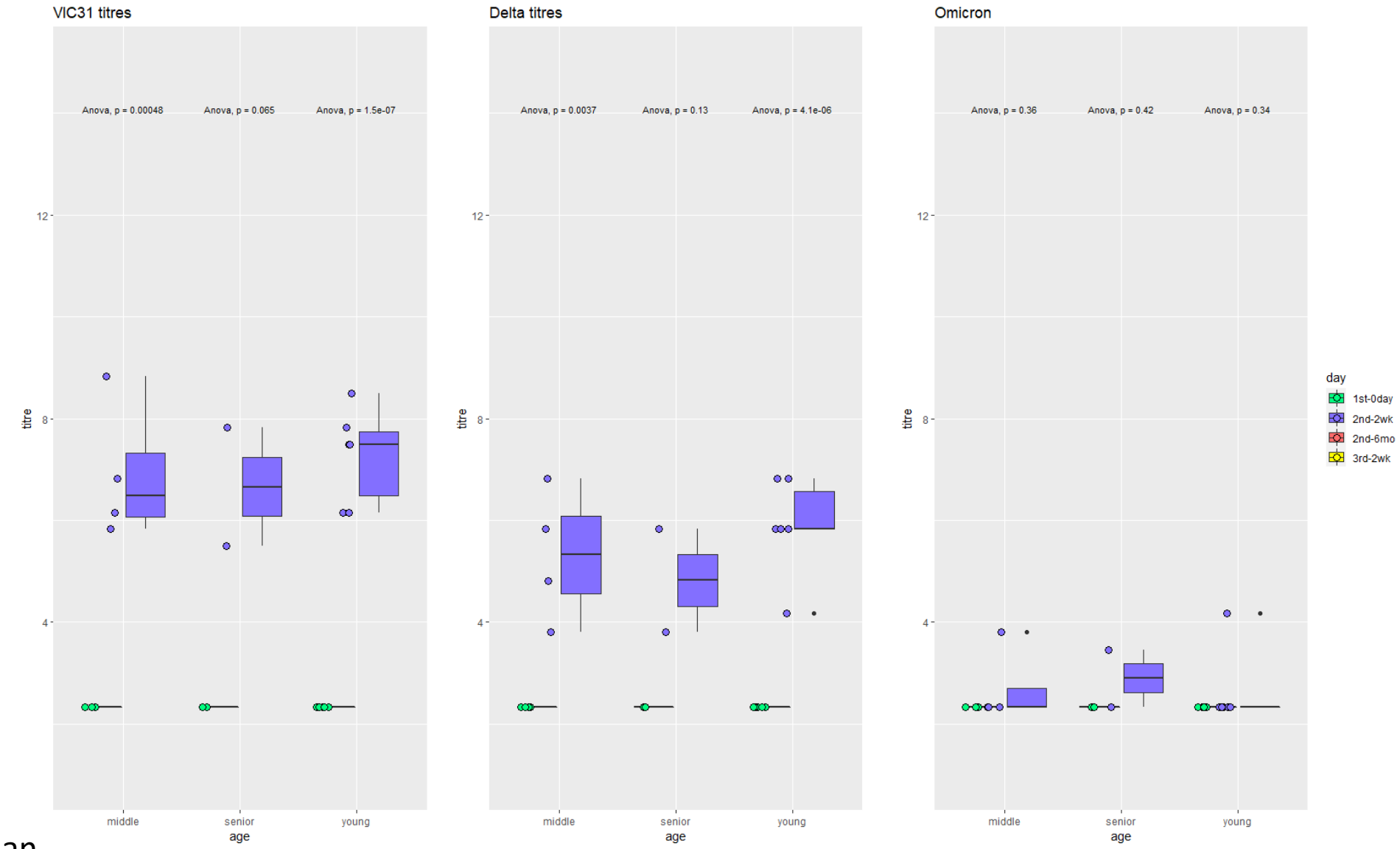
Comparison of VNT titres by age - Pfizer



