Sources of UNCERTAINTY
ESTIMATING THE PREVALENCE OF COVID-19

UNCERTAINTY Estimates have some uncertainty because they do not test the entire population.

What makes a good estimate?

A good estimate is UNBIASED and PRECISE.
Consider three archers aiming for a target:

Archer A is UNBIASED because the average position of all the arrows is the center of the target.

However, you can see they are not precise because the arrows are spread all over the target.

Archer B is PRECISE because all the arrows are close together.

However, they are *biased* because all the arrows landed away from the center of the target.

Archer C is ACCURATE — the arrows are close together *(precise)* and in the center of the target *(unbiased)*.

We design our sampling and estimation plan to try to be like Archer C.
We want our estimates to be close to the true prevalence (unbiased) and have little uncertainty (precise).

Q: CAN WE GET AN EXACT ESTIMATE OF THE PREVALENCE OF COVID-19 IN THE POPULATION?

While that is theoretically possible, it is unlikely because there are various sources of uncertainty.
In TRACE, there are two main sources of uncertainty that we must address.

Sampling Error

Because the sample is a subset of the population, the estimate can differ from actual prevalence *by chance.*

To illustrate, suppose you have a bag with four orange rocks and four black rocks, and you randomly select four rocks.
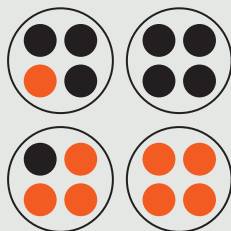
Population

Random Samples

A perfectly representative sample would yield two orange and two black rocks.

But sometimes you'll get three or four of one color, purely *by chance.*

Similarly, a random sample from a population won't always exactly match the characteristics of that population.

The research team can tell you how accurate the estimate is, and estimates of uncertainty (like margin of error) can help provide a range of reasonable values for the true prevalence.

Testing Error

It is possible for a COVID-19 test to return an incorrect result.

False Negatives
The test returns a negative result (no COVID-19) when the person actually does have COVID-19. This is called a *false negative*.

False negative test results are somewhat common. The Oregon Health Authority estimates that one-third of people with COVID-19 will falsely test negative. However, this does not mean that one-third of negative results are incorrect.

False Positives
If the test returns a positive result when the person does not have COVID-19, this is called a *false positive*. False positives are very rare in TRACE and therefore all positives should be treated like true positives.
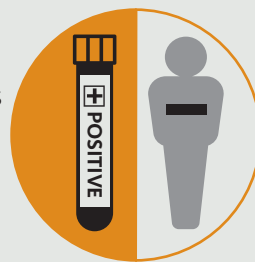
Inconclusive
It is also possible for a test result to be *inconclusive*. This is not an error, but it means that the test was unable to determine whether or not the person has COVID-19.

Prevalence estimates produced from TRACE sampling are mathematically adjusted for the possibility of false negatives and false positives in the test.