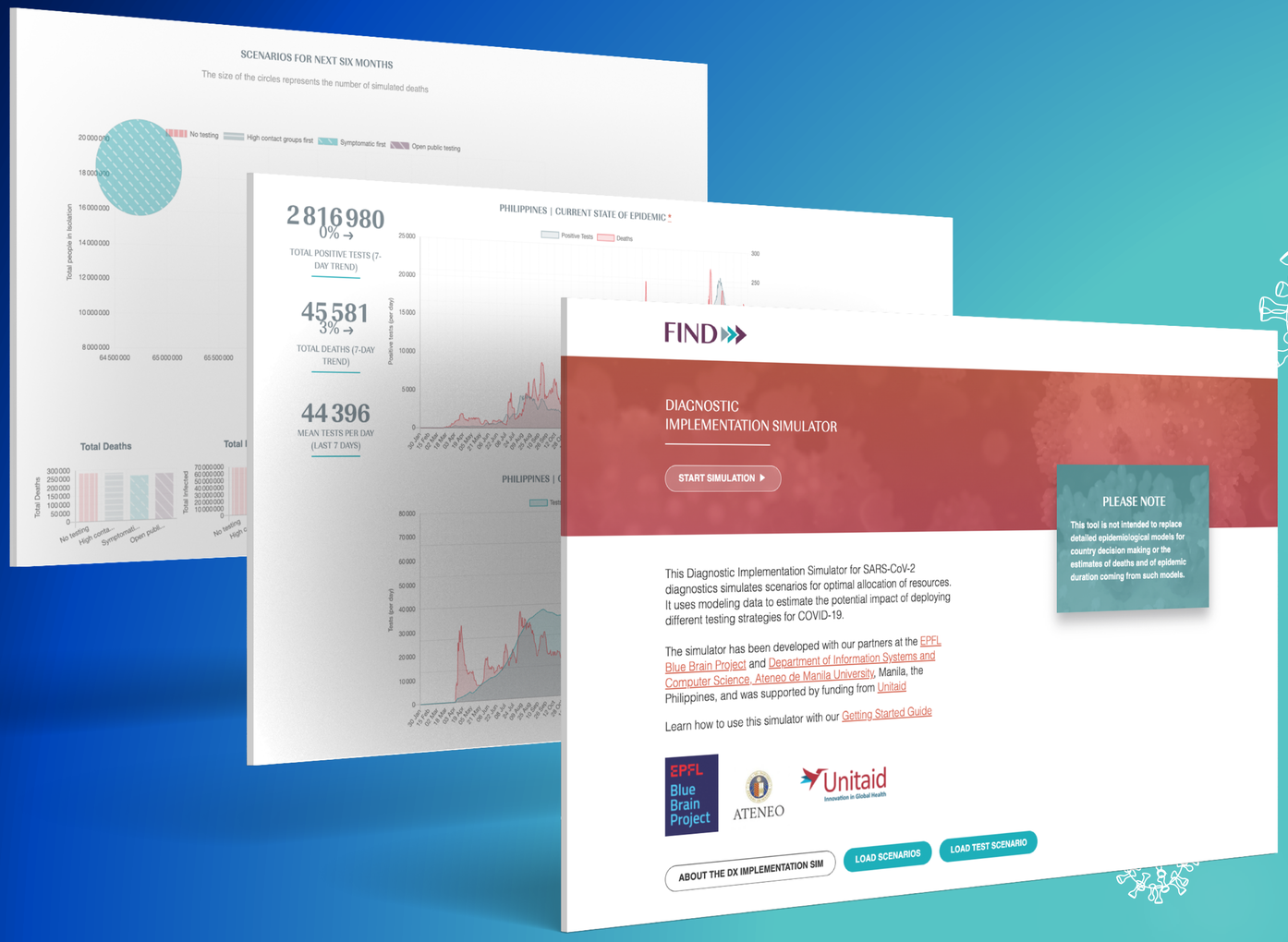
EPFL Blue Brain Project

FIND



User Guide

Diagnostic Implementation Simulator for COVID-19

Getting started with the FIND Diagnostic Implementation Simulator

What can I do with the Simulator?