Comparison of VNT titres by age - Moderna



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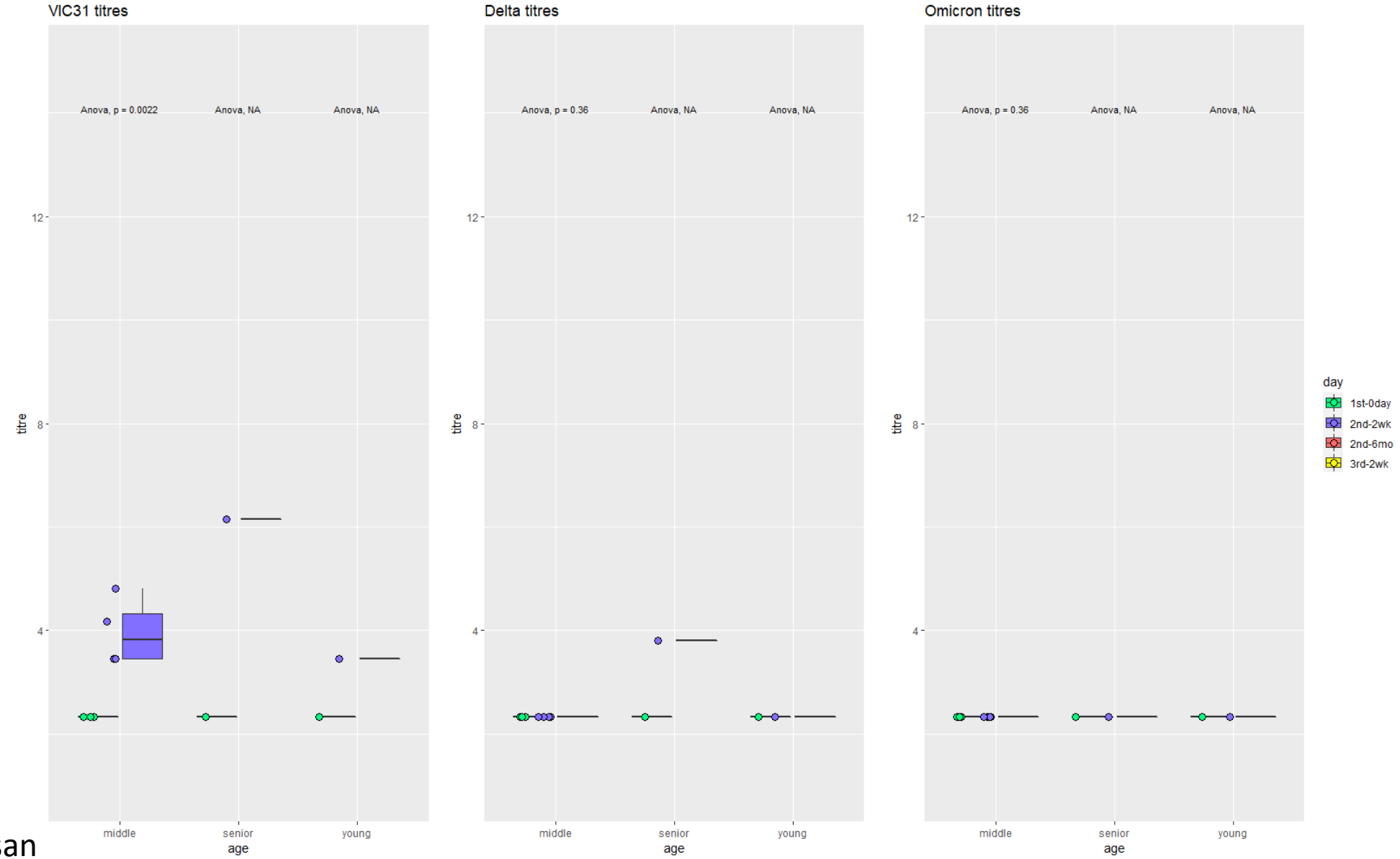
Comparison of VNT titres by age - AstraZeneca



