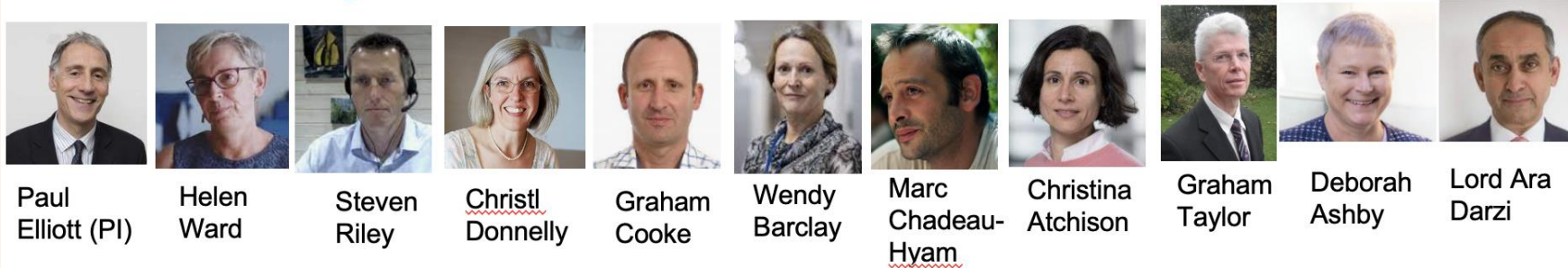


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OMS Digital Pandemic Preparedness Workshop

Digital tools and remote testing in pandemic preparedness: lessons from the REACT Study

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REACT (REal-time Assessment of Community Transmission) Study

- To produce timely estimates of community prevalence & distribution of SARS-CoV-2 in England
- Funded by DHSC
- Random cross-sectional samples of people from NHS Patient List
- REACT-1: May 2020 – Mar 2022, 19 rounds, self-collected swabs for lab-based PCR testing (ages 5+)¹
- REACT-2: June 2020 – May 2021, 6 rounds, self-tests for SARS-CoV-2 IgG (age 18+)²
- >4 million participants
- Online surveys: socio-demographics, households, symptoms, medical history, behaviours