The FIND Diagnostic Implementation Simulator allows you to explore the interaction between the course of the COVID-19 pandemic in a given country, different kinds of government intervention, and different testing strategies.

The focus of the simulator is on testing. The definition of testing policy calls for many decisions ranging from which kind of test to use, who will be tested, and when. Optimal testing strategies will change based on the way the pandemic evolves. A strategy that is optimal at the height of the pandemic might be less effective at controlling the course of the epidemic at later stages.

Taking a test run

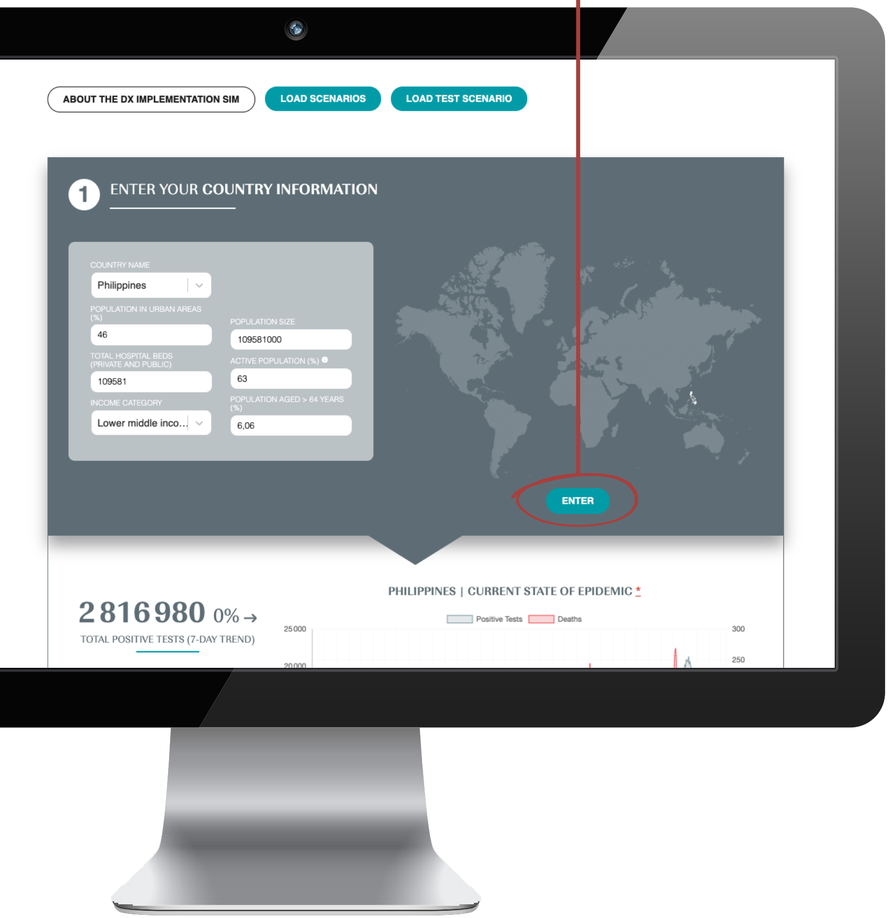
If you have not already done so, ***open the simulator by clicking on this link*** https://www.finddx.org/covid-19/dx-imp-sim/

You will see this page

Click on the button "Load test scenario".
In this example, we will load the data for the Philippines.

① Enter your Country Information

You will see that the system automatically loads some basic country information about the Philippines.



