

# Serosurveillance principles and challenges

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# Summary in advance.

Is herd immunity near?

Corona seroprevalence in donors is an indicator for:

- past infections in population so far.
- level of vaccination so far.

But:

- resp. infections vary: mildly mucosal to severely systemic, antibody responses vary and wane (IgA, IgM, IgG).
- vaccination has different Ab response mechanism (?)

Choose suitable Ab screening assay.

# Antibodies = protection?

When (re-)exposure occurs:

Do past infection and vaccination prevent disease and infectivity?

# Antibodies = protection?

When (re-)exposure occurs:

Do past infection and vaccination prevent disease and infectivity?

**Yes!** (in UK)

see pre-print:

Emma Pritchard et al.:

Impact of vaccination on SARS-CoV-2 cases in the community:

a population-based study using the UK's COVID-19 Infection Survey.

- No relevant disease and no high PCR signals after past infection or after 1 dose of Astra or Pfizer.

# Are donors representative?

Regarding air-borne, snot-borne, food-borne and water-borne infections:

*why not...* but:

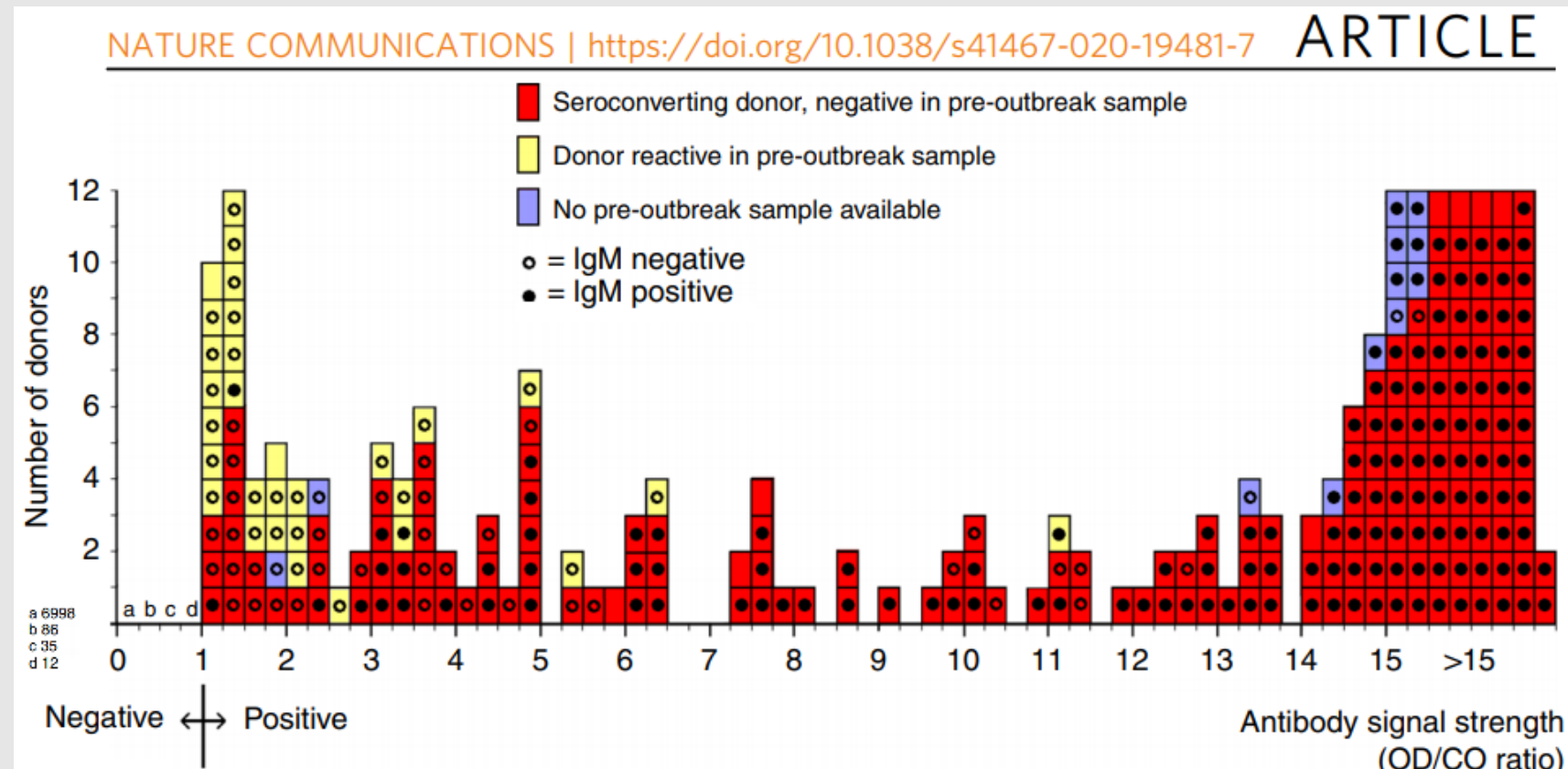
- Donors may be more aware and more compliant with preventive measures.
- Paid plasma donors in poor regions may be more at risk for corona infection.

Sampling:

- Beware of frequent plasma donors recruited *because* of their covid.

# Is your antibody test specific?

- non-specific reactivity
- cross reactivity because of previous human coronavirus-229E, -NL63, -OC43 or -HKU1 infections. (limited serum panels available).