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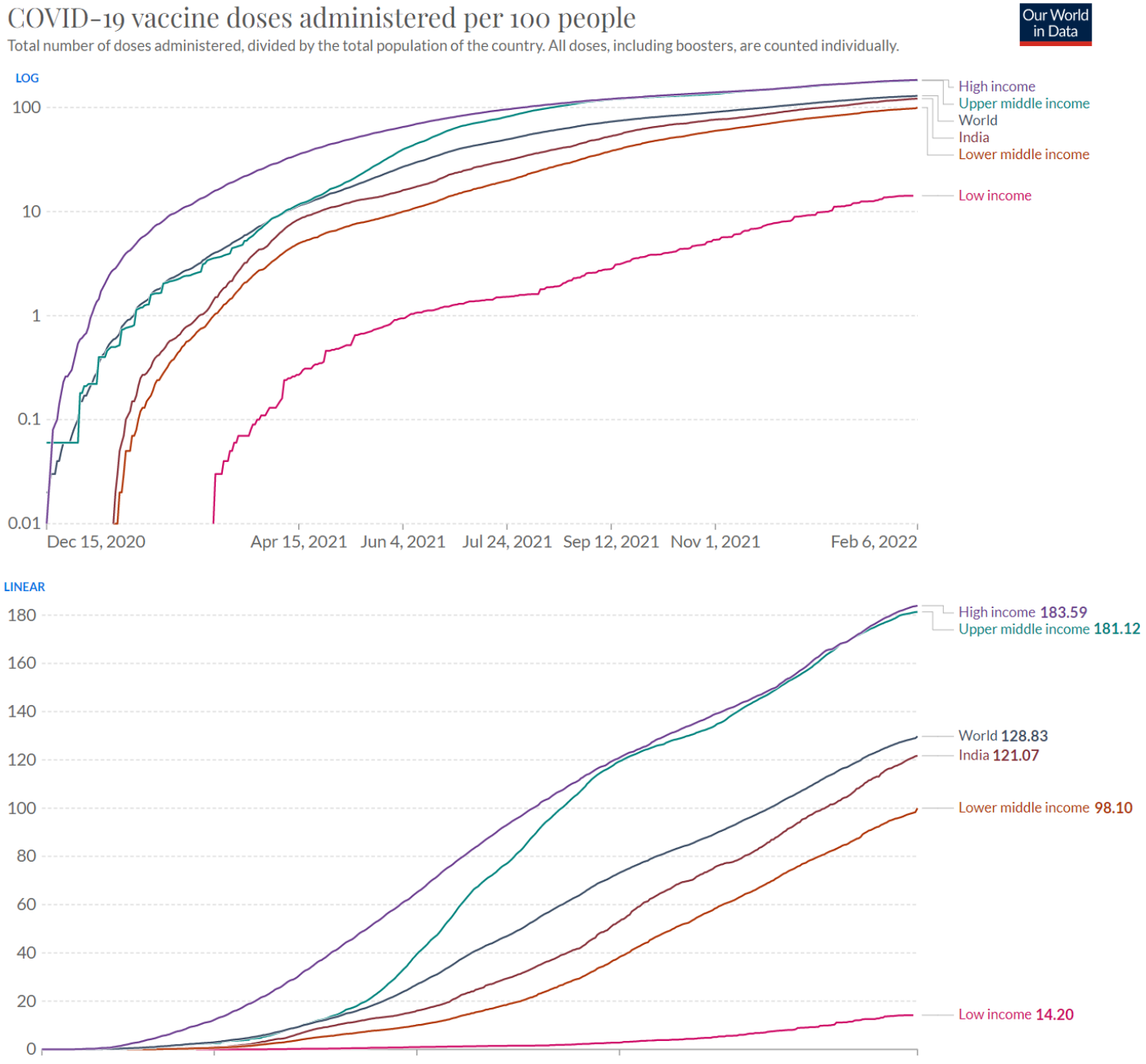
Implications for vaccine equity