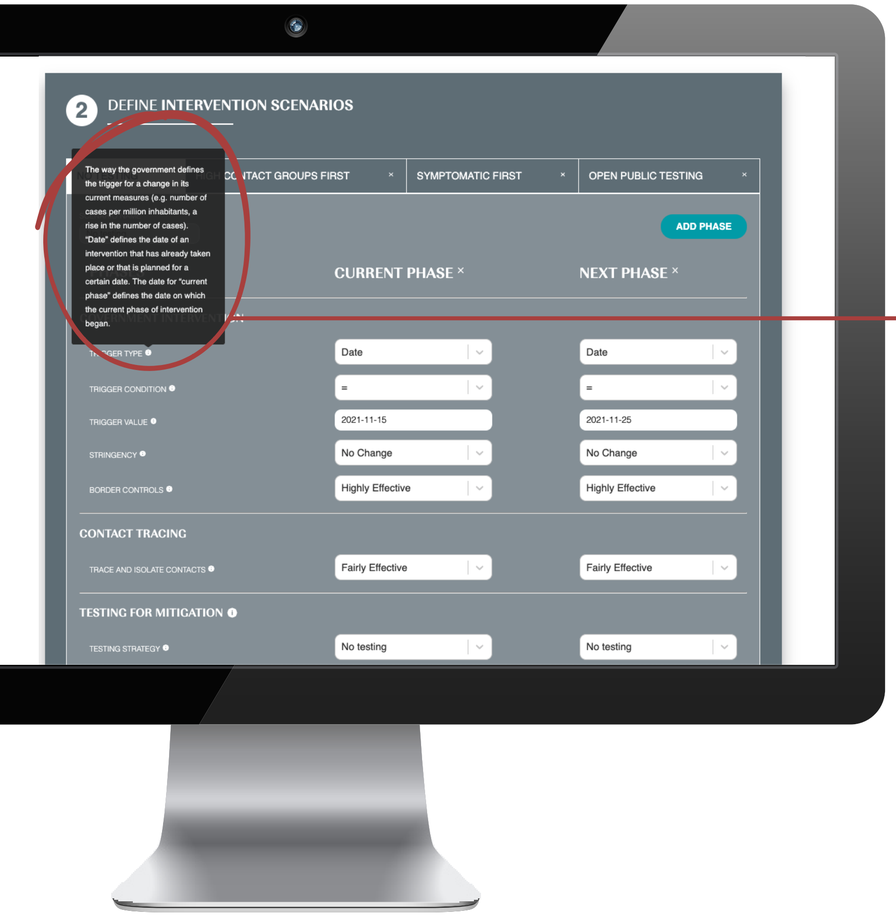
Click ENTER. *You will see a new page showing the current state of the pandemic:* the total number of people who have tested positive since the start of the pandemic, the total number of deaths, the total number of recoveries, the average number of tests per day over the last week, and the percentage change in these numbers over the last week.

The graph on the top right shows how the number of positive tests and deaths have evolved over the course of the pandemic. The graph on the bottom right shows the total number of tests and the number that have given a positive result.

Note: we update the data every day so the numbers you see here will not correspond exactly to those you see when you use the simulator yourself.

② Define Intervention Scenarios

If you scroll down, you will see this screen:



The options on this page allow you to specify government measures and testing strategies for the current phase of the pandemic, the next expected phase, and any additional phases you wish to add. You can change any of the fields for any phase. *If you hover the cursor over the name of the field, you will see a tooltip explaining what it means* ***(see picture on the left).***

However, the test scenario you loaded has already defined some options for the Philippines. To try them out, without changing anything, ***click on "See scenarios"***

③ Select and View Proposed Scenarios

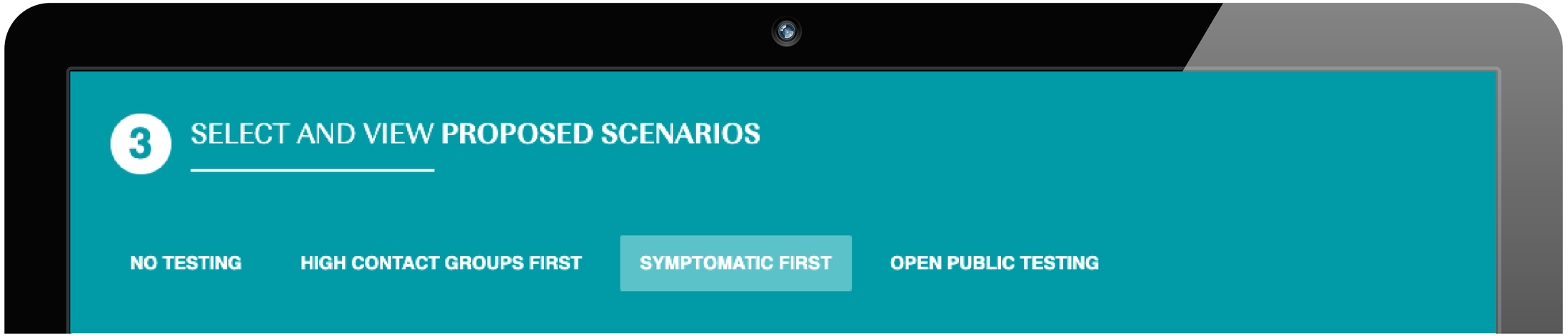
The first tab **(NO TESTING)** simulates the way the pandemic would be likely to develop if there was no testing of any kind.