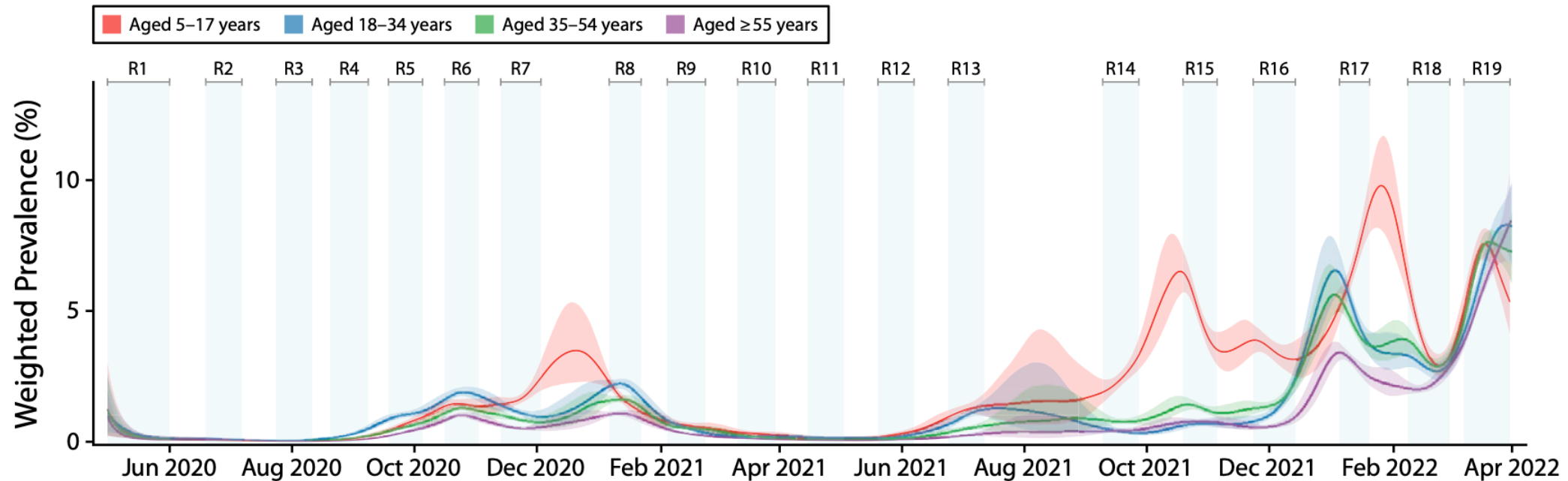


1. Elliott et al. [Am J Public Health. 2023;113\(5\):545–554](#)
2. Ward et al. [Am J Public Health. 2023;113\(11\):1201–1209](#)

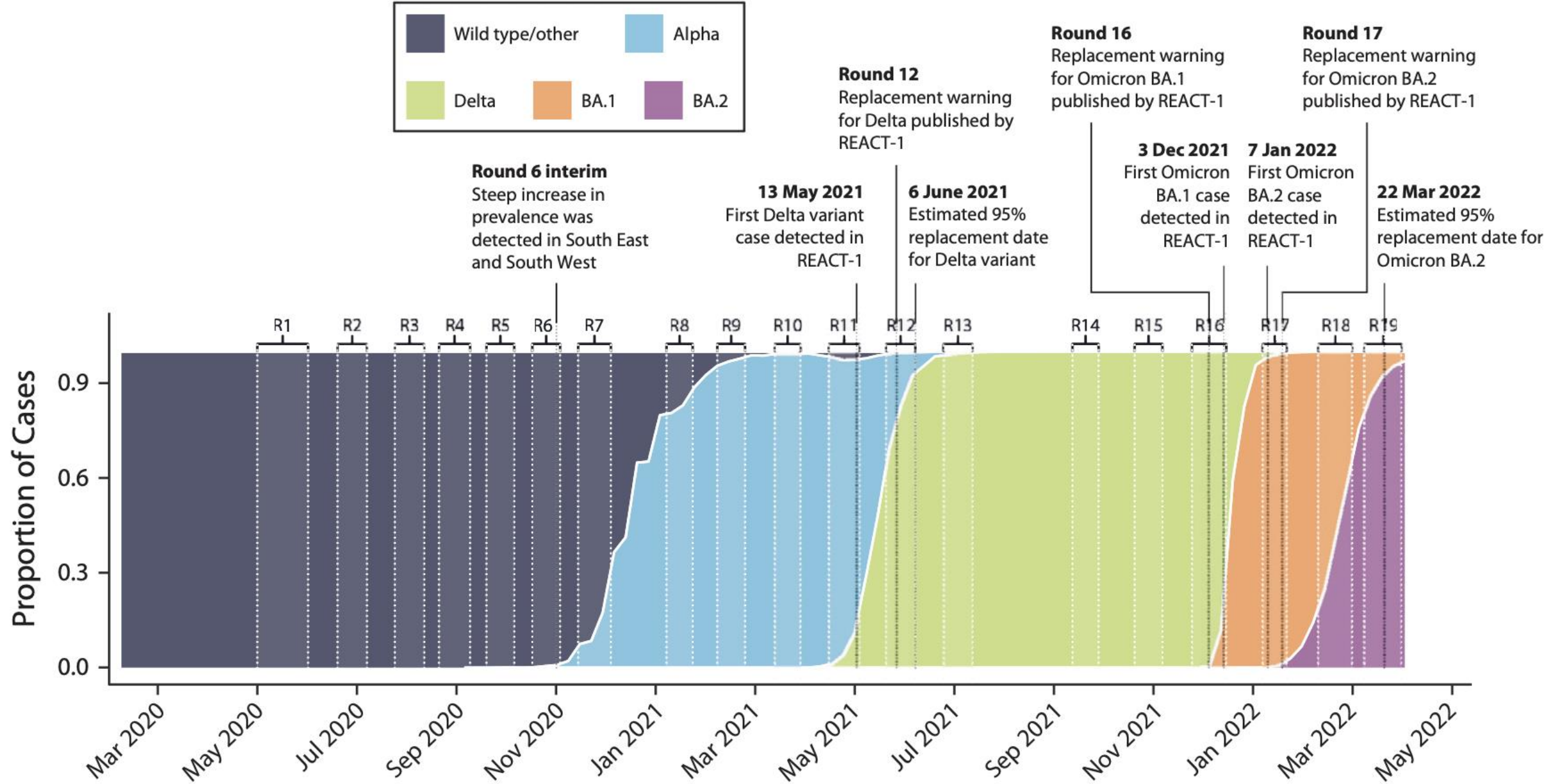
Lessons - 1:

Rapid bio-behavioural surveillance at scale is possible and useful

- **Acceptable:** > 2.5 million participants in REACT-1 (19 rounds, 19% response), and >900,000 in REACT-2 (6 rounds, 29% response)
- **Rapid:**
 - pipeline to report virus prevalence estimates by age, area etc. within days
 - reporting of uptake of new policies and relevant behaviours and symptoms



Useful - provided early evidence of emerging variants



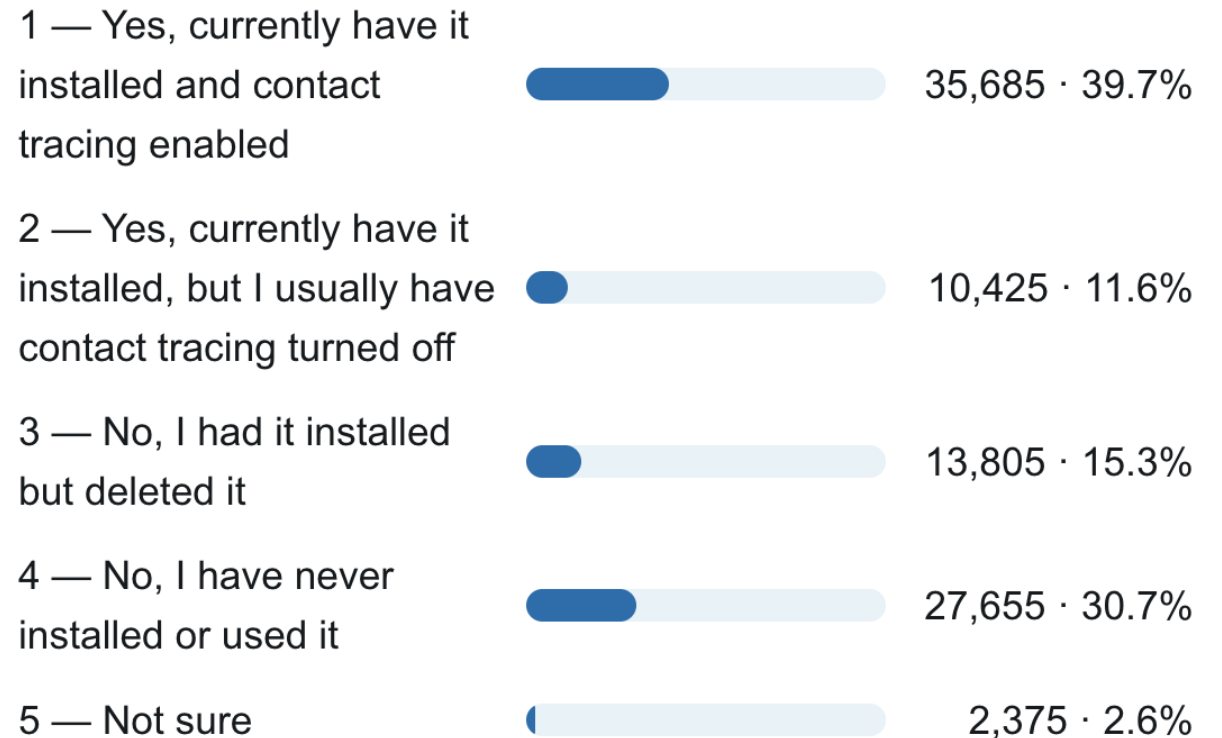
Example: use of NHS COVID-19 app

Data from almost 150,000 people per round about use of NHS COVID-19 app

REACT-1 Round 14 NUMBER

round n = 146,860

Do you currently use the NHS COVID-19 app?