UNIVERSITY of York



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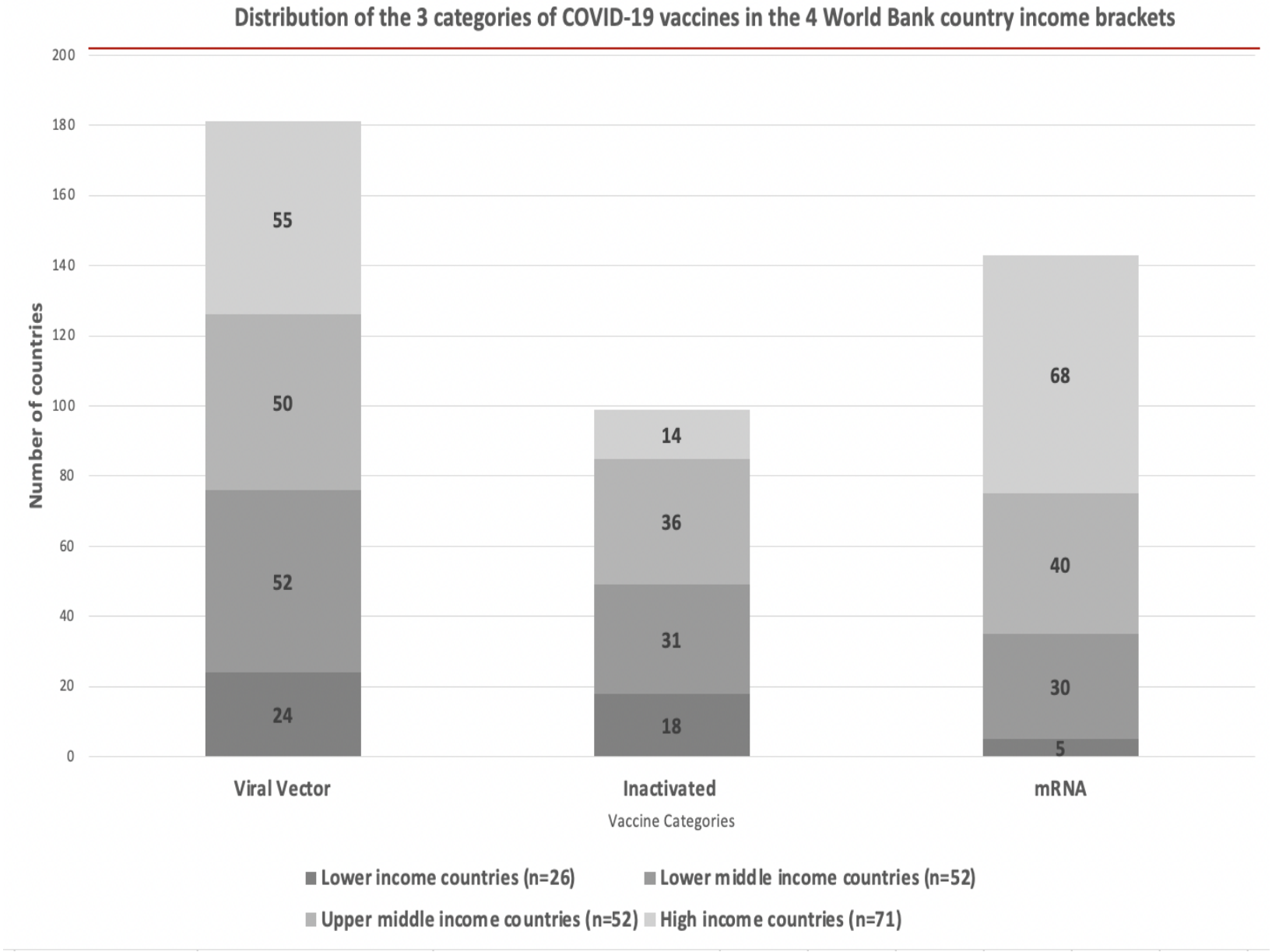
Implications for vaccine equity