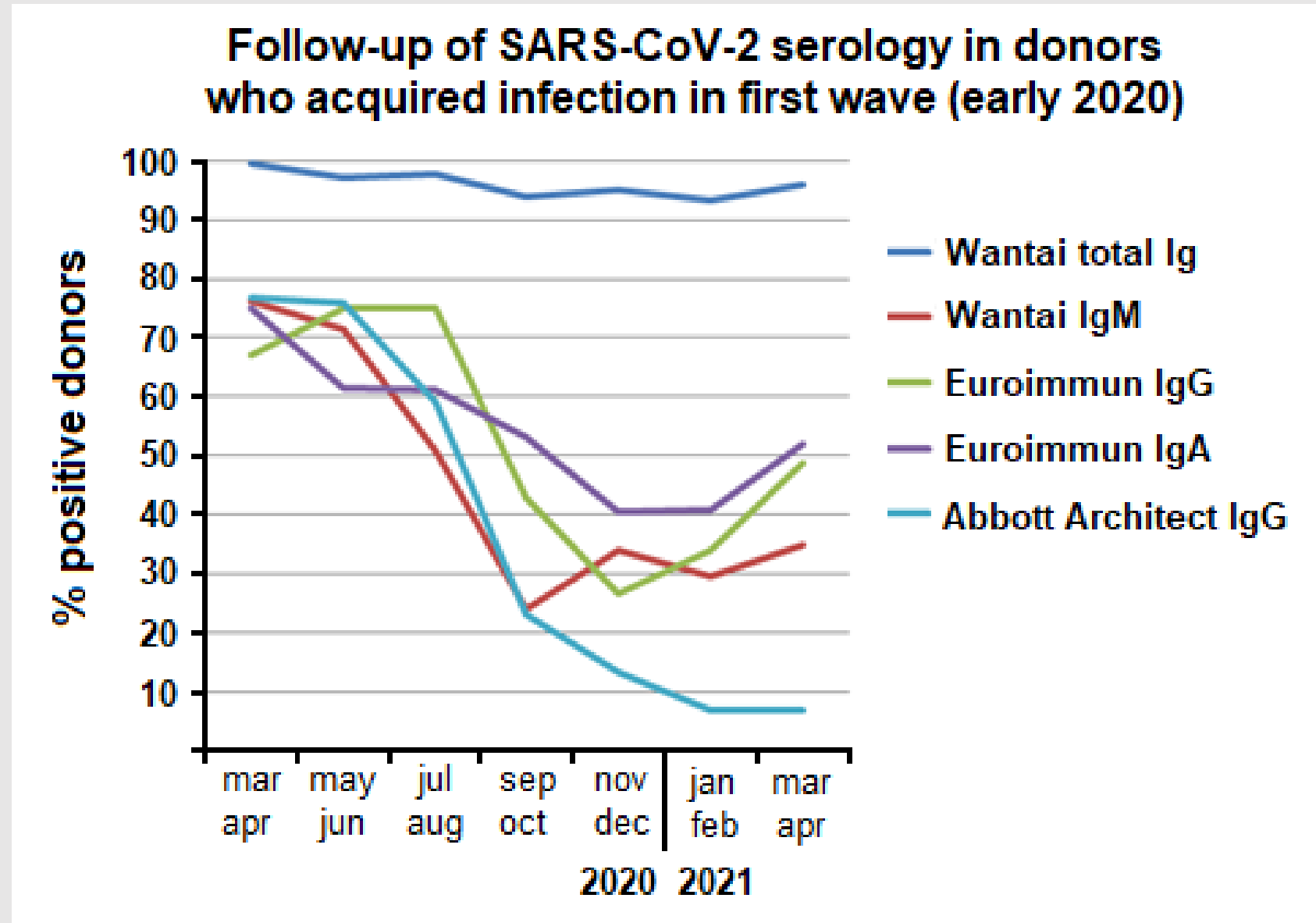


# Is your antibody test sensitive?

Contrary to the serology of 'systemic' viral infections (such as HIV, HBV, HCV, CMV, EBV, VZV, HSV) the serology of respiratory viruses varies widely:

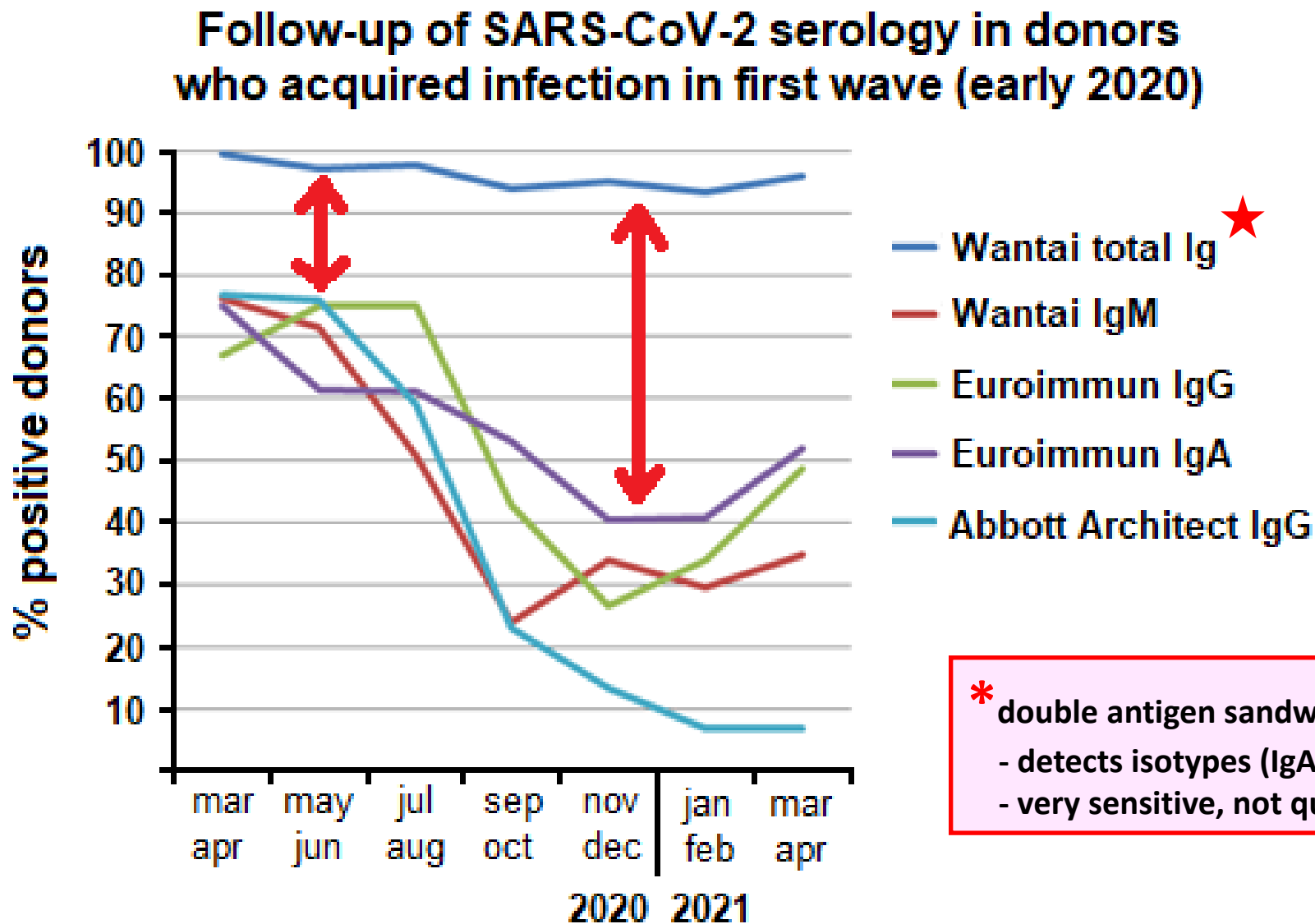
- between individuals and over time.
- different IgA / IgM /IgG responses
- weak, partial and strong responders
- different waning patterns

# Is your antibody test sensitive?



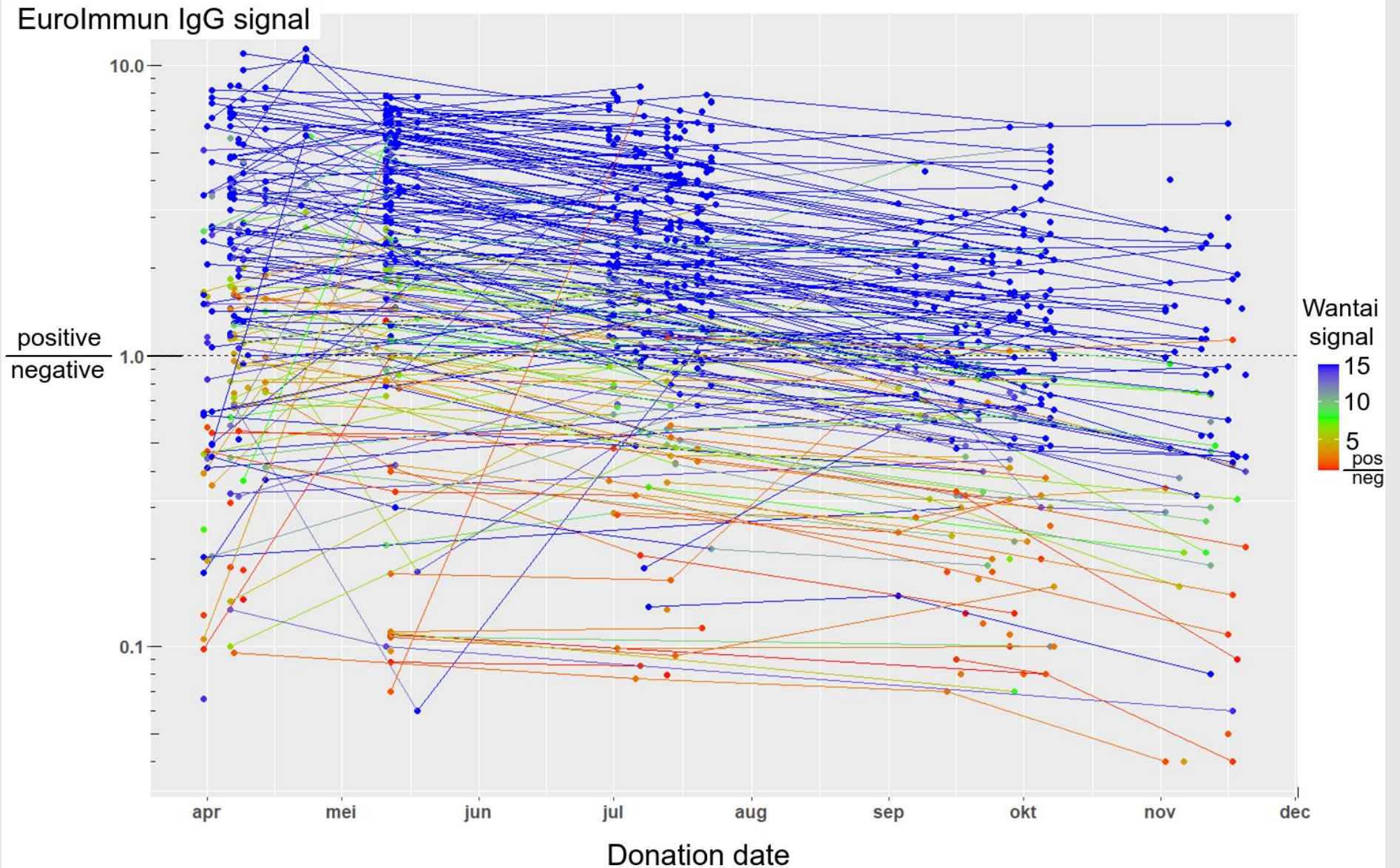


# Is your antibody test sensitive?



# Is your antibody test sensitive?

striking differences  
between EIAs  
for waning  
corona antibodies



# Herd immunity

Let's assume that  $R_0$  of SARS-CoV-2 is 3. (recent meta-analysis: 2,9)

For each infectious person: when at least 2 of 3 bystanders are immune, the corona outbreak spontaneously ends.

Hence at least  $2/3 = 67\%$  immunity is our goal...

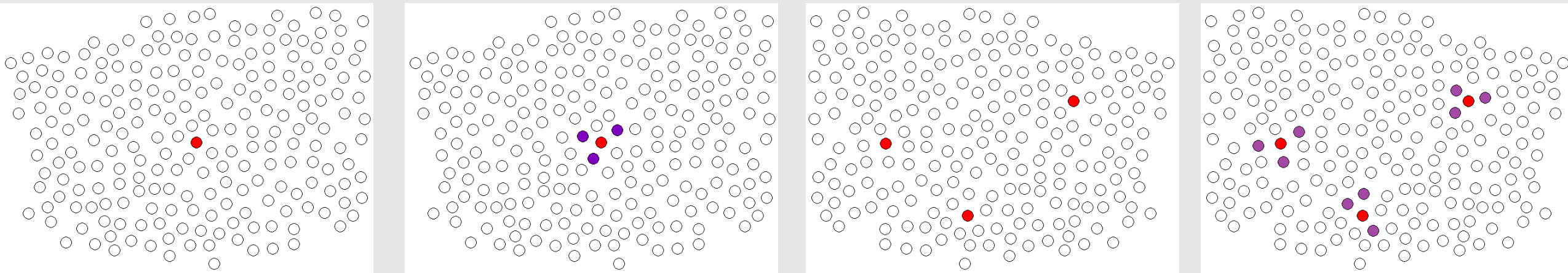
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$R = 3$  :



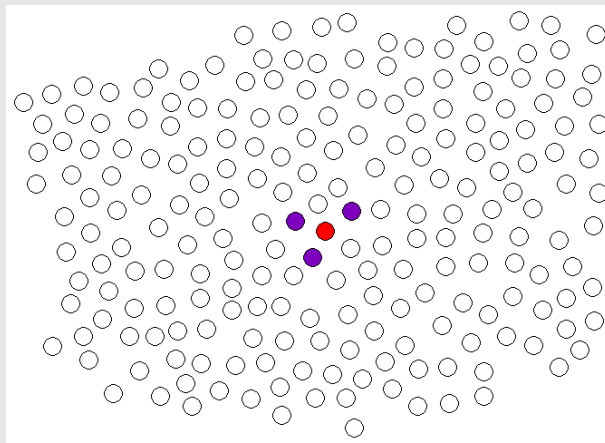
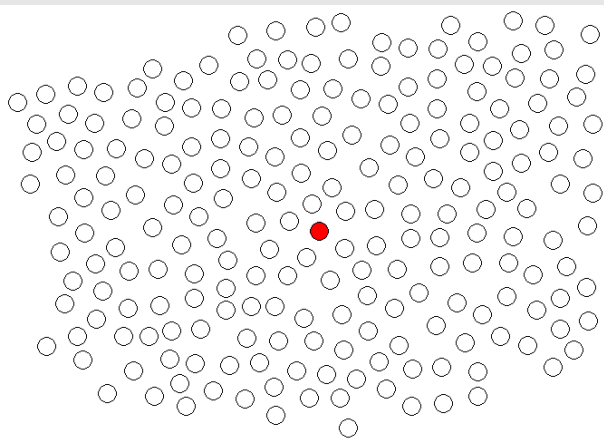
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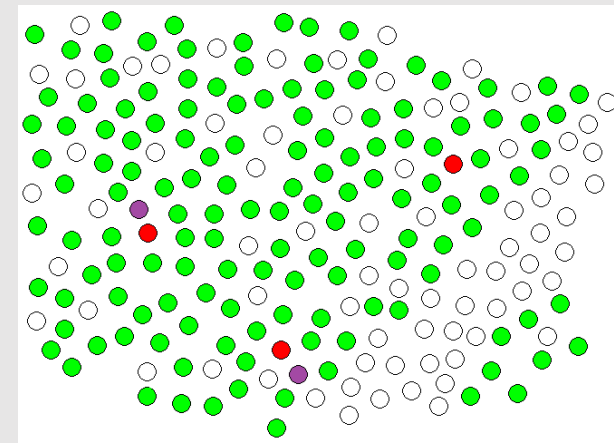
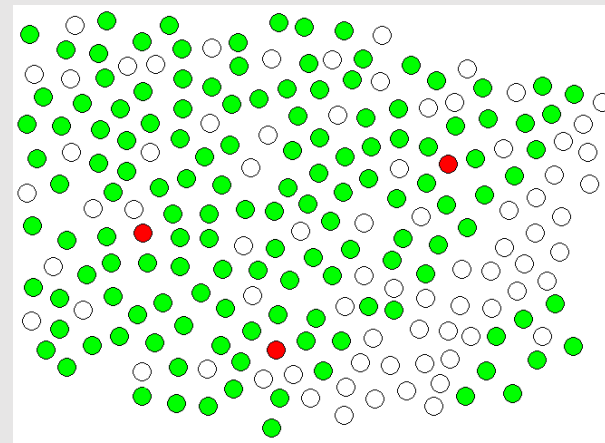
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$R = 3$  :



$R < 1$  :

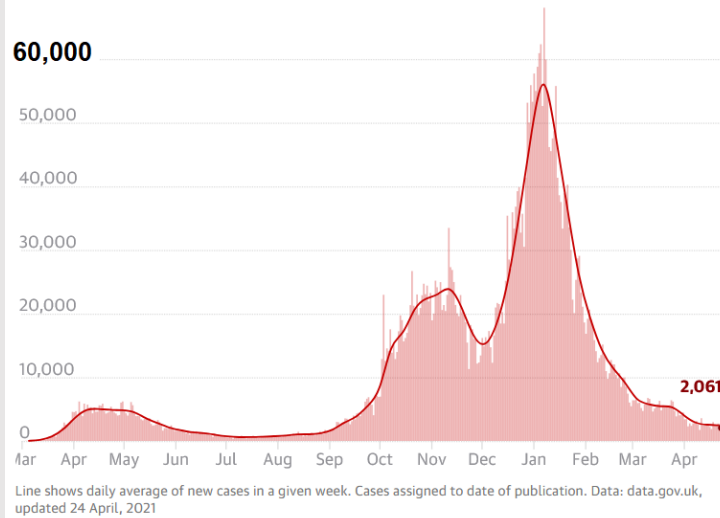


# Vaccination: doable and effective

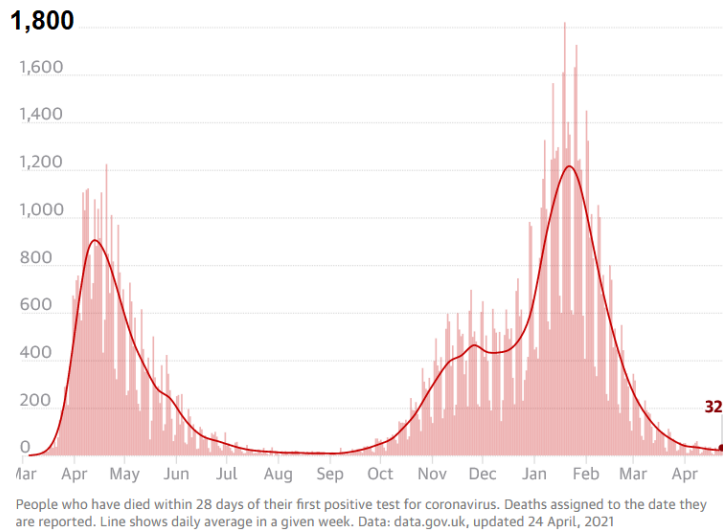
UK:  
from COVID  
drama  
to end of  
lock down.

this lecture is  
prerecorded,  
status dd  
April 24th

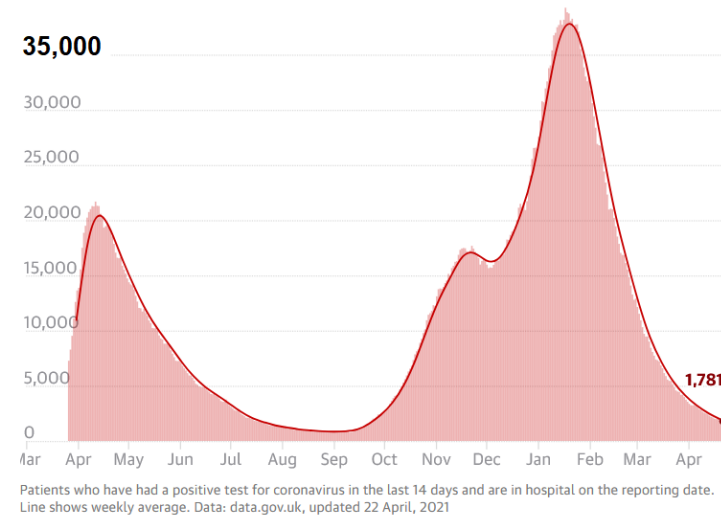
UK: new coronavirus cases per day



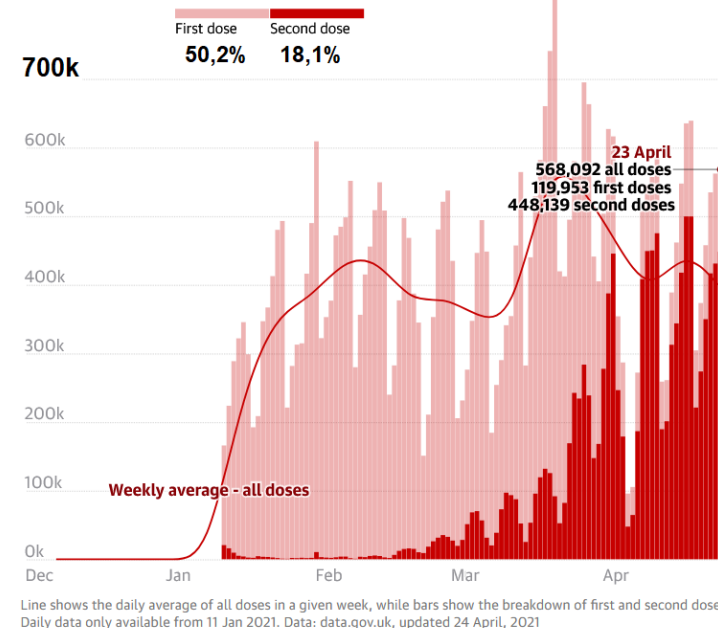
UK: coronavirus deaths per day



UK: people in hospital with coronavirus each day



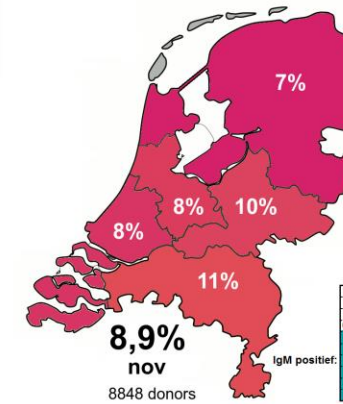
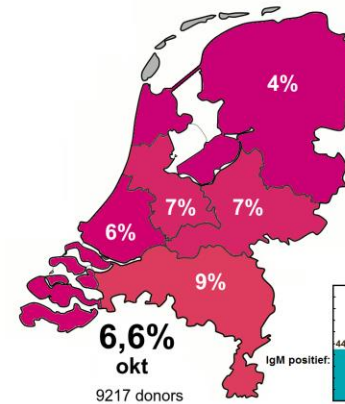
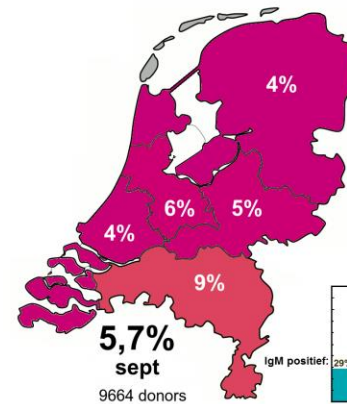
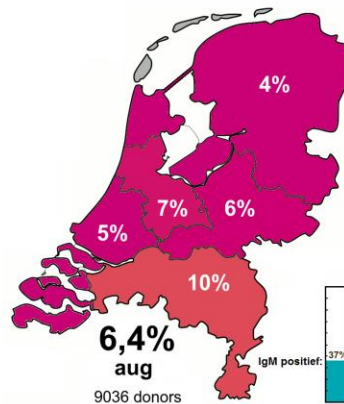
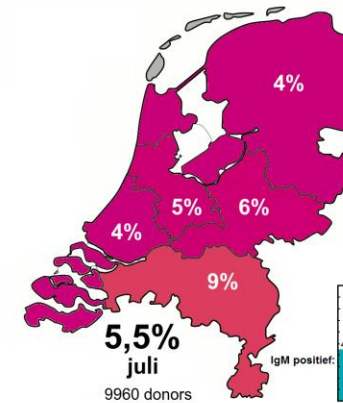
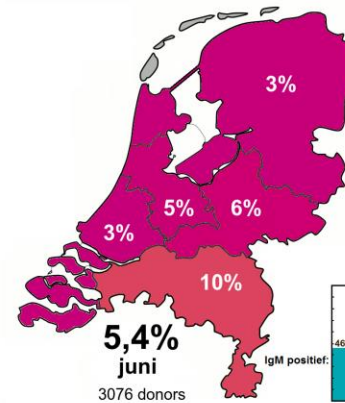
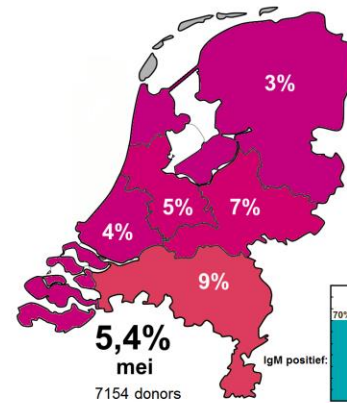
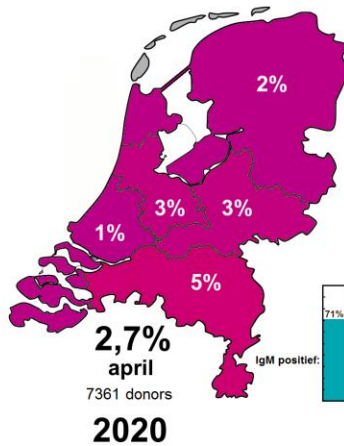
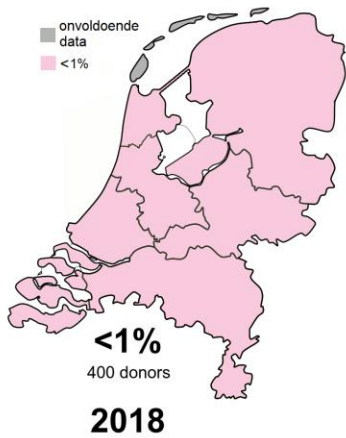
UK: people vaccinated each day



and in  
Holland  
?

hospitals  
still flooded,  
monitoring  
relevant:

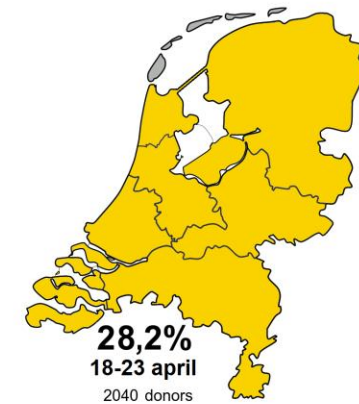
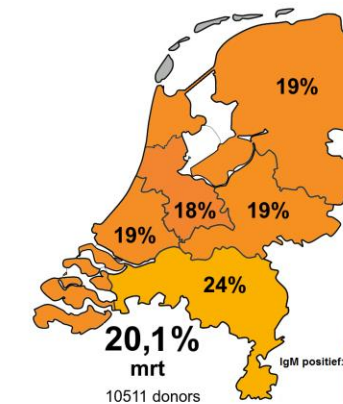
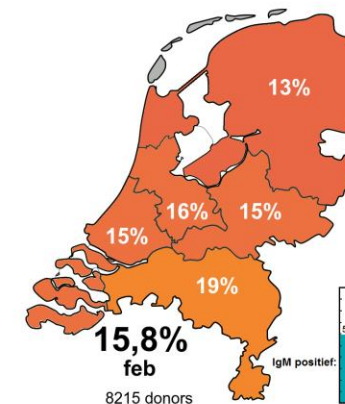
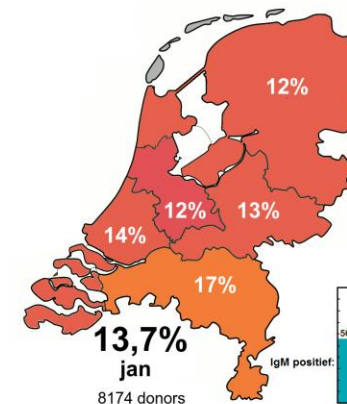
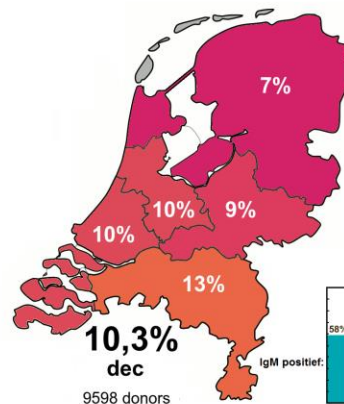




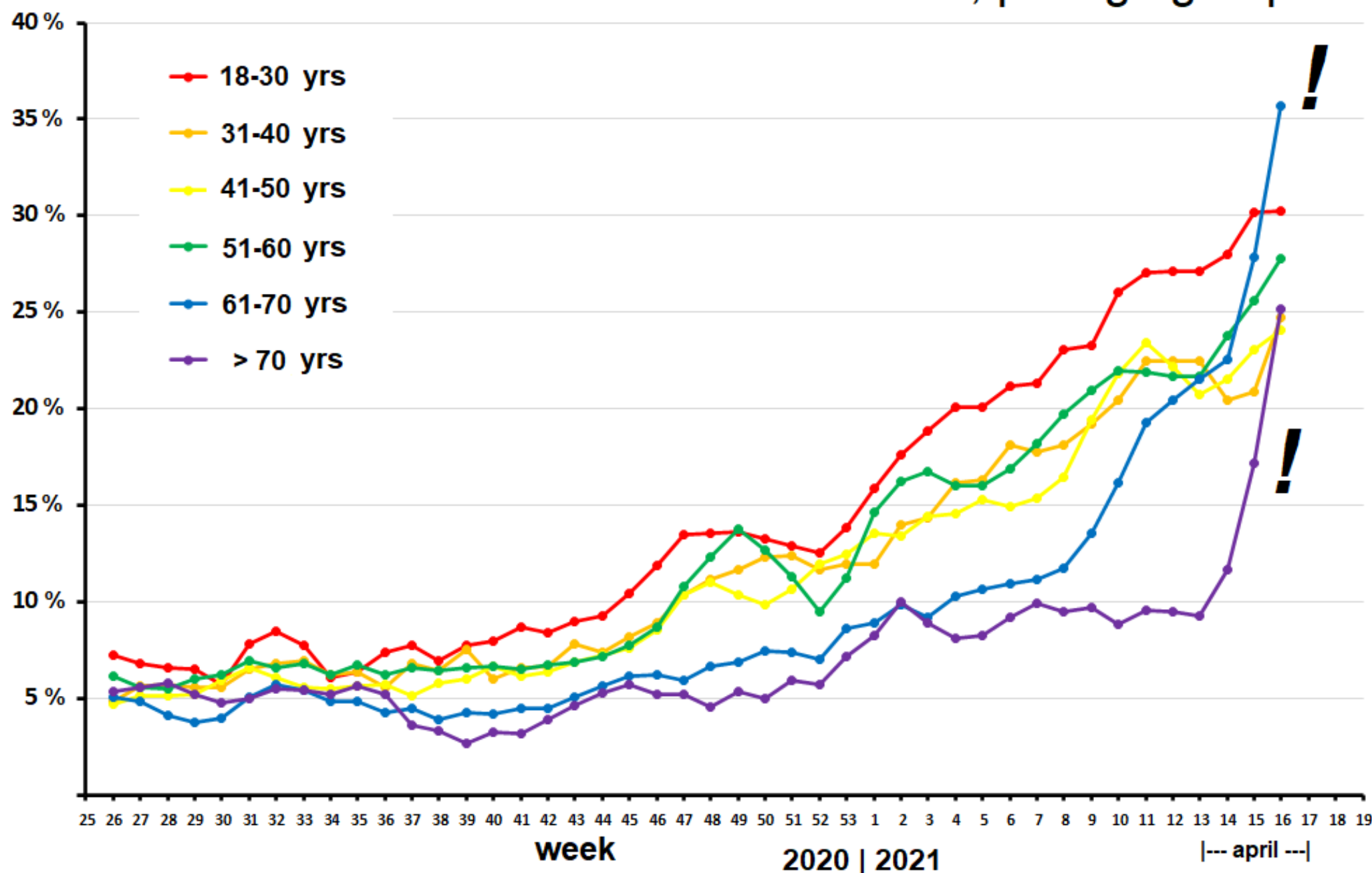
Last week of April:  
finally vaccination takes  
off in Holland too.

corona seroprevalence:  
24% -> 28% in one week

% Sanquin donors  
met antistoffen  
tegen SARS-CoV-2



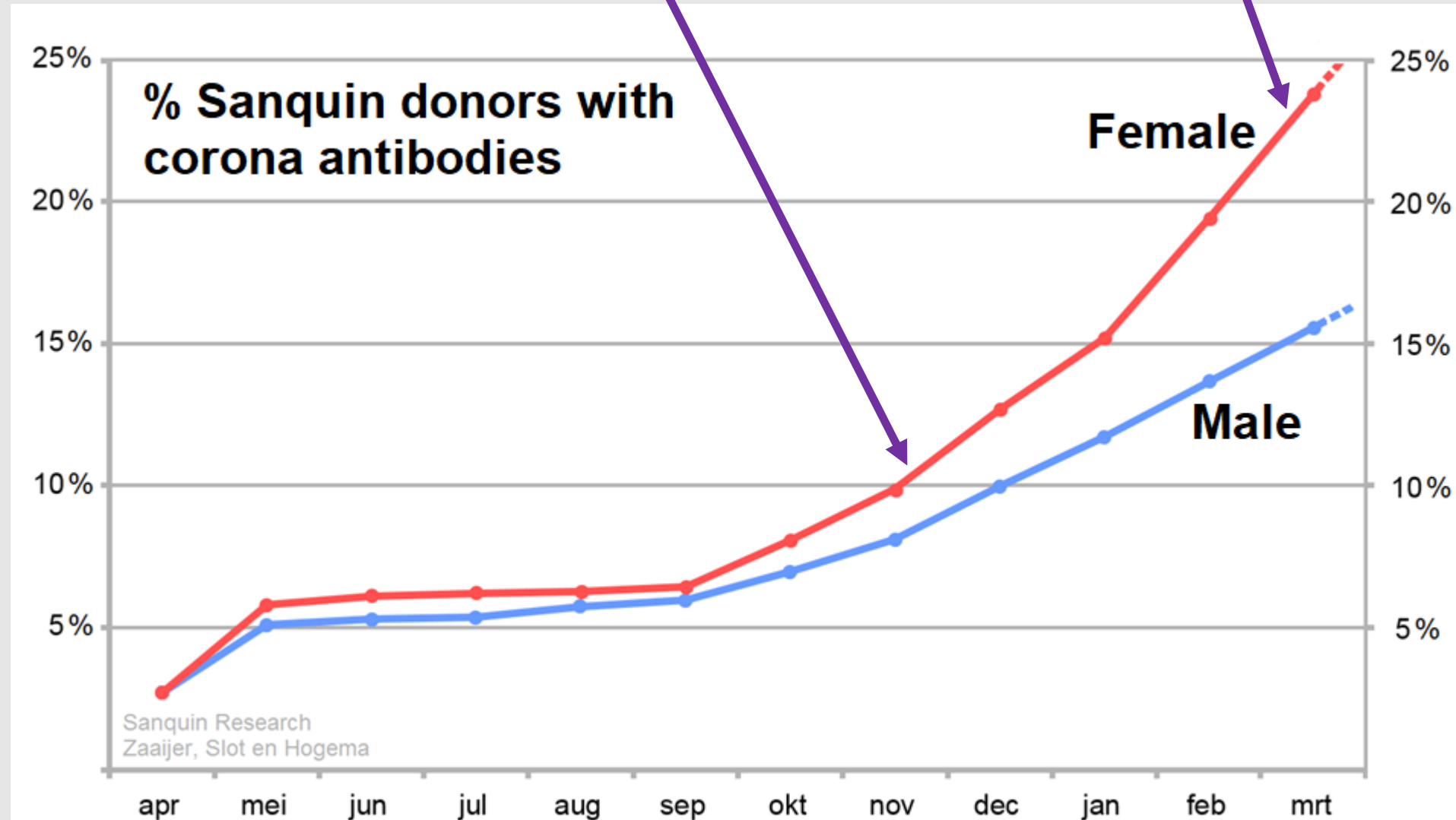
# Coronavirus antibodies in Dutch donors, per age group





Dutch health care workers: 200.000 male and 1.200.000 female.

occupational infections and vaccination



SARS-CoV2 Ab positive  
donations in Holland,  
march/april 2021,  
**preliminary results:**

68% infection  
32% vaccination

Vaccination antibodies:  
77% female donors  
23% male donors

# Differentiation between antibodies after infection and after vaccination

- Corona infections induce spike- and nucleocapsid-antibodies.
- RNA/adenovirus vaccines induce spike antibodies, not nucleocapsid antibodies.  
(Sinovac vaccine = "purified inactivated whole virus" = which antigens ?)

Theoretically you can apply the principle of HBV anti-s and anti-core serology:

anti-spike (RBD)	anti-NC	
pos	neg	= vaccinated
neg or pos	pos	= natural infection

provided that anti-spike and anti-NC remain equally detectable after infection/vaccination.

antibodies  
to spike  
(Wantai)

infection  
or  
vaccination

positive



10

3

1

0.1

1.0

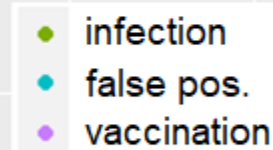
10.0

100.0

positive

antibodies to nucleocapsid (Roche)

natural infection, not vaccination



# Thank you!

Sanquin's FOP team (finger on the pulse):



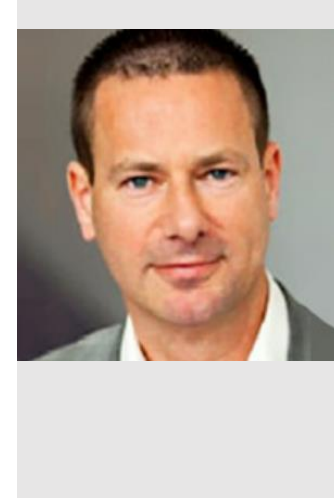
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Boris Hogema  
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Ed Slot  
medical secretary