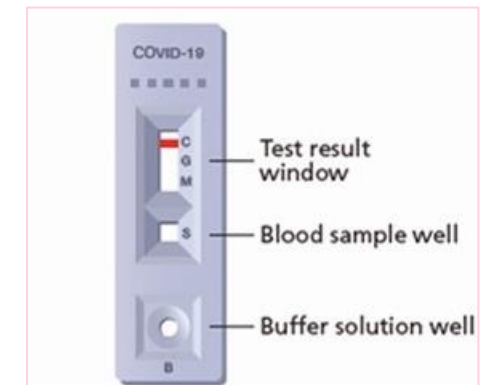


Lessons – 2:

Self-testing for antibodies is acceptable & useful*

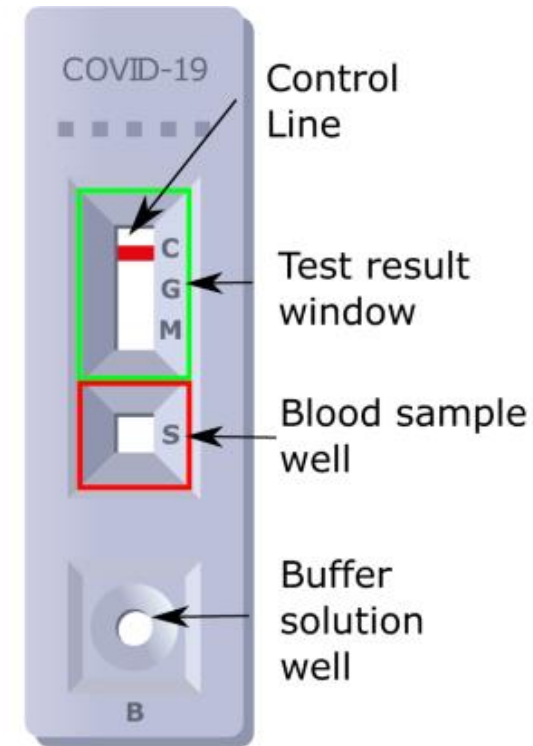
Extensive public involvement and testing in April – May 2020

- 330 public advisors co-designed materials
- Pilot study in 14,400 adults (invited through random sampling)
- Acceptability and usability:
 - >98% of participants attempted test
 - >97% completed test
 - >94% reported a valid result
 - substantial concordance with clinician-read results
- Over 6 rounds of REACT-2 over 900,000 people used the test (~29% response)