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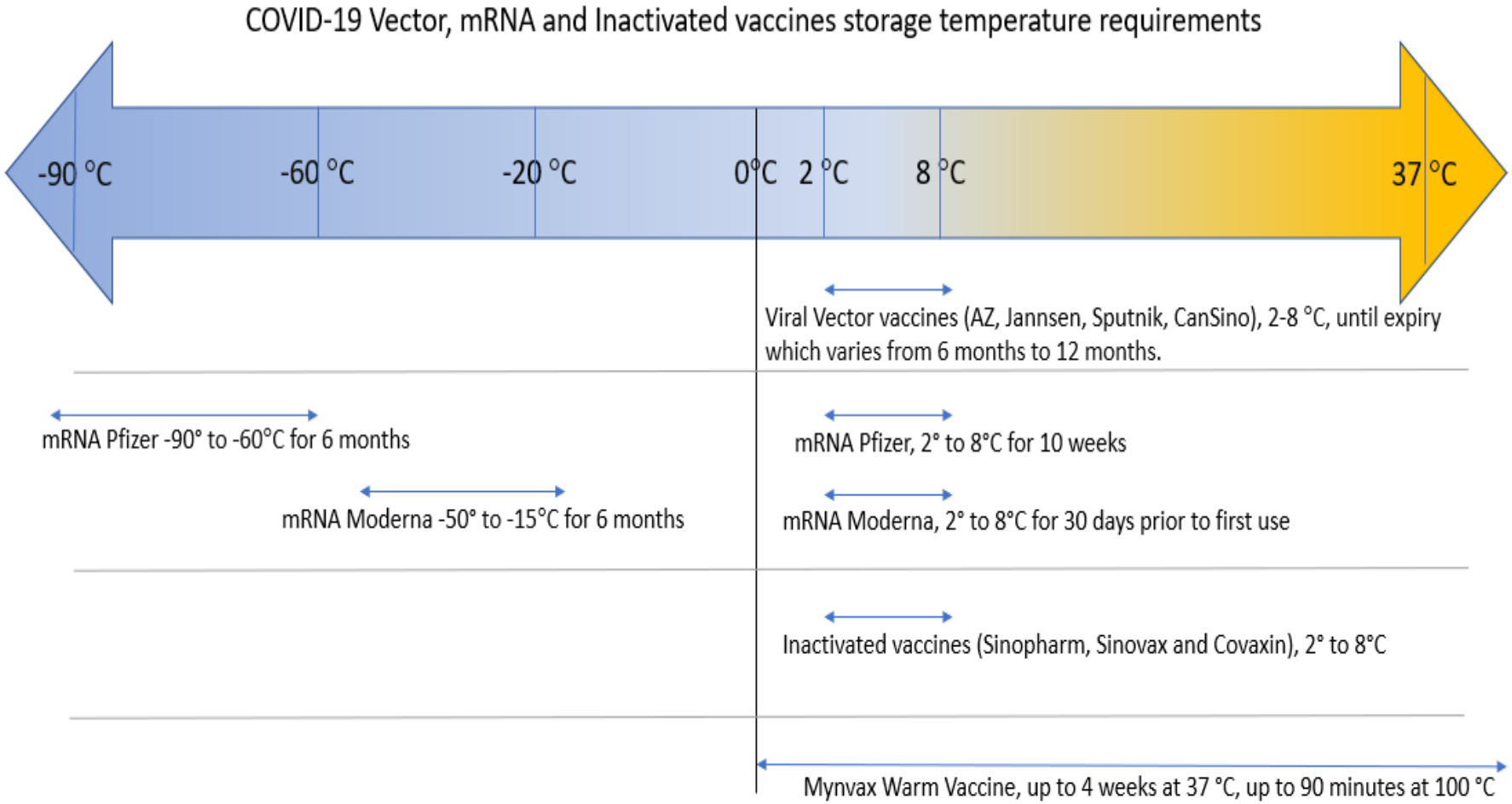
Warm vaccines