The second **(HIGH CONTACT GROUPS FIRST)** simulates what would happen if you give priority for testing to people who cannot isolate easily (essential workers, people living in degraded urban areas), regardless of whether they are showing symptoms or not.

The third **(SYMPTOMATIC FIRST)** simulates a policy that gives priority to people showing symptoms.

The last tab **(OPEN PUBLIC TESTING)** simulates testing given on a “first come first served basis” where tests are offered to anyone who asks for one.

The panel that now appears simulates the results of four scenarios based on four different test policies (shown in the tabs at the top of the panel).



The first panel below the tabs compares the effects of the four scenarios. In the **“bubble graph”** at the top of the panel, the size of the bubbles shows the total number of deaths expected with each policy.

The positions of the bubbles from left to right show how many people are infected; the positions from top to bottom shows how many are isolated.

The **“bar graphs”** at the bottom of the page provide another view of the total number of deaths and infections forecast for each scenario. They also provide information on the maximum number of people infected or isolated over the course of the pandemic. This is an indication of the pressure on the public health system.

The simulator assumes current levels of vaccination and vaccination effectiveness. Government policies are assumed constant unless otherwise specified.

The simulator does not model changes in population behavior in response to increases and decreases in cases and deaths (e.g. increased or decreased social distancing). Where cases are rising rapidly, spontaneous social distancing can slow down or halt the rise, even in the absence of government regulation; when they are falling, more relaxed behavior can produce the opposite effect. In the first case, the simulator will over-estimate the number of cases and deaths. In the second case, they will be under-estimated.

Additional graphs provide data on the total number of tests conducted per day ***(1)*** , an estimate of R_eff (the effective reproduction number) - an indicator used by epidemiologists which represents the number of secondary infections caused by each primary infection ***(2)***, and an estimate of the country prevalence (the total proportion of the country's population that have been infected with the disease since the beginning of the pandemic) ***(3)***.

The last graph ***(4)*** uses the simulator to estimate the effects of four levels of testing: no testing (0x), the actual level of testing today (1x), double the level of testing today (2x) and triple the level of testing today (3x). The simulations cover the period from today's date until 180 days in the future. The results are expressed in terms of lives saved compared to "no testing".

Finally a table ***(5)*** reports the number of tests that would be needed to conduct a so-called seroprevalence study in order to find out how many people are infected in a certain number of subgroups (e.g. 5 age-groups). The number of tests is estimated to provide 95% confidence that the level of seroprevalence estimated from the sample is within one percentage point of the true current figure for the population of that country.