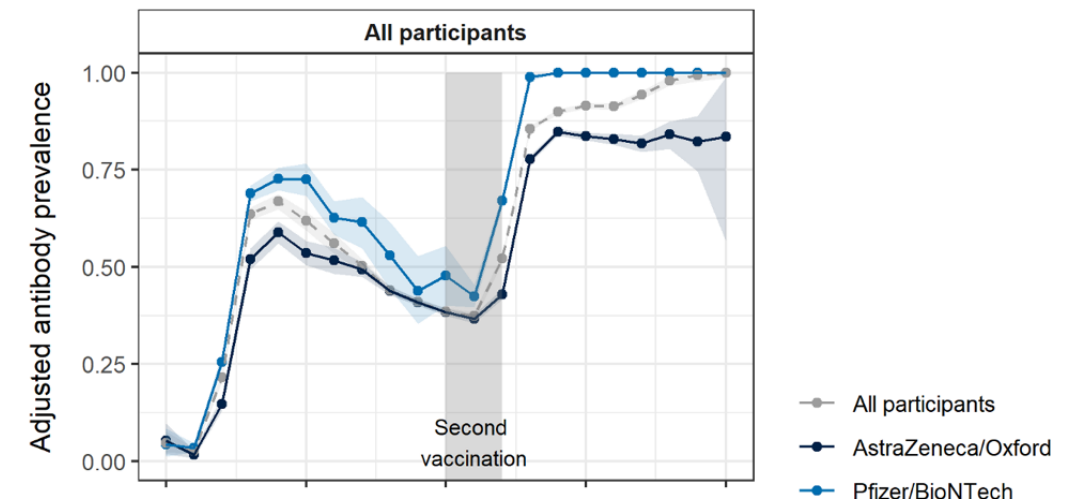
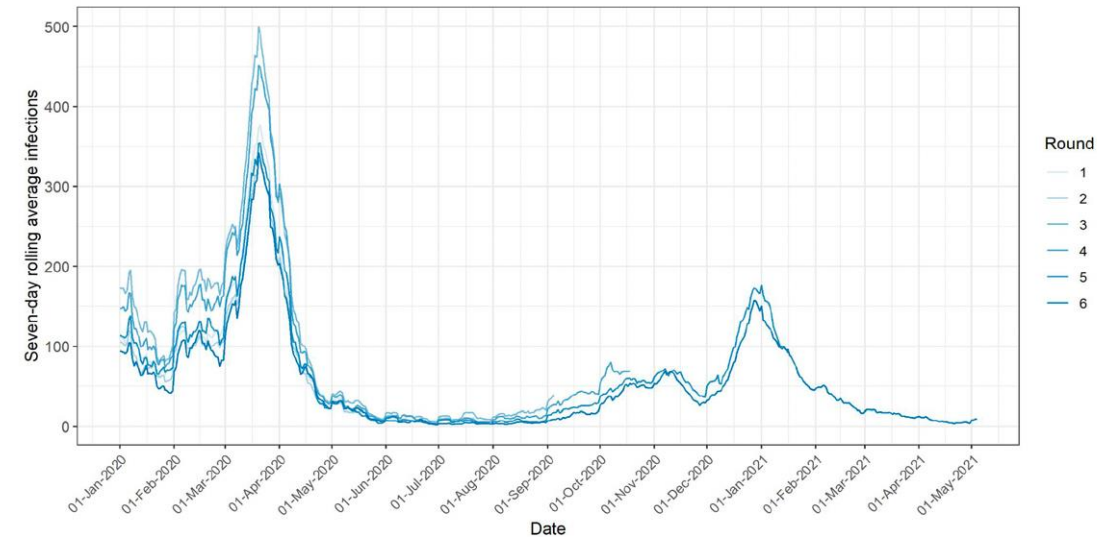
Machine learning to support self-test results*

- Machine learning, computer vision and signal processing algorithms used to develop ALFA (Automated Lateral Flow Analysis) to analyse images of antibody self-test
- Used REACT-2 image library of 595,339 participant-submitted test photographs
- ALFA showed
 - substantial agreement with human experts (Cohen's kappa 0.90–0.97)
 - performed better than study participants, particularly for weak positive IgG results
- Compared to human experts:
 - Specificity 98.7–99.4%
 - Sensitivity 90.1–97.1%



Use of self-testing for antibodies

- When widespread testing not available in the community, REACT-2 provided estimates for
 - numbers of people exposed to the virus in first wave
 - Scale of inequalities in prevalence by age, ethnicity, socioeconomic status, region, employment
 - Overall and stratified case fatality ratio
 - Waning of antibody positivity following infection and vaccination
 - Frequency of persistent symptoms (long COVID)



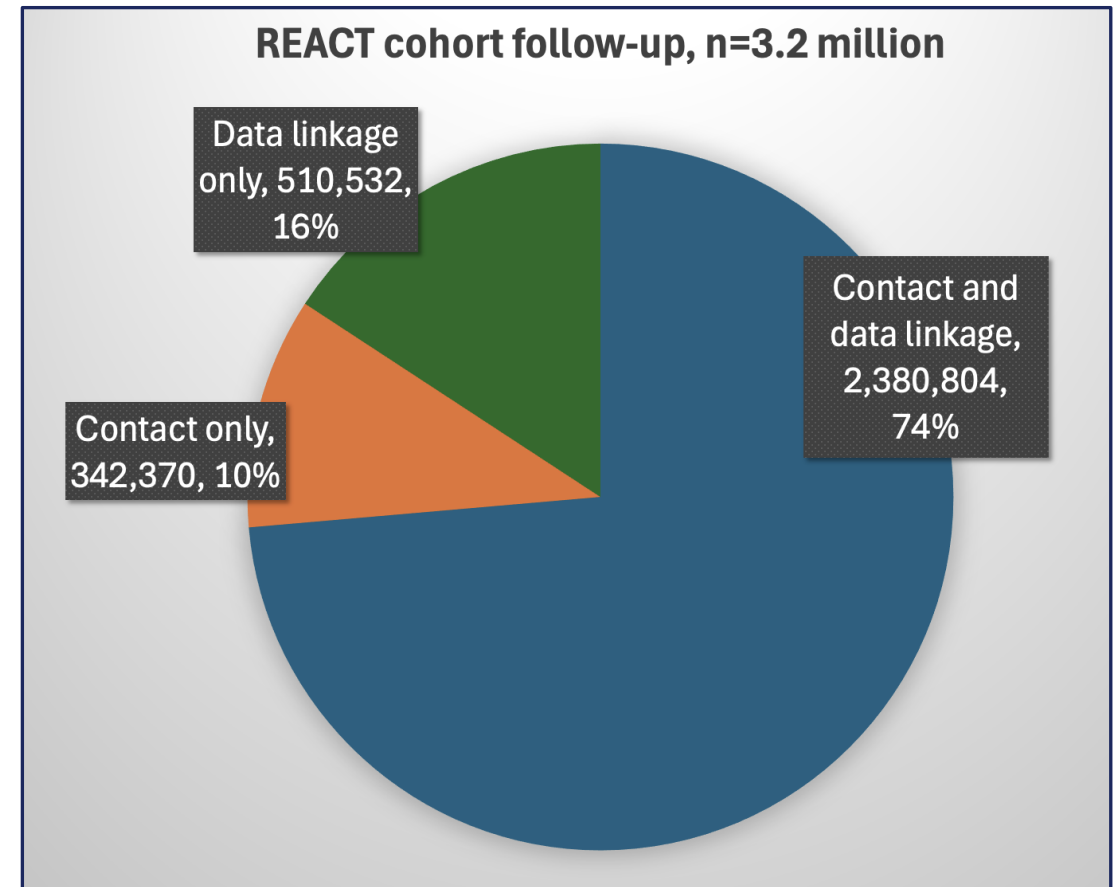
Ward et al [Lancet Reg Health Eur](#) 2021

Ward et al. [Nature Comms](#) 2022

Whitaker et al. [Nature Comms](#) 2022

Lessons - 3: Potential for wider use of REACT

- Data available for analyses of pandemic risks, behaviours, contacts, symptoms, recovery etc.
- 3.2 million people from REACT-1 and -2 in follow-up for 20+ years:
 - linked NHS data
 - periodic surveys & cognitive assessments
- Initial focus Long COVID
- Clinical sub-cohort of 10,500 people



Potential of REACT cohort for rapid surveillance of new threats/ other health conditions

- Consented cohort (or sub-sample) can be rapidly contacted for surveys, testing, invitation to new research. For example
 - Syndromic surveillance of influenza-like illness, up to 40,000 responses per week when added to routine follow-up survey
 - 10,000 people recruited to a Dementia Trials registry for potential inclusion in early treatment trials
 - Follow-up surveys assess medium- and long-term impact of pandemic on health and cognition
 - Monitoring vaccine sentiment over time

A “pandemic ready cohort” - implications for Digital Pandemic Preparedness

- Potential to shift to app-based cohort (currently email/SMS and directed to web)
- Ability to rapidly introduce community surveillance is crucial – an established cohort provides a powerful starting point
- Community and participant involvement has been important in retaining trust and response rates

Conclusion

- Digital tools deployed in robustly designed community studies can provide crucial intelligence:
 - Self- reported symptoms and behaviour
 - Self-collected swabs and self-testing
 - Monitoring of longer-term impacts
- Essential to refresh cohort over time and work to maximise response and minimize participation bias
- Ongoing engagement & involvement of participants keeps the cohort “oven ready” and can be an early test-bed for many digital tools

Thank you!

For further info and collaboration, contact
h.ward@imperial.ac.uk or submit [data](#)
[access form](#)