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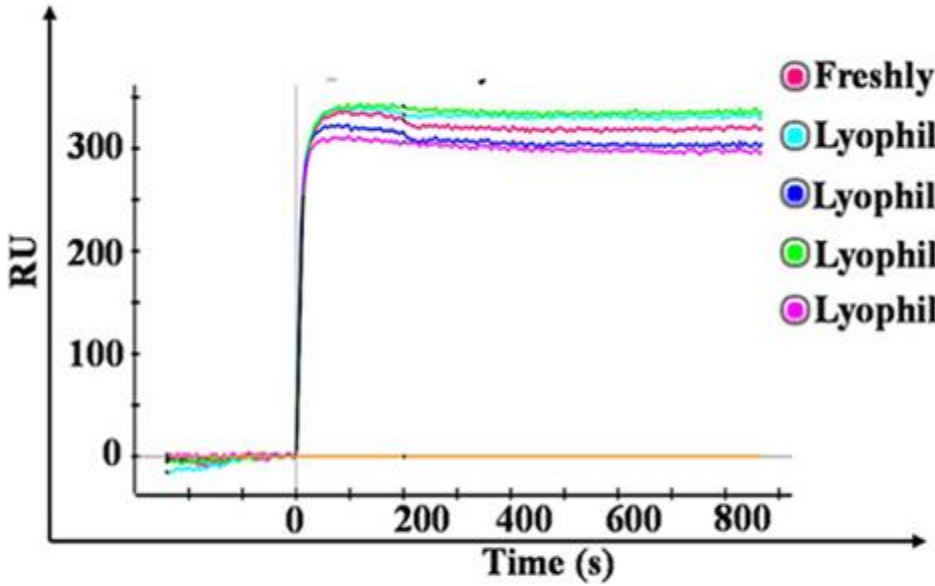
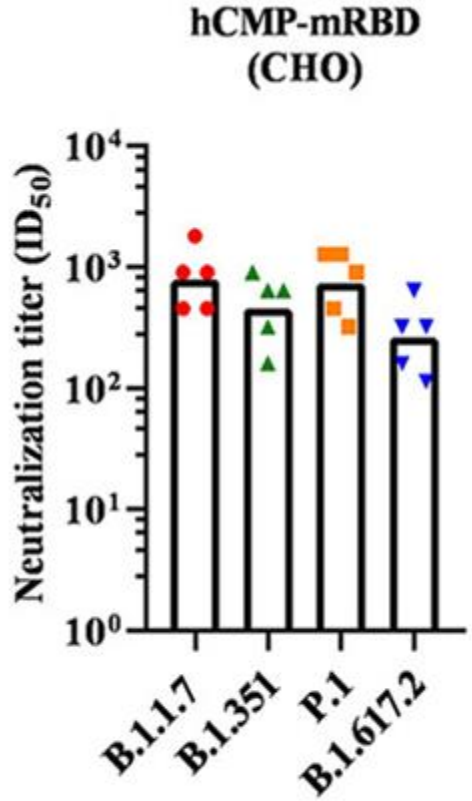
Warm vaccines



Extended thermal stability



Immunogenicity and Protective Efficacy of a Highly Thermotolerant, Trimeric SARS-CoV-2 Receptor Binding Domain Derivative

Sameer Kumar Malladi, Unnatiben Rajeshbhai Patel, Raju S. Rajmani, Randhir Singh, Suman Pandey, Sahil Kumar, Sara Khaleeq, Petrus Jansen van Vuren, Shane Riddell, Sarah Goldie, Savitha Gayathri, Debajyoti Chakraborty, Parismita Kalita , Ishika Pramanick, Nupur Agarwal, Poorvi Reddy, Nidhi Girish, Aditya Upadhyaya, Mohammad Suhail Khan, Kawkab Kanjo, Madhuraj Bhat, Shailendra Mani, Sankar Bhattacharyya, Samreen Siddiqui, Akansha Tyagi, Sujeet Jha, Rajesh Pandey, Shashank Tripathi, Somnath Dutta, Alexander J. McAuley, Nagendrakumar Balasubramanian Singanallur, Seshadri S. Vasan, Rajesh P. Ringe*, and Raghavan Varadarajan*

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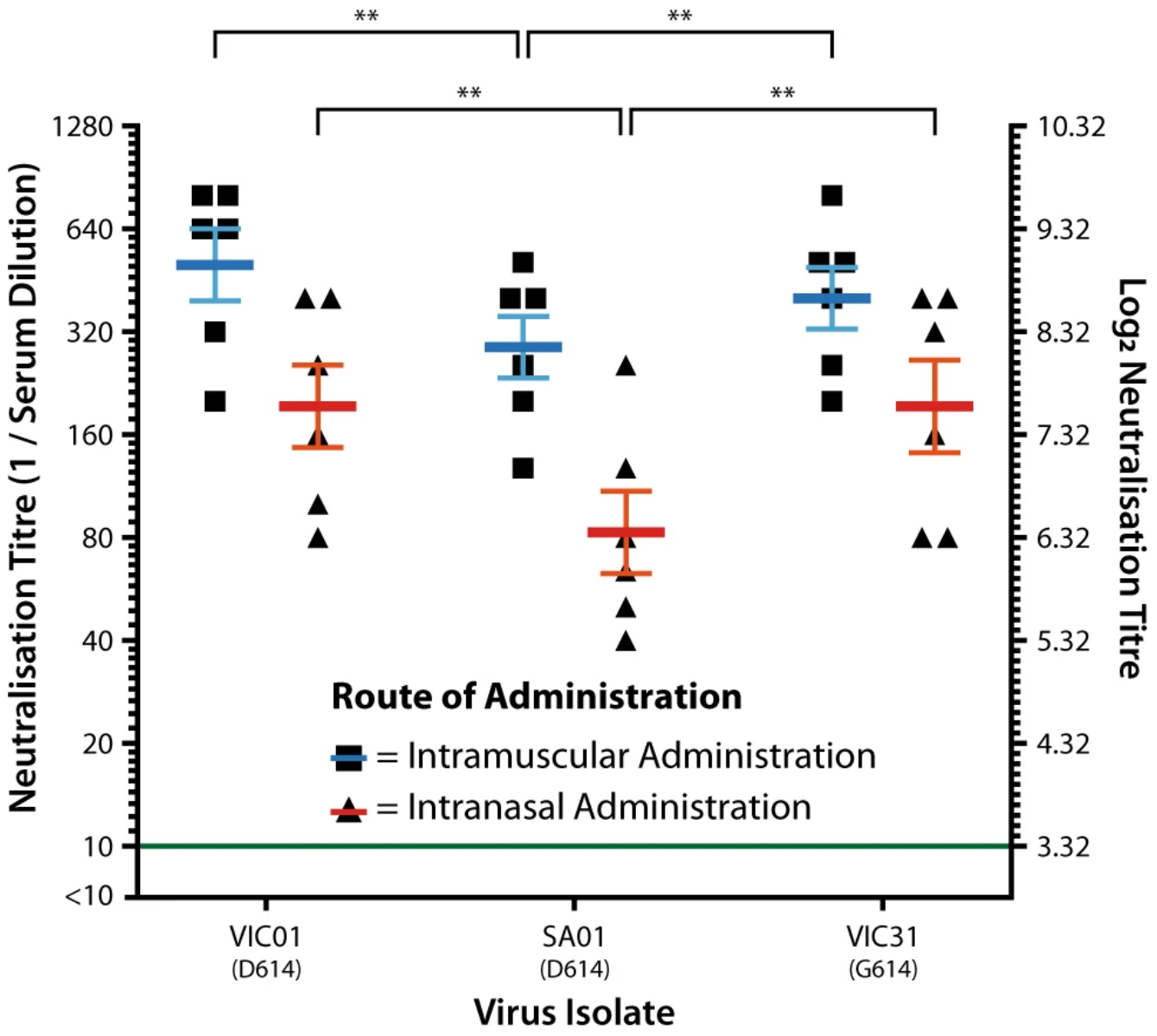
Intranasal route CEPI

nature

NEWS · 09 MARCH 2020 Ewen Callaway

Labs rush to study coronavirus in transgenic animals — some are in short supply

The first results are emerging: teams in China have reported initial findings from infecting monkeys[1] and mice[2] that have the human *ACE2* gene. Labs working on ferrets say they should also have initial results soon: a team led by virologist S. S. Vasan at the Australian Animal Health Laboratory in Geelong has found that the animals are susceptible to SARS-CoV-2. The researchers are now studying the course of infection, before testing potential vaccines. Ferrets are a popular model for influenza and other respiratory infections because their lung physiology is similar to that of humans, and researchers hope they will mimic aspects of COVID-19 in people, such as its spread.



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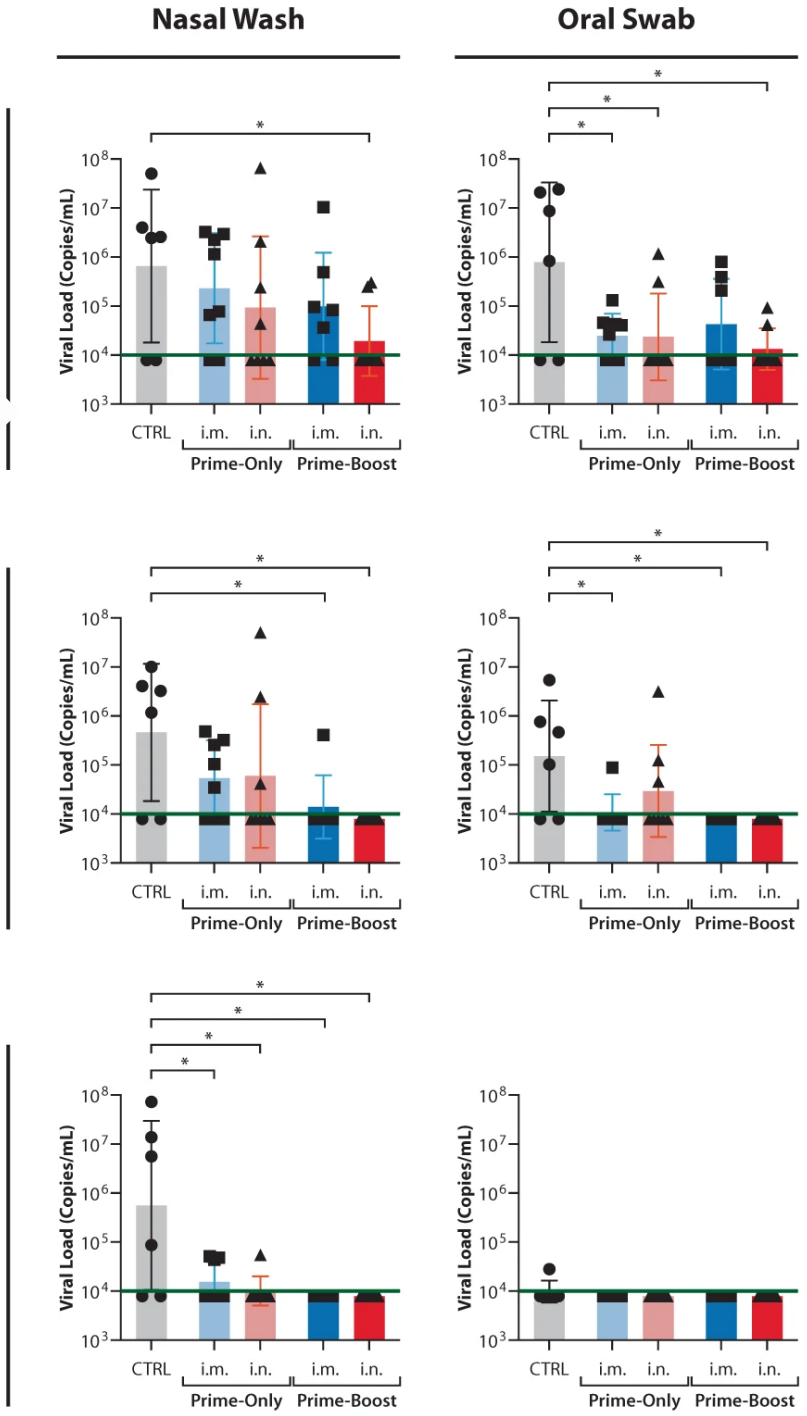
ChAdOx1 nCoV-19 (AZD1222) vaccine candidate significantly reduces SARS-CoV-2 shedding in ferrets

Glenn A. Marsh, Alexander J. McAuley, ... S. S. Vasan + Show authors



Treatment Groups

- = Control (n=6)
- = Prime-Only Intramuscular (n=8)
- = Prime-Only Intranasal (n=8)
- = Prime-Boost Intramuscular (n=7)
- = Prime-Boost Intranasal (n=8)

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