

Immune Memory to COVID-19

- **Longitudinal analysis of virus-specific B and T cell responses in COVID-19 patients**
- **Cohort of >200 convalescent patients followed for 8 months**
- **Atlanta and Seattle**

- 1. Binding antibody to SARS-CoV-2 spike protein**
- 2. Neutralizing antibody titers to SARS-CoV-2 (live virus neutralization assay)**
- 3. Memory B cell responses to SARS-CoV-2 spike**
- 4. CD4 T cell responses to SARS-CoV-2 spike and several other proteins**
- 5. CD8 T cell responses to SARS-CoV-2 spike and several other proteins**

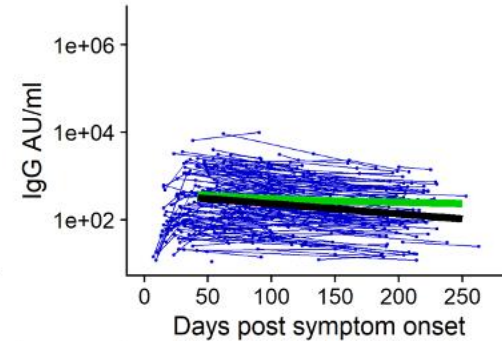
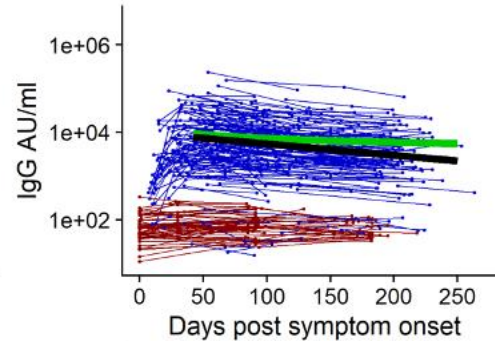
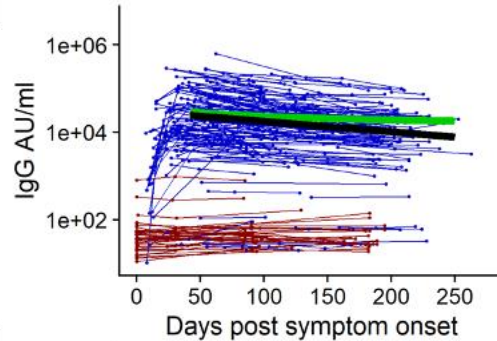
Antibody responses to SARS-CoV-2 spike protein show a bi-phasic decay with an extended half-life

Spike
Exponential : $t_{1/2} = 126$ days
Power Law : $t_{1/2} = 238$ days

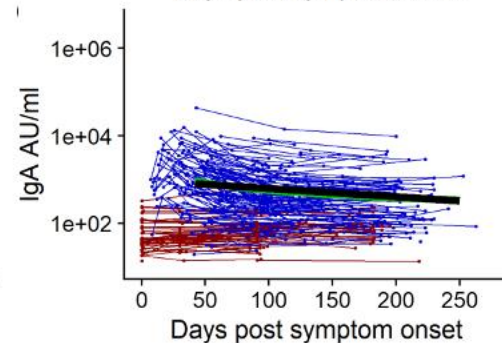
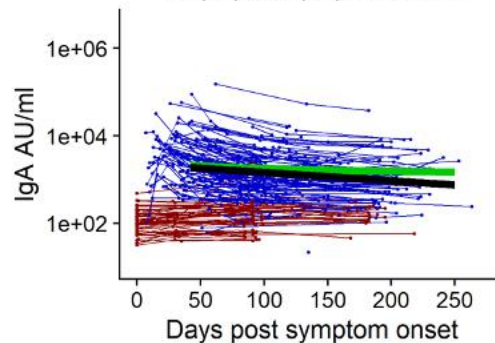
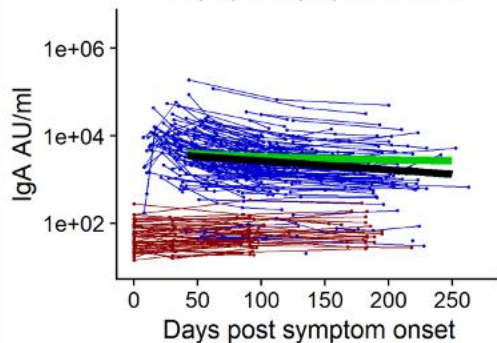
RBD
 $t_{1/2} = 116$ days
 $t_{1/2} = 209$ days

NTD
 $t_{1/2} = 130$ days
 $t_{1/2} = 244$ days

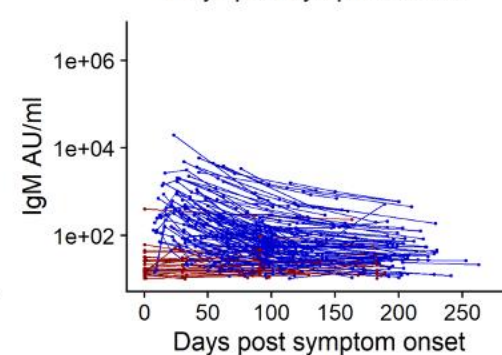
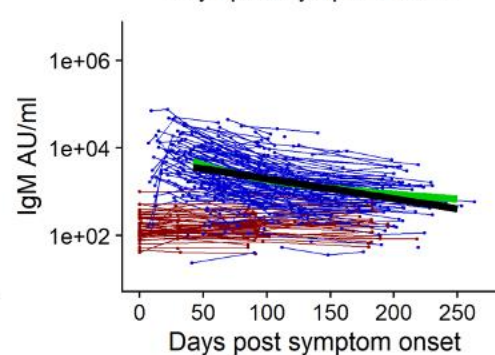
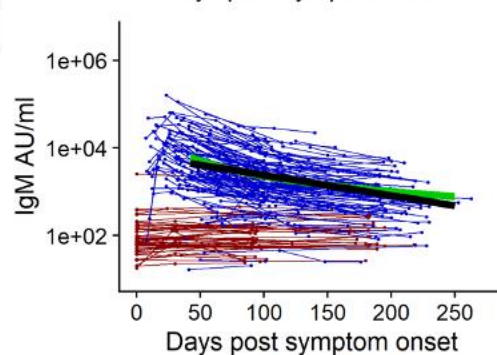
IgG
 $n=222$
COVID-19
 $n=51$
Pre-pandemic



IgA
 $n=190$
 $n=51$



IgM
 $n=190$
 $n=51$

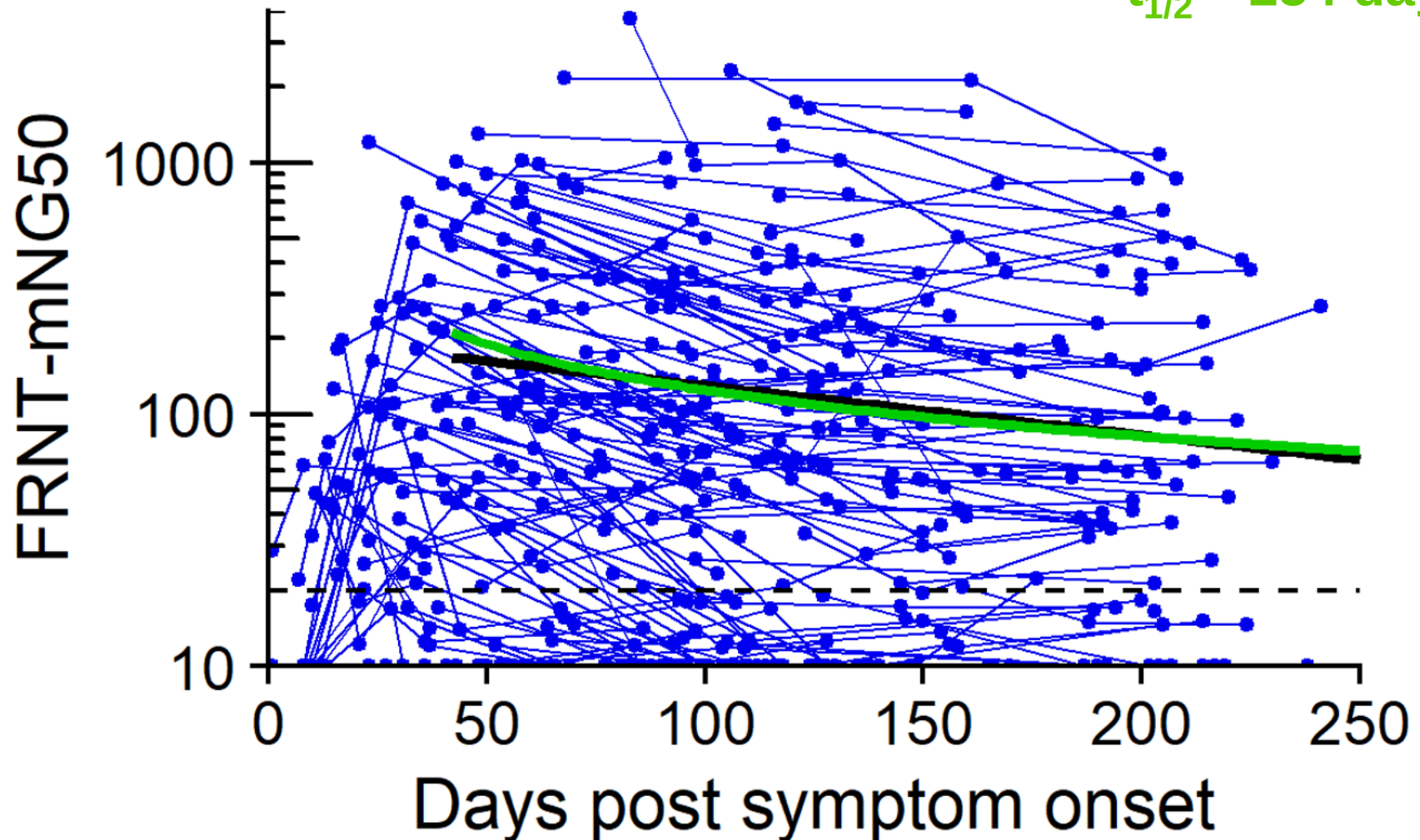


Neutralizing antibody responses

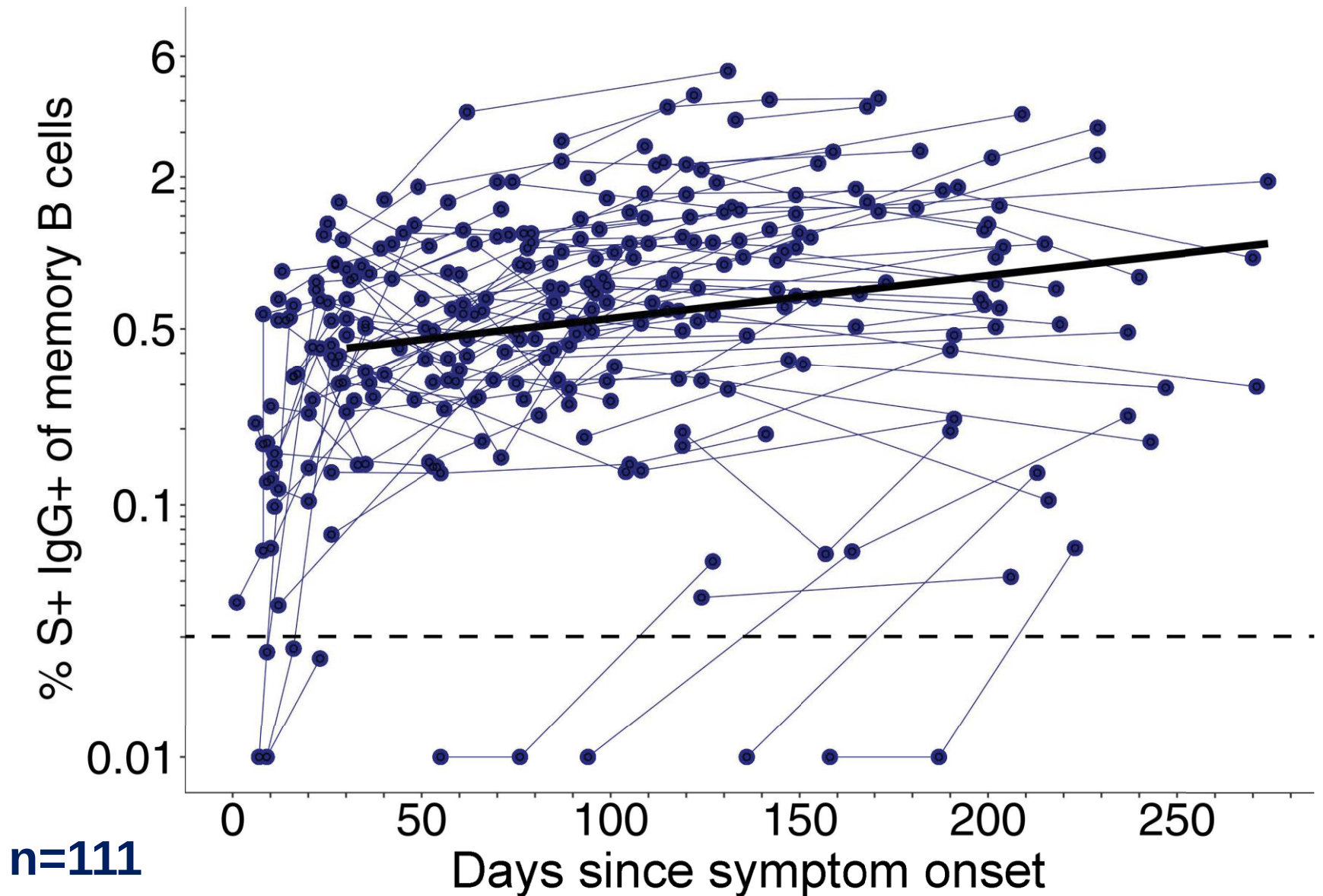
n=183

$t_{1/2} = 150$ days

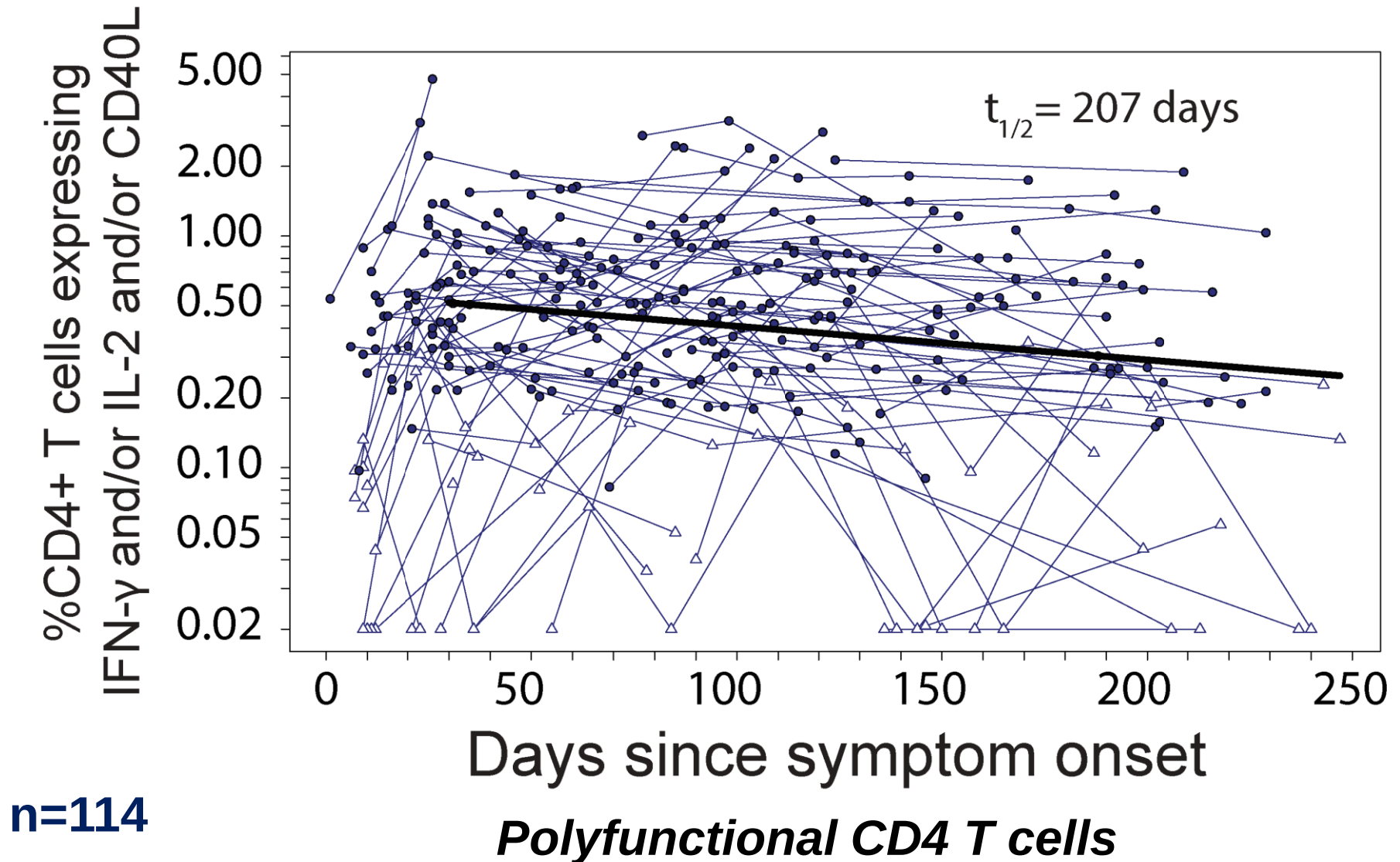
$t_{1/2} = 254$ days