Using the simulator

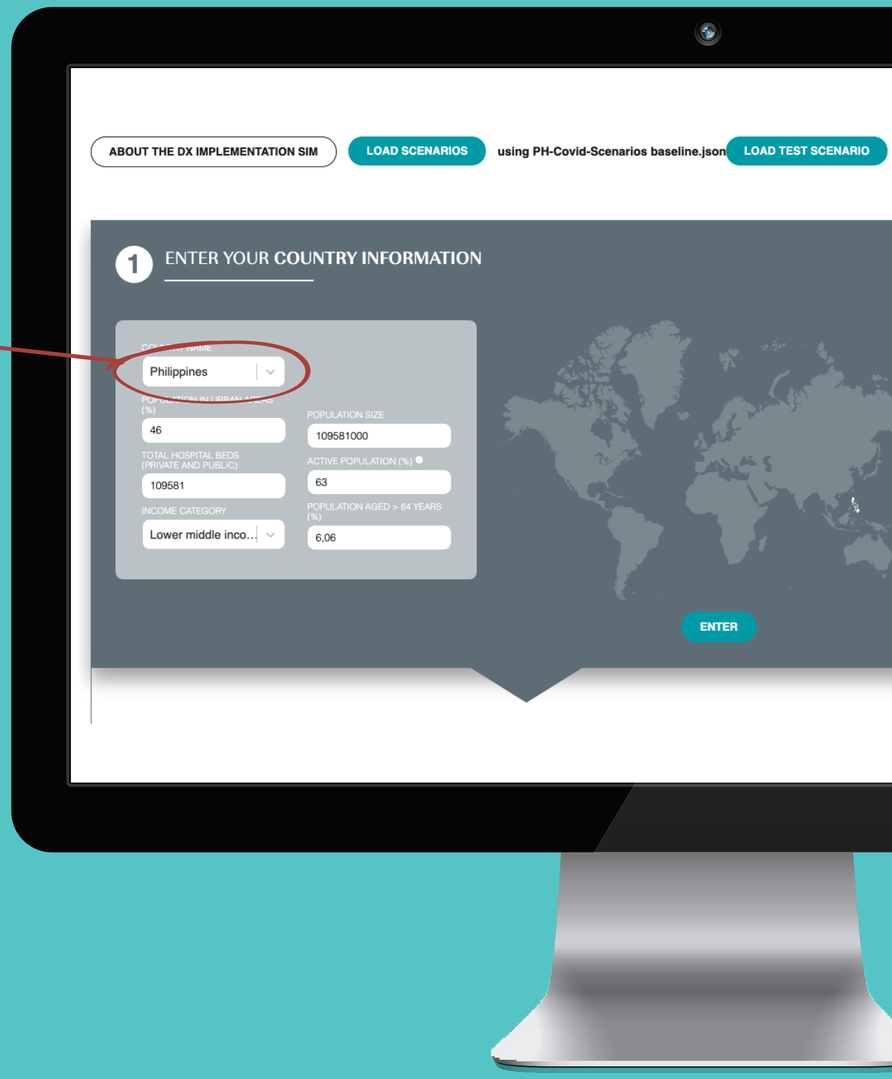
To use the simulator yourself, begin by choosing the country that interests you using the top left-hand field in Panel 1.

The simulator will fill in most of the values automatically. A few countries lack data for hospital beds. Please use national data to fill in this field if it is left empty.

When you are ready, ***click ENTER***, look at the data for the current state of the pandemic, go to the next panel and set the start of the current phase to today's date. Then ***click on "See Scenarios"*** at the bottom of the page.

The system will display results for each scenario, based on the "default values of the parameters" in Panel 2. ***Go to the tab for SYMPTOMATIC ONLY*** and note down the number of deaths associated with this scenario.

This estimate will probably not correspond to the actual data. To accurately simulate the situation in your country of choice, you will need to define your own scenario, which replicates the policies in place in that country.

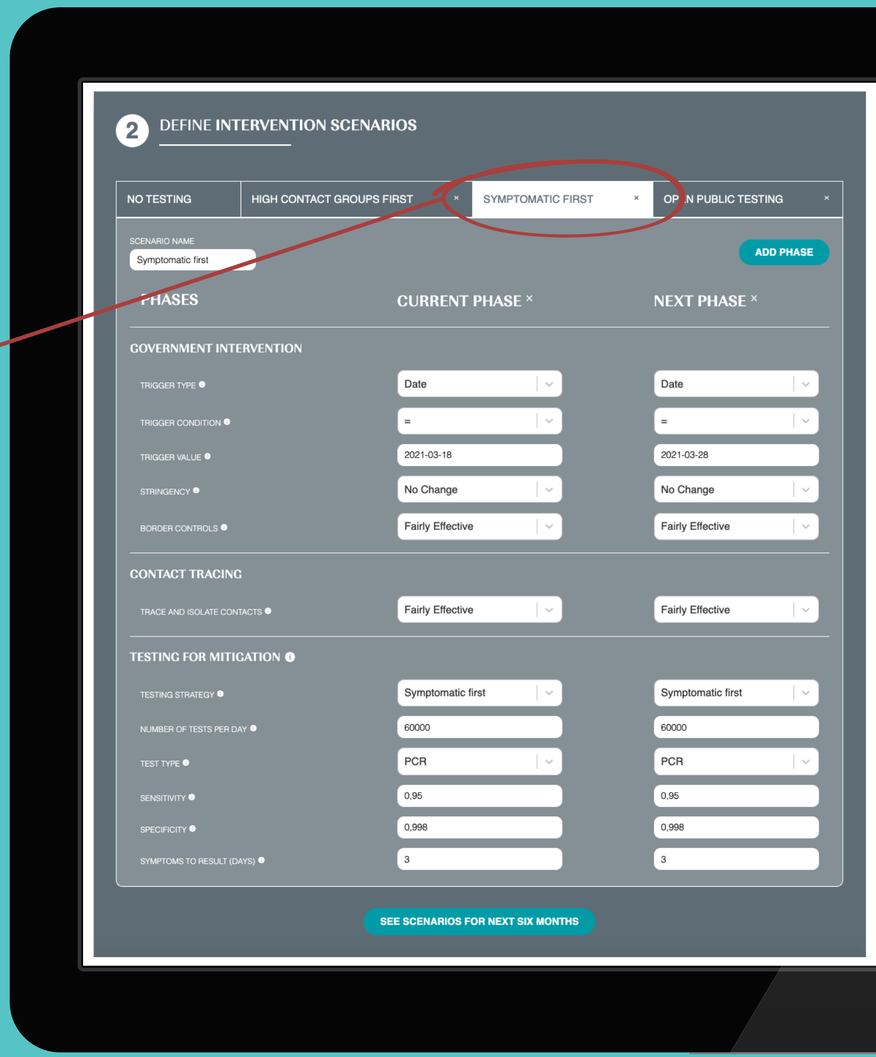


Defining a new scenario

To define a new scenario, you will need to set the parameter values in Panel 2.

Let us define the parameters for just the scenario **(SYMPTOMATIC FIRST)** where people with symptoms of COVID-19 are the first in the queue for testing.

To do this ***click on the tab SYMPTOMATIC FIRST.*** When you click on it, the tab will turn white, showing this is the active scenario.



Simulating a milder intervention

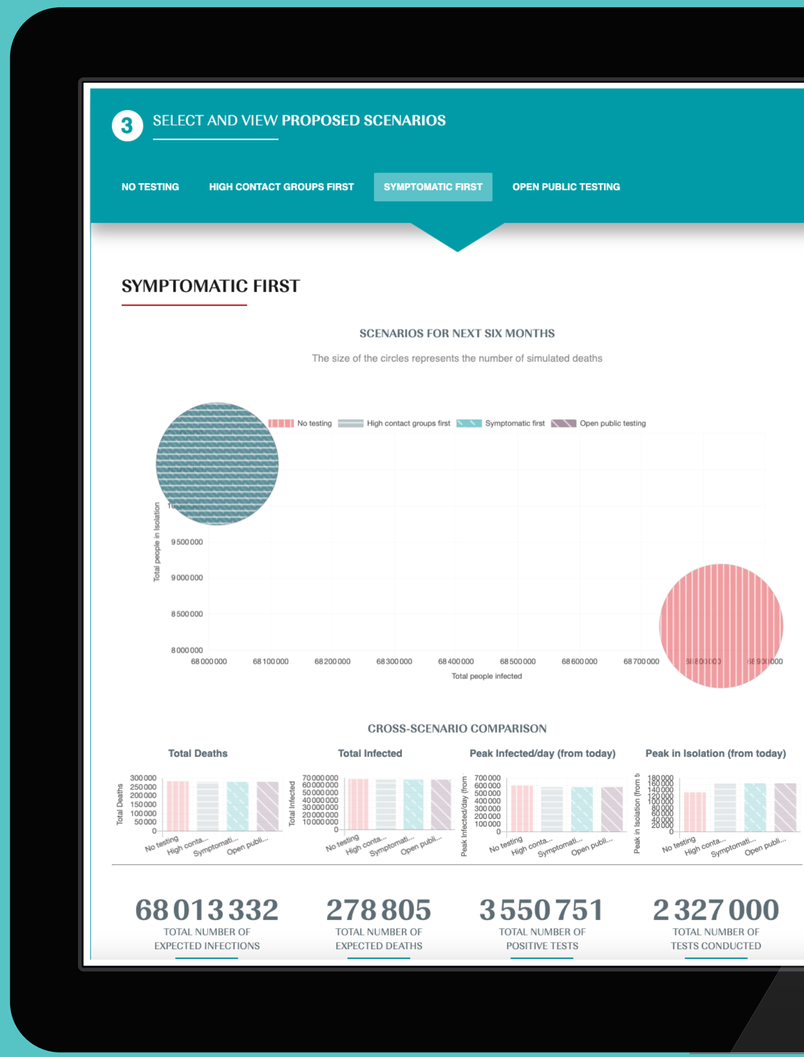
One critical factor determining the dynamics of the pandemic in your country is the effectiveness of government intervention. This depends on several factors: in particular the **“stringency”** of the rules the government imposes, and the degree to which the population follows the rules.

The FIND Diagnostic Implementation Simulator allows you to simulate what happens when there is a major or minor tightening, or loosening of current restrictions.

In our test scenario we assumed no change in government restrictions.

Now we can simulate the likely course of the epidemic if government restrictions are slightly loosened.

The number of deaths increases dramatically.

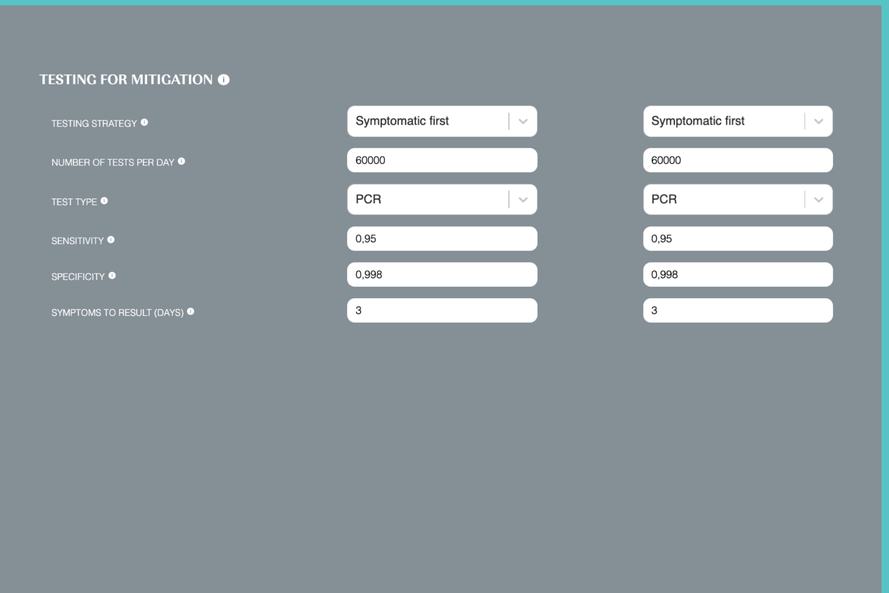


Exploring other scenarios

Different testing strategies

The FIND Diagnostic Implementation Simulator allows you to simulate what would happen if the government of a country changed its current testing policy. For instance, we could explore what could happen with an increase or decrease in the number of tests performed each day, the use of tests with higher or lower sensitivity or specificity than those currently in use, an improvement in contact tracing, or a reduction in the time taken to book a test and obtain the results.

To simulate the effects of such measures, use the Testing for Mitigation Panel shown here



To explore other scenarios, you will need to change the values of one or more of the other fields. The best way of proceeding is to change one field at a time. Below, you will find a quick summary of what you can do with the different fields.

For more information use the tooltips you will find if you hover the cursor over a specific field.

Number of tests per day: this is the number of tests conducted each day for purposes of mitigation (i.e. to detect and isolate infected people capable of infecting others). Use national data to find a realistic value for this field.

Test type: this is the type of test you are using for mitigation testing (tests for care, seroprevalence studies and surveillance studies may use different types of test).

Sensitivity: sensitivity is a technical term, describing as a percentage the ability of a test to correctly identify the proportion of people with an infection. Different types of test have different levels of sensitivity. Many modern COVID-19 tests offer a sensitivity of at least 95% under laboratory conditions. The sensitivity of rapid tests may be lower.

Specificity: specificity is a technical term, describing as a percentage the ability of a test to correctly identify people without an infