

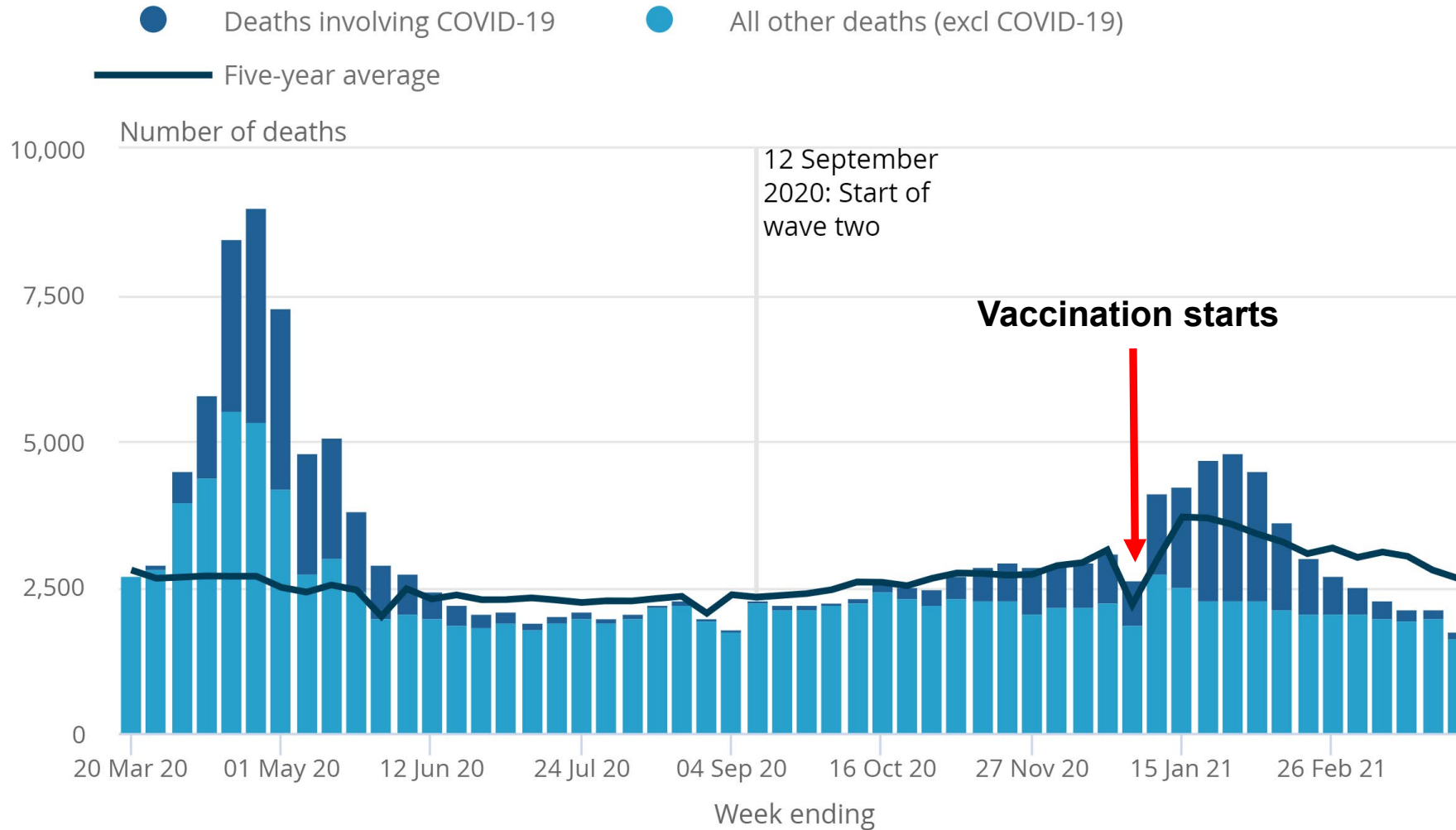
SARS-CoV-2 infection and immunity in Care Homes (VIVALDI study)

Dr Laura Shallcross
l.shallcross@ucl.ac.uk



UNIVERSITY OF
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Weekly deaths in care homes residents, England and Wales

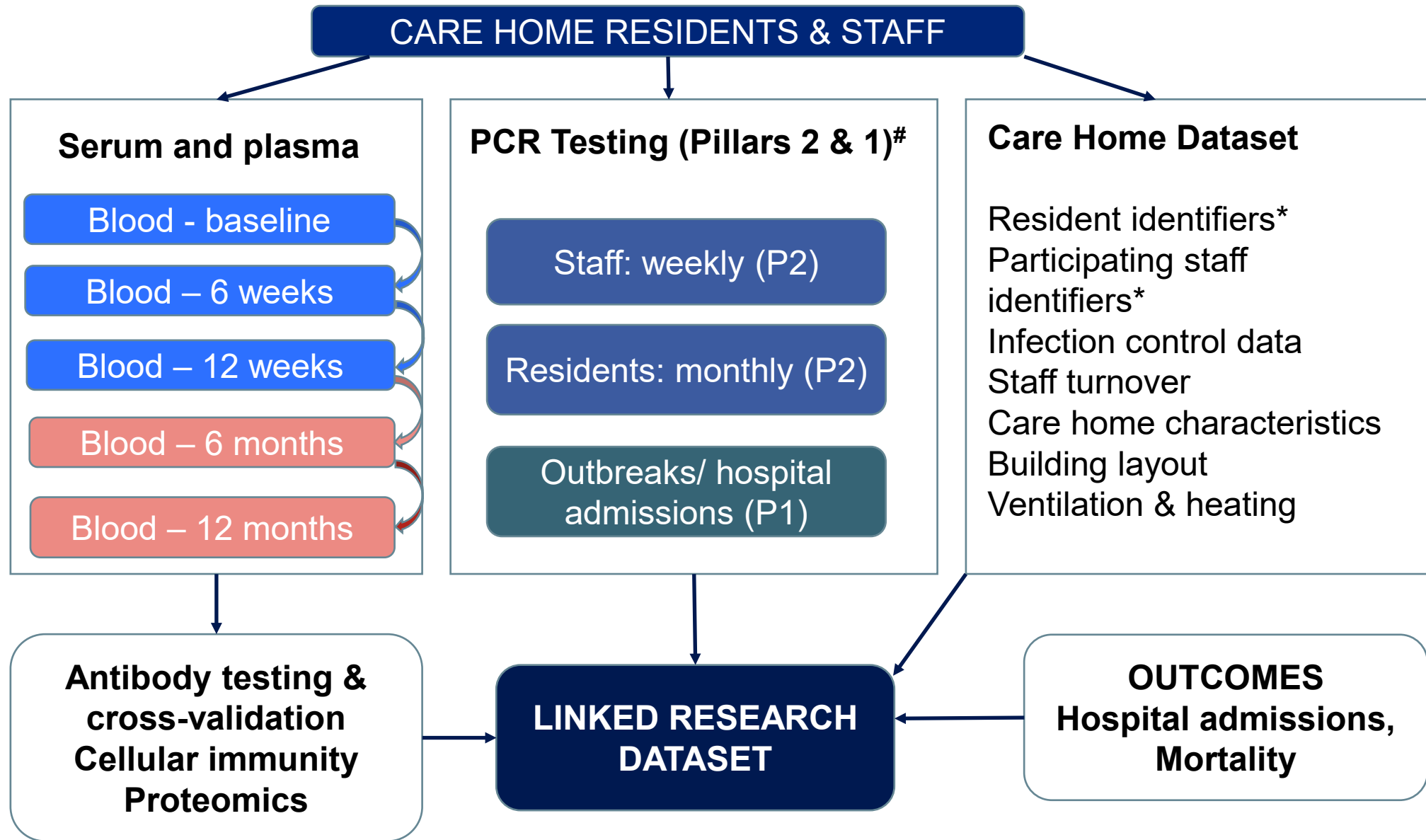


- Deaths in care homes 20% higher than 5 year average
- Policy decision (31 Dec 2020) to extend vaccine dosing interval to 12 weeks
- Whole care home PCR testing programme

Source: Office for National Statistics (ONS)

So many research questions....

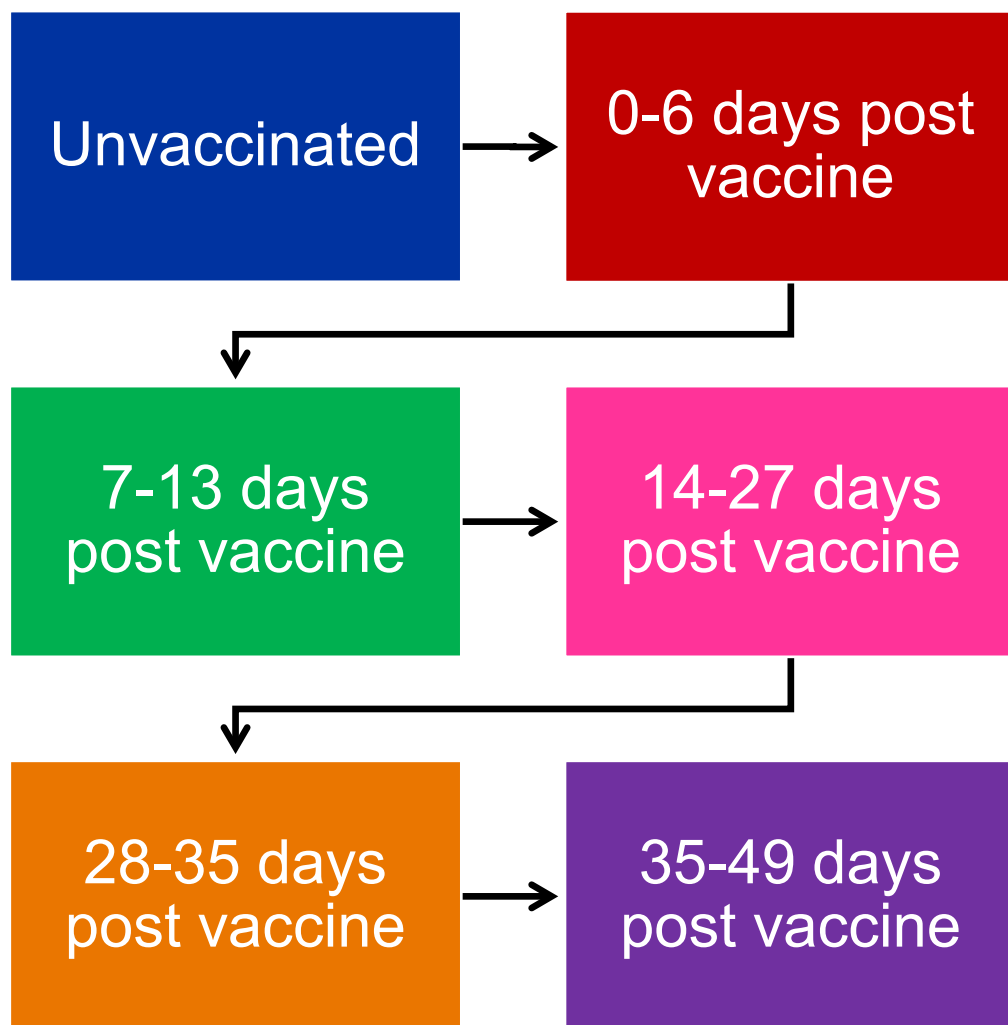
- What proportion of care home staff and residents have been infected with SARS-CoV-2?
- Can staff and residents be infected with SARS-CoV-2 twice?
- What are the risk factors for outbreaks and large outbreaks?
- What is the effectiveness of vaccination in preventing SARS-CoV-2 infection in care home residents?
- What is the duration of natural and vaccine-induced immunity?



data available from March 1st; *enables linkage between datasets

Vaccine effectiveness

Aim and Analytical approach



- Aim: To estimate the relative hazards (risk) of PCR-positive infection in specific time periods following first dose vaccination, relative to unvaccinated individuals
- Residents only
- Cox regression adjusting for age, sex, local incidence of infection, care home size, residents, prior infection and clustering by care home

Characteristics of residents and care homes

Residents n =10,412	
Age	86 (80-91)
Female	7247 (69.6%)
Previous infection	1155 (11.1%)
Mean PCR tests per month	1.6 (1.2-2.2)
PCR positive events	1335/36352 (3.7%)
Symptomatic at testing	84/1126 (7.4%)
First vaccine dose	9160 / 10412 (88.0%)
ChAdOx1	6138 (67.0%)
BNT162b	3022 (33.0%)

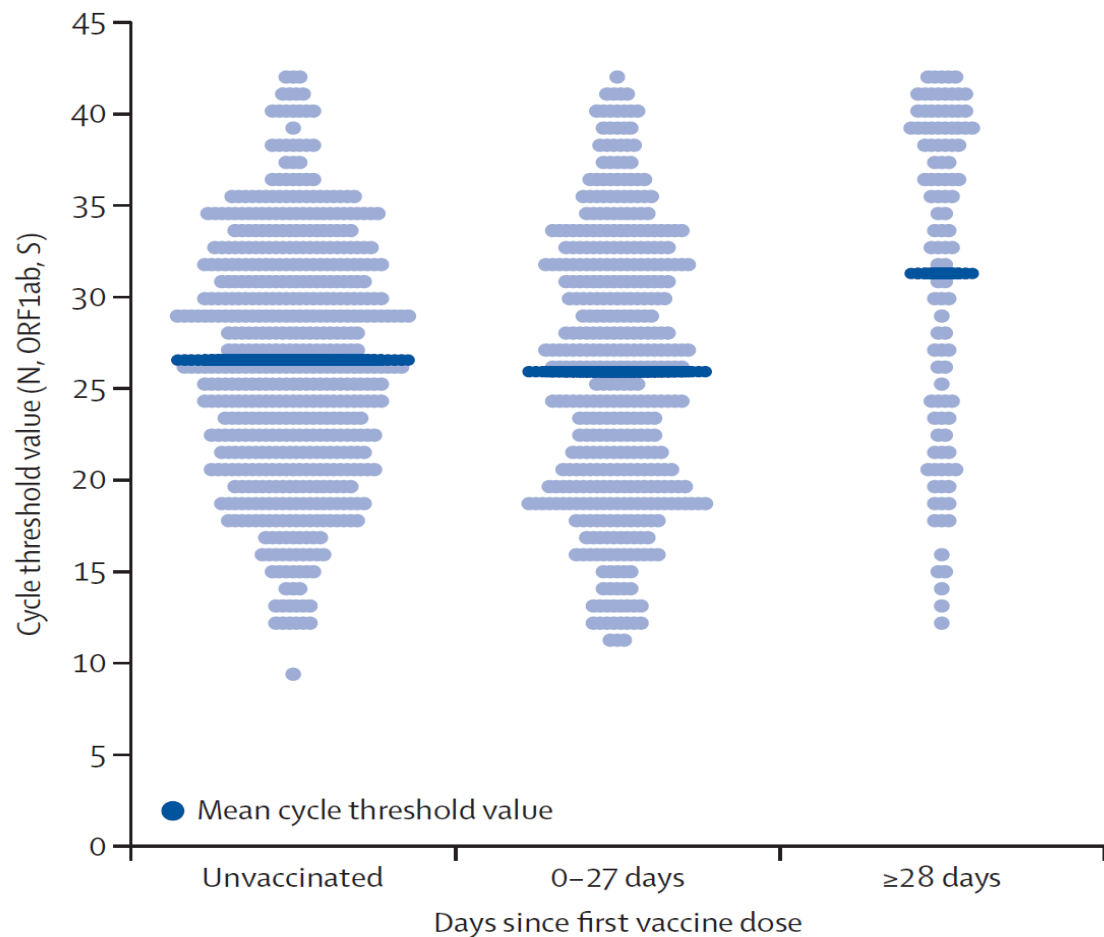
Care homes n=310	
For profit	228 (73.5%)
Not for profit	72 (23.2%)
Independent	10 (3.2%)
Most residents vaccinated with ChAdOx1	203 (65.5%)
Total bed capacity	47 (38-61)
Date by which >75% care homes started vaccination	Jan 19, 2021
Most residents vaccinated with BNT162b	99 (31.9%)
Total bed capacity	51 (42-64)
Date by which >75% care homes started vaccination	Jan 7th 2021

Adjusted Hazard Ratios for PCR positive infection following 1st dose vaccination

Category	Testing rate per 1000 person days	Infection rate per 10,000 person days	Adjusted HR (95%CI)	P value
Unvaccinated	45.54	21.39	1	
0-6 days	52.15	22.06	0.64 (0.38-1.06)	0.083
7-13 days	59.60	25.98	0.83 (0.54-1.28)	0.404
14-20 days	48.89	26.21	0.96 (0.57-1.60)	0.866
21-27 days	52.15	19.99	0.92 (0.53-1.59)	0.762
28-34 days	48.17	9.74	0.44 (0.24-0.81)	0.0087
35-48 days	74.29	9.36	0.38 (0.19-0.77)	0.0069
49+	130.55	14.55	0.49 (0.20-1.17)	0.108
Overall	54.21	19.91		

Adjusted for age, sex, local SARS-CoV-2 incidence, care home size and clustering by care home

Cycle threshold (Ct) values for PCR positive tests, by exposure category



Vaccination status	Samples	Mean Ct value (SD)	P value
Unvaccinated	552	26.55 (6.57)	-
0-27 days	411	25.91 (7.38)	0.158
28 + days	107	31.29 (8.71)	<0.0001

Key findings

- In residents, first dose vaccination provides substantial protection against new infection for at least 7 weeks
- Vaccinated individuals who become infected with SARS-CoV-2 may be less likely to spread infection compared to unvaccinated individuals who become infected
- Both vaccines protect against the α (B.1.1.7) variant, but efficacy against other VOCs is uncertain
- Further work is required to evaluate the effectiveness of the 2nd dose and the duration of immunity

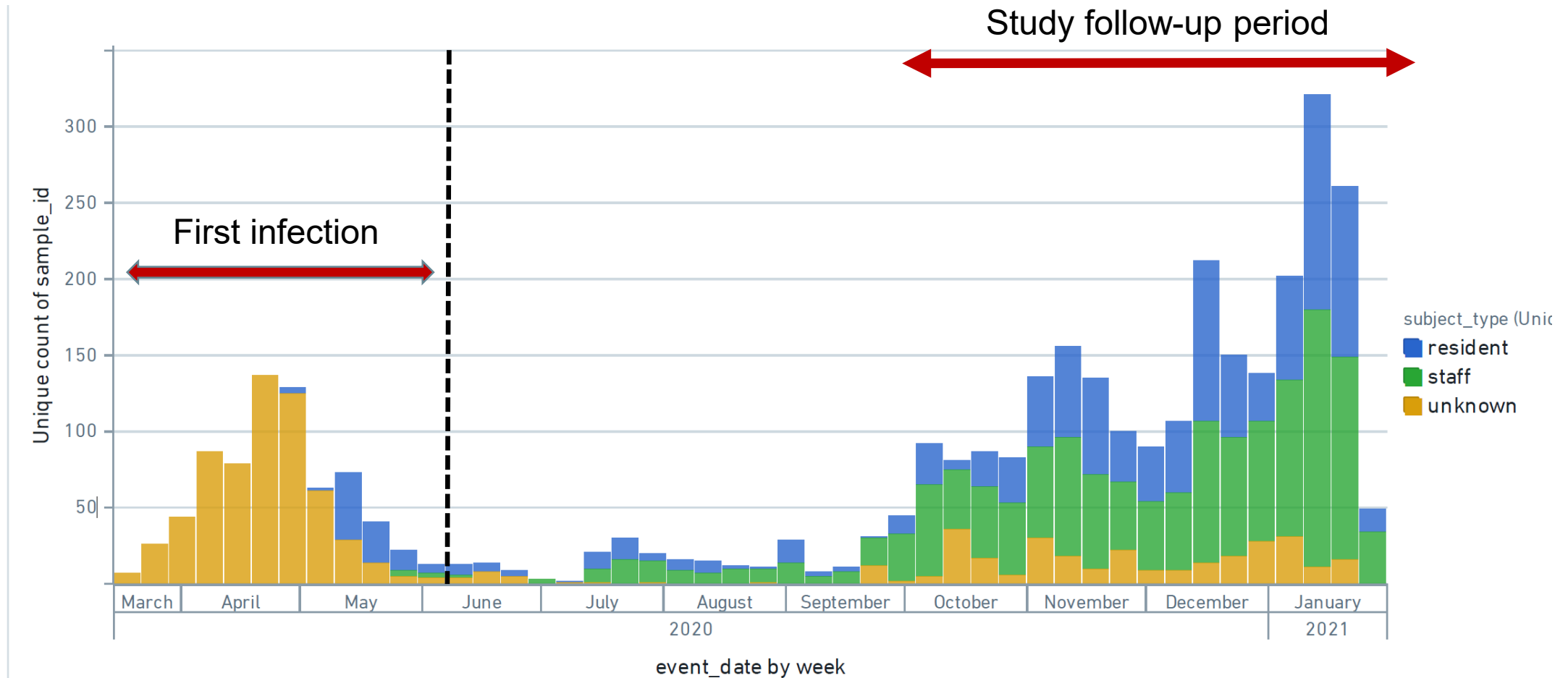
Duration of immunity

Can staff and residents with SARS-CoV-2 antibodies be infected twice?

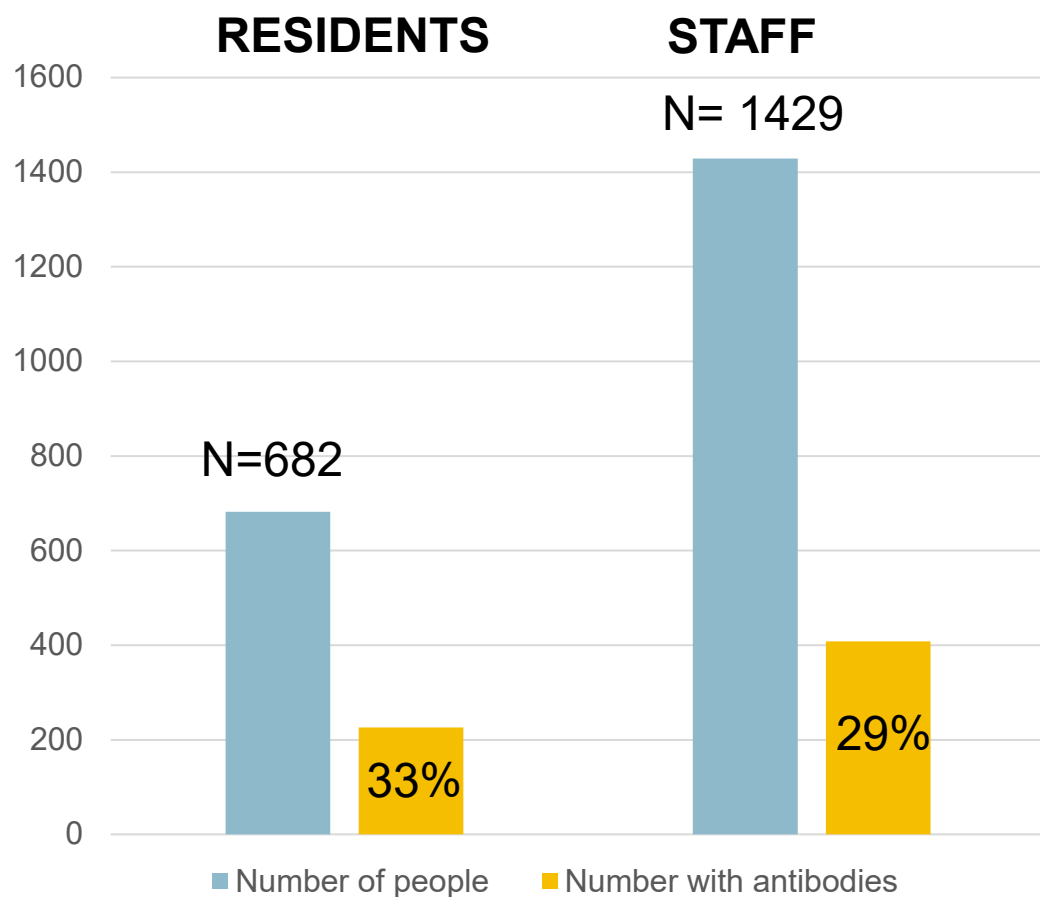
- Studies in healthcare workers (Oxford, SIREN, UCLH)
- No large scale studies in care home residents
- Immune responses may be impaired in older adults (immune-senescence)

- Partnered with Four Seasons Healthcare
- Blood sampling in 100 care homes (June/July; Aug/Sep; Oct/Nov)
- Blood samples tested for COVID-19 antibodies

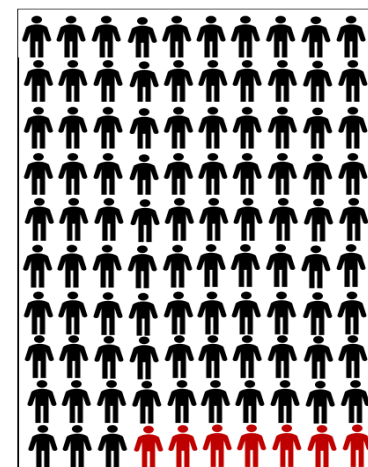
Number of PCR positive tests in staff and residents from care homes participating in VIVALDI March 2020-Jan 2021



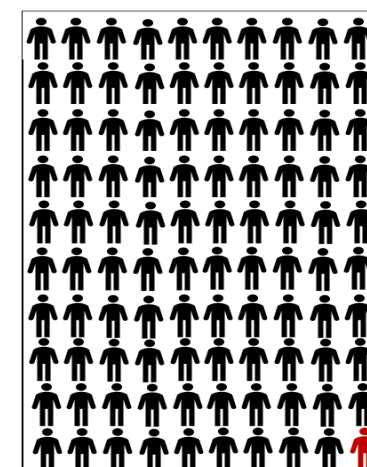
Seroprevalence and risk of PCR-positive infection



In an average 4 week period between Oct 2020 and Feb 2021



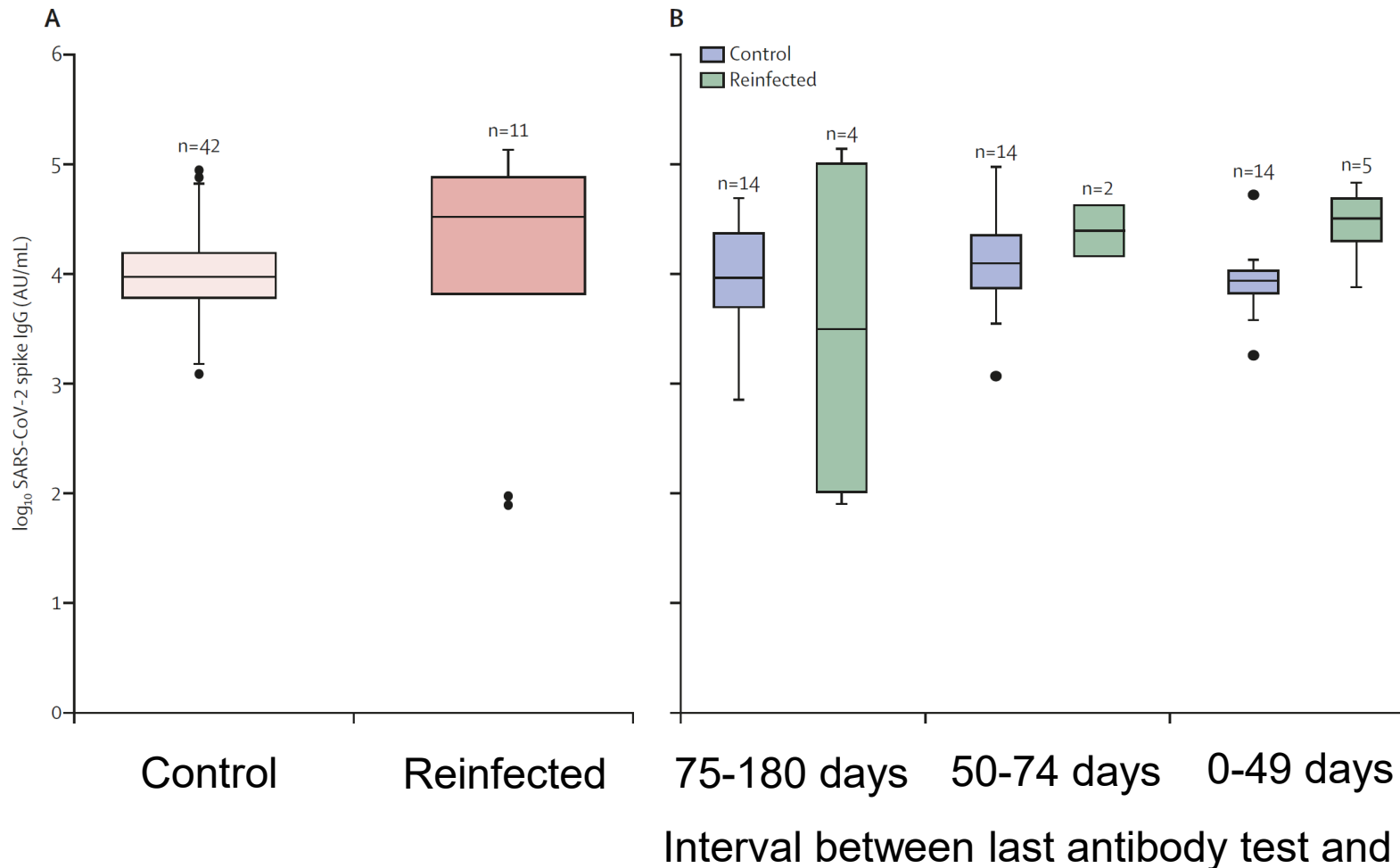
6.9% **antibody-negative** residents will get COVID-19



<1% of **antibody-positive** residents will get COVID-19

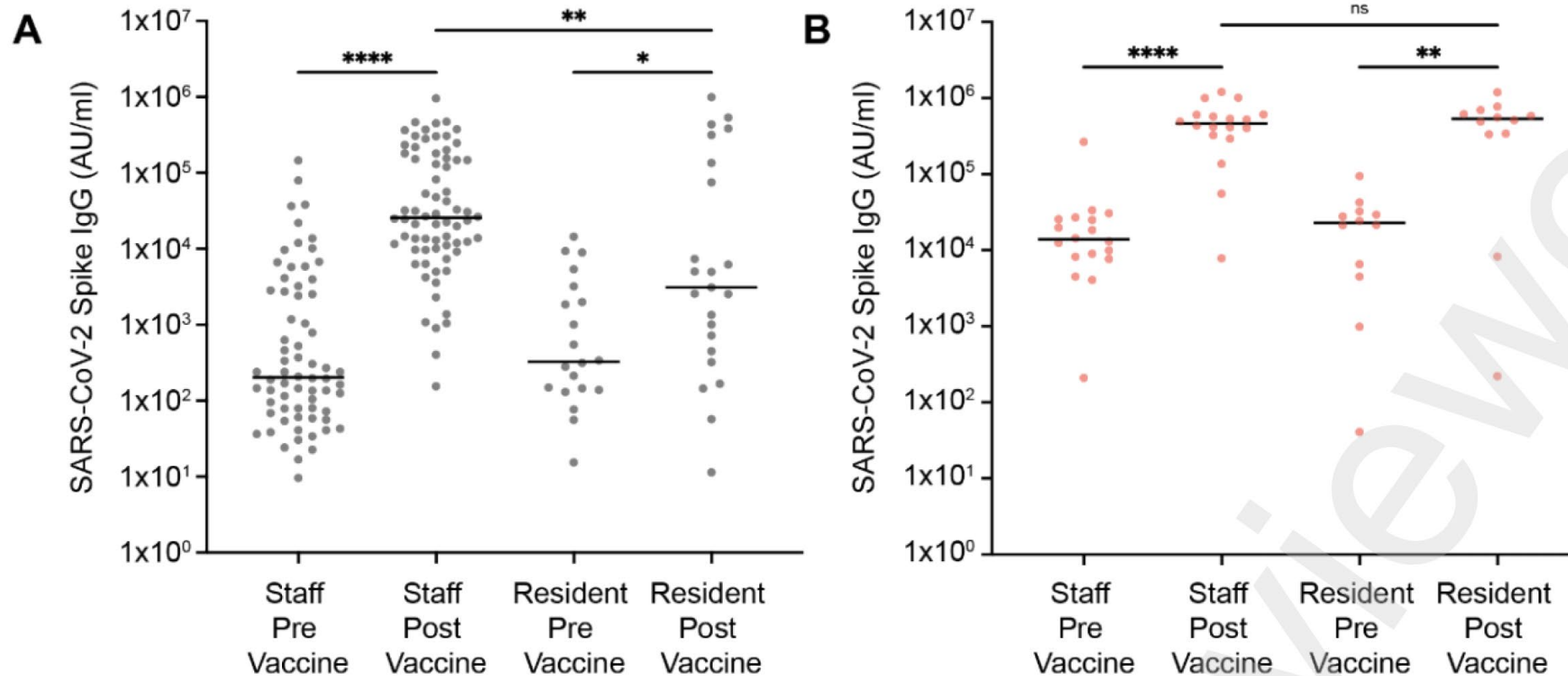
Adjusted HR for PCR-positive infection in antibody-positive versus antibody-negative residents is 0.15 (95% CI: 0.05-0.44)

Spike antibody titres in reinfected cases versus controls



We don't know the date of index infection which makes it difficult to make inferences about waning immunity

Spike antibody titres post vaccination are higher in staff and residents who have had natural infection



Key findings

- Residents and staff with antibodies are substantially less likely to develop PCR-positive infection for up to 10 months following their primary infection
- The magnitude of vaccine-induced antibody response (Dose 1) is higher in individuals with natural immunity
- Investigating immune correlates of protection is challenging due to limited sample size and poor quality data on the date of primary infection
- Estimating waning immunity following vaccination is likely to be easier as the vaccination date is well recorded (although loss to follow-up problematic)

Next steps

Challenges and priorities over the next 6-12 months

- Vaccination coverage: influenza and SARS-CoV-2
- How to monitor waning immunity & vaccine effectiveness against VOCs
 - Antibodies
 - PCR
 - Cellular immunity
 - Viral sequencing
- Balancing the need to prevent infection ingress against the negative impact on staff residents and relatives of restrictive disease control measures e.g.
 - Visitor restrictions
 - Testing
 - Masks etc.
- Surveillance systems (data + testing)

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