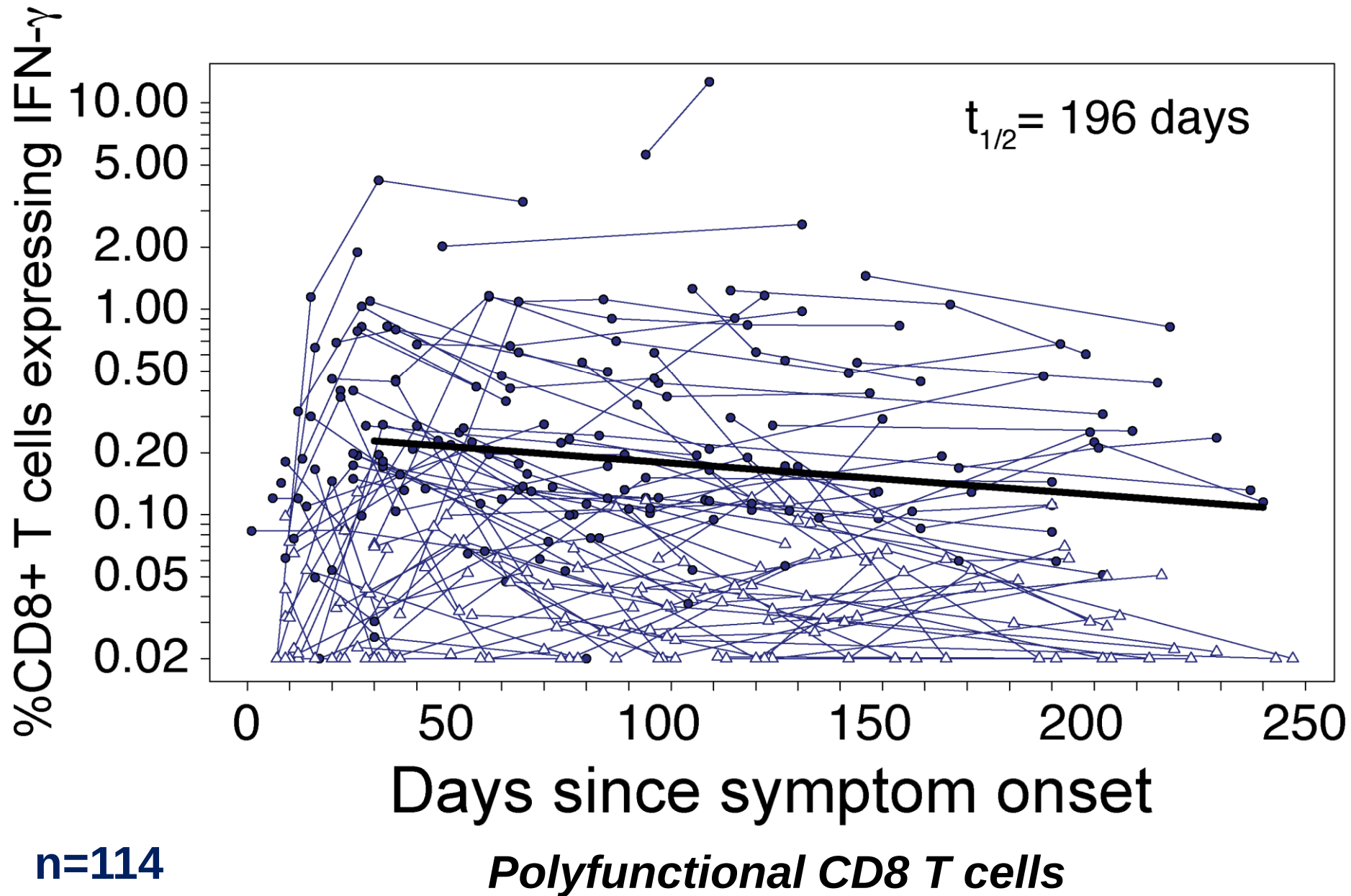
SARS-CoV-2 spike reactive memory B cells increase and then remain stable over 8 months



SARS-CoV-2 CD4 T cell responses

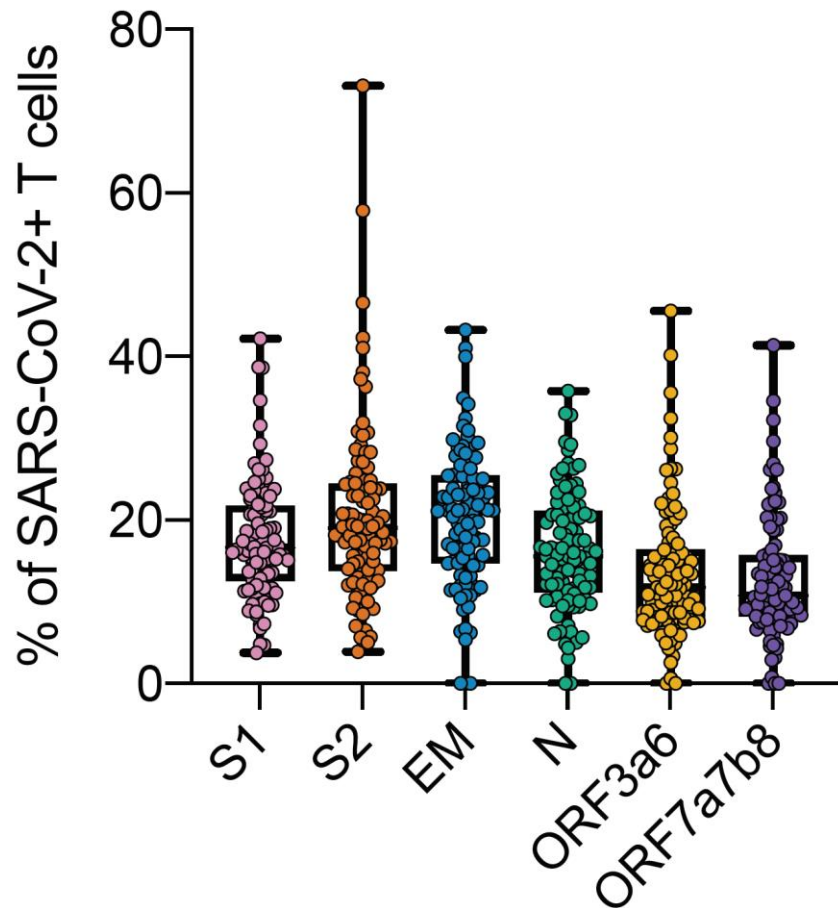


SARS-CoV-2 CD8 T cell responses

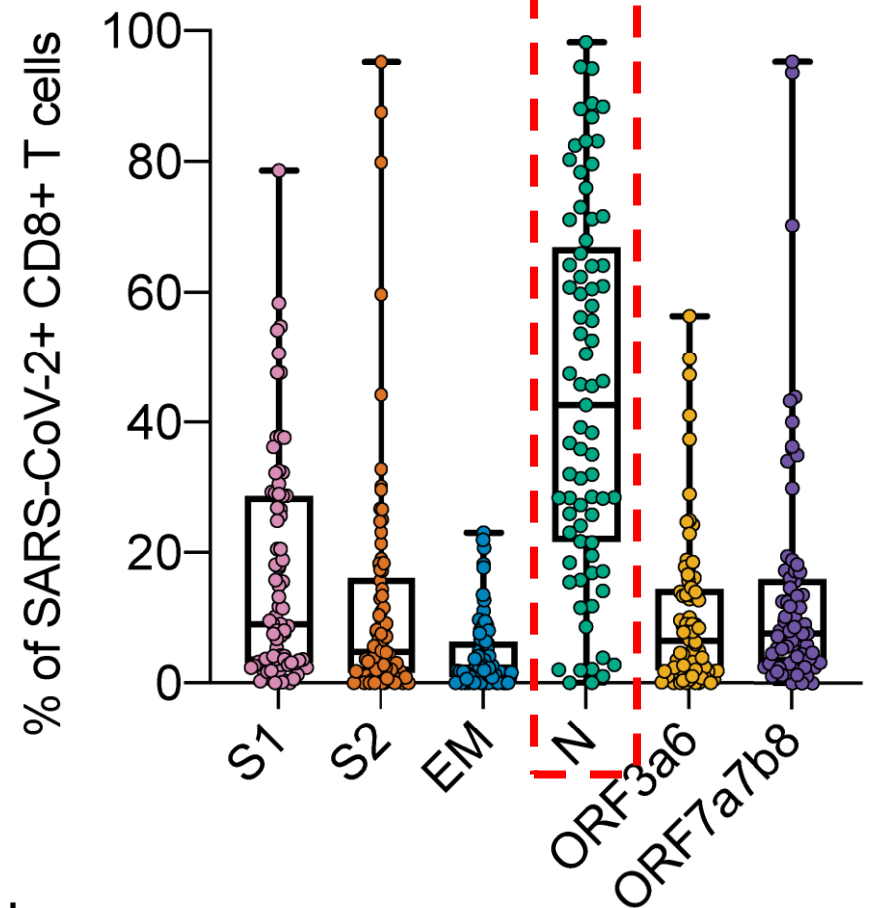


CD4 and CD8 T cells target different SARS-CoV-2 antigen specificities

CD4

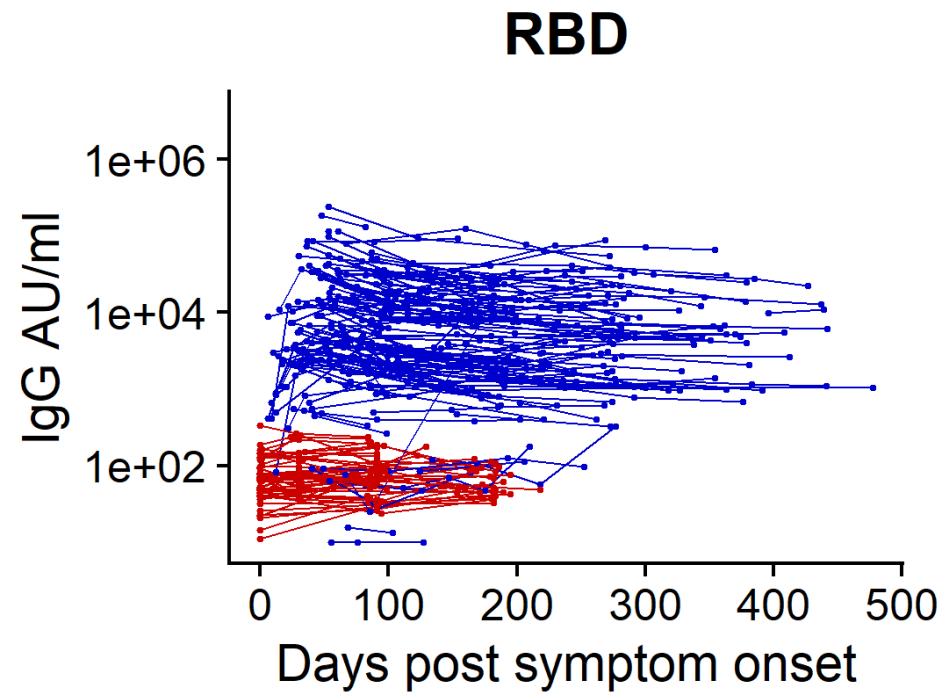
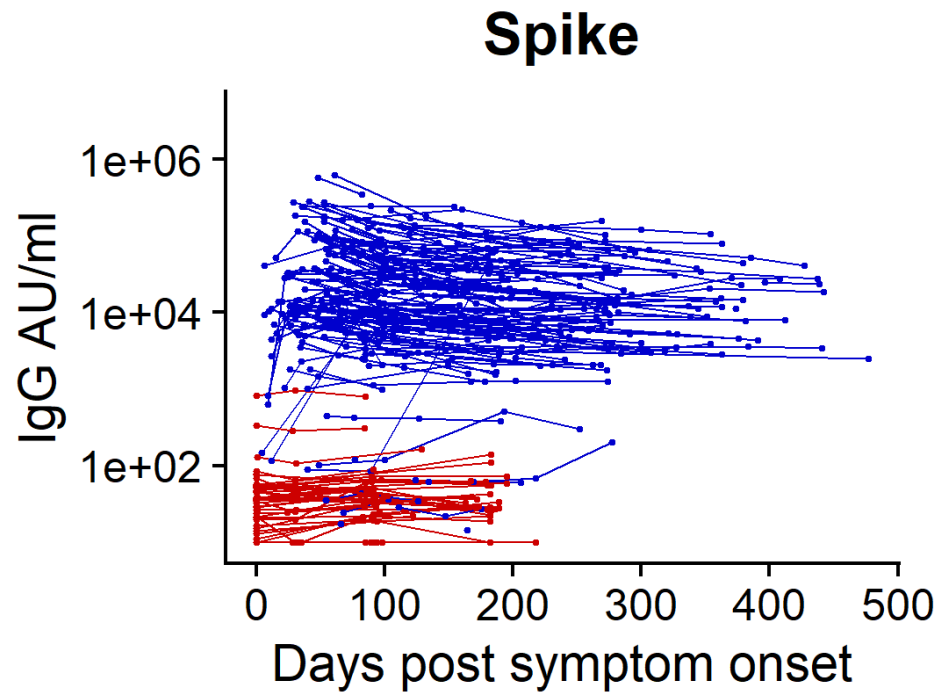


CD8



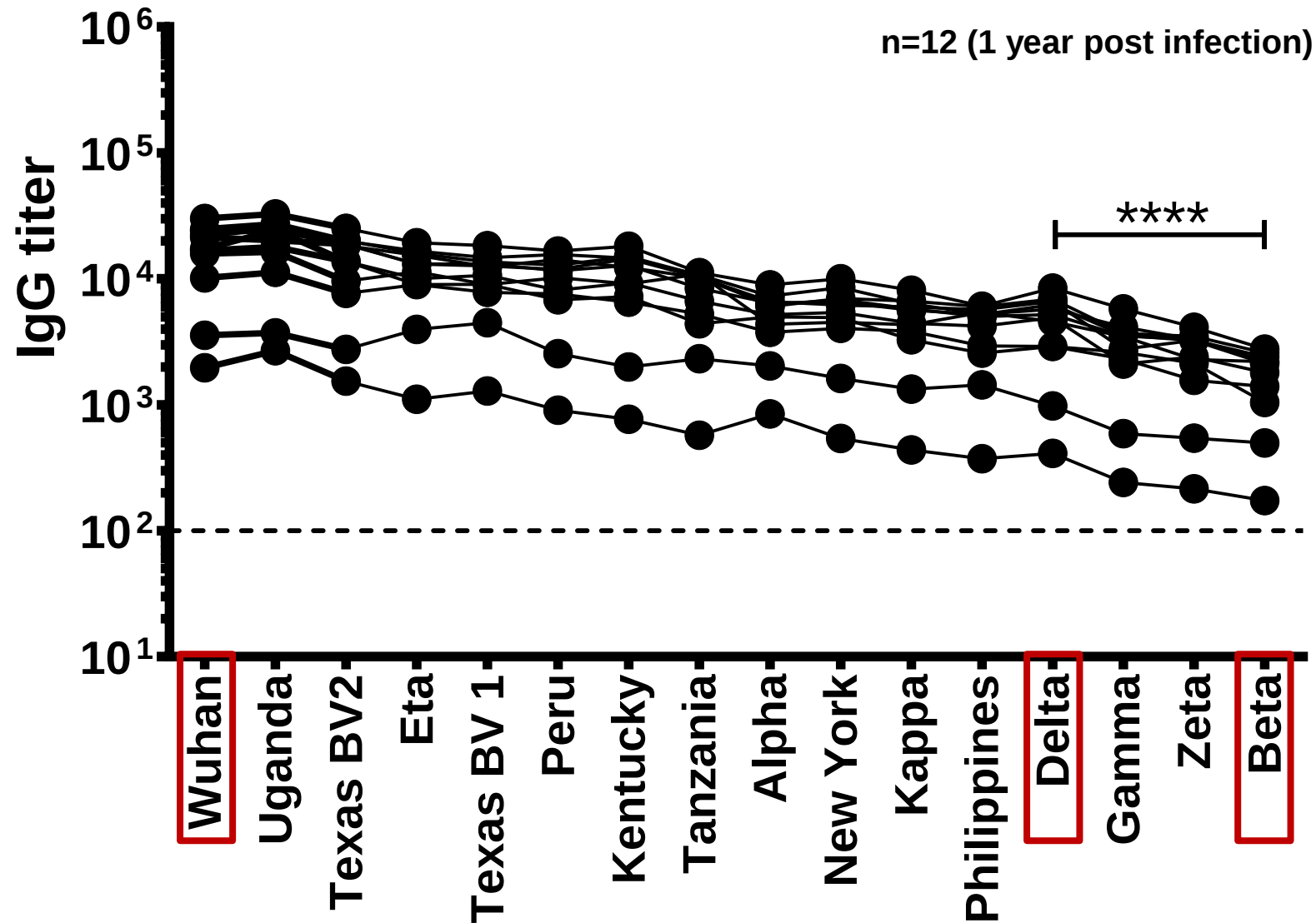
**Importance of including
nucleocapsid protein in
SARS-CoV-2 vaccines for inducing
an optimal CD8 T cell response**

Durable antibody responses for >1 year post infection



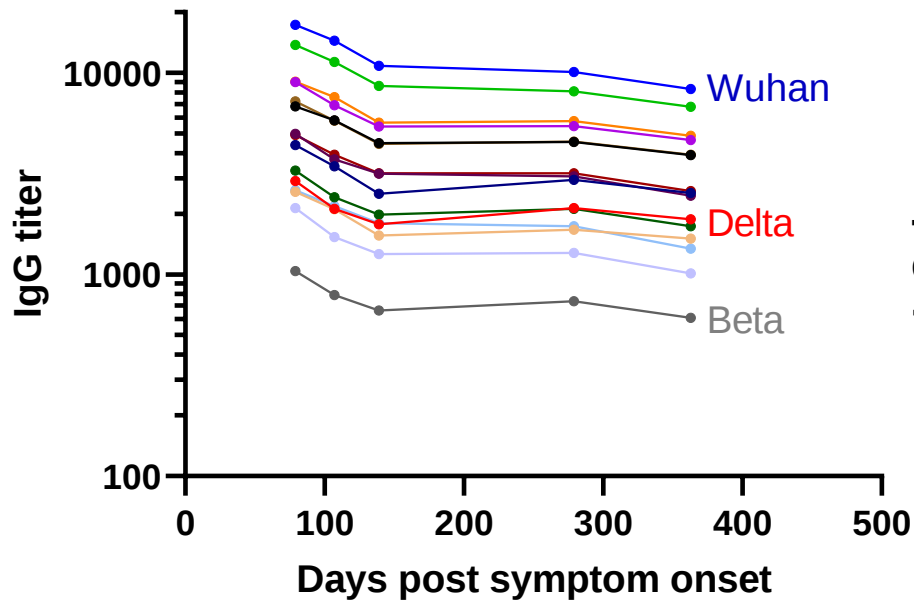
**Reactivity to
SARS-CoV-2 variants?**

Reactivity of infection-induced antibody to spike protein of SARS-CoV-2 variants

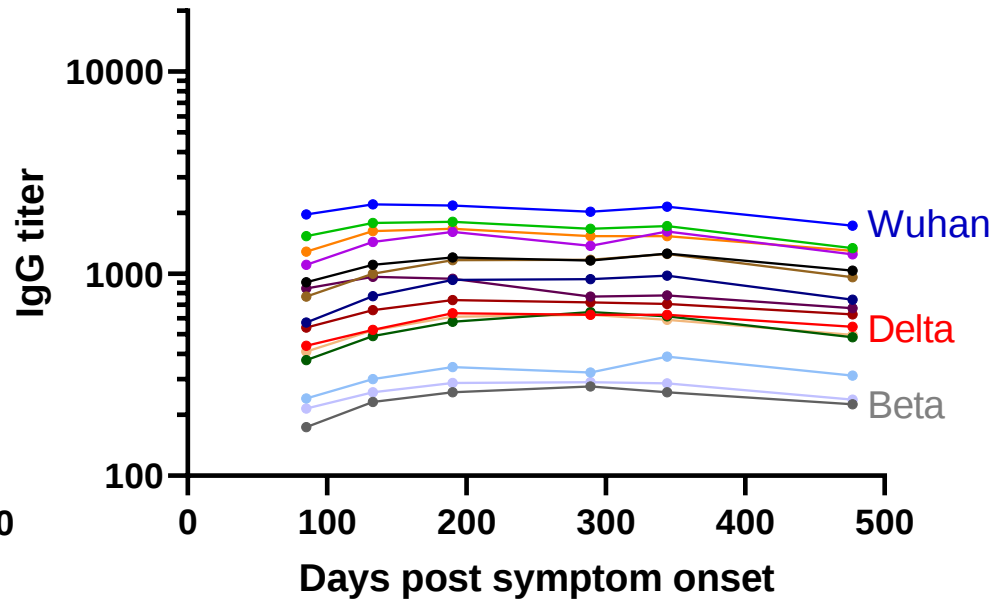


Longitudinal antibody titers to spike proteins of SARS-CoV-2 variants in convalescent COVID-19 patients

Patient 1



Patient 2



Broad and Durable Immune Memory

Protective Immunity?

**Protection against
infection versus disease?**

Acknowledgements

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