IgG testing

There is a problem with IgG testing for the SARS-CoV-2 virus in low incidence populations.

Every test has limitations to its sensitivity and specificity. Sensitivity gives the accuracy in terms of identifying those who have truly developed antibodies after exposure and infection with the SARS-CoV-2 virus. Specificity tells how well the test excludes a positive result for those who have not had the infection.

The first problem is that many of these tests may be of low quality and may not have high specificity and sensitivity. Nevertheless, let's assume we get excellent tests with both a sensitivity and specificity of 96 percent. The sensitivity of RT-PCR testing of COVID-19 in an active patient is about 60 to 70 percent. IgG and IgM antibody tests generally are pretty good, but 96 percent would be top notch quality, and we should not assume the tests will really be this good.

Now let's use the excellent test in a population that has been highly exposed to SARS-CoV-2. Say half the population has had the infection, mostly asymptomatic, and 100 people are tested.

	True Positive recovered	True Negative (not exposed)
Test show positive	48	2
Test shows negative	2	48
Total	50	50

Thus, the test will misclassify 4 people; two false positives and two false negatives. Here, 96 percent of those classified as positive really are, so this is reliable and useful information. If those with positive test were truly immune, and could not get or spread the disease, there would be little risk from the two percent false positives as herd immunity would be sufficient from the 96% true positives, to allow easy disease transmission.

Now let's apply the same excellent test to another population; this one where there has only been limited spread of the disease and only two percent of the population is actually immune.

	True Positive recovered	True Negative (not exposed)
Test show positive	2	4
Test shows negative	0	94
Total	2	98

In this population the two true positive cannot be distinguished from the four false positives. Now, two-thirds of those testing positive are not really immune. The tests are only correct less than one third of the time. Testing is worse than useless – even with an excellent quality test.

What can be done?

Use cluster testing. Since this is a highly infectious disease, most family members living with an infected person are at high risk of infection. Robert, who is at low risk of severe disease, thinks he could have been exposed and had asymptomatic disease, but he has been careful to avoid infection. Testing him would give little information. However, he has been staying home with his wife and daughter who have also not had symptoms. If all three are tested, and all 3 test positive, the risk all three *being false-positive* is about one in 25^3, or one in 15,625, rather than one in 25 as it is with a four percent false-positive rate for a test with 96% specificity. Thus, cluster testing can increase the reliability of these tests in lower exposure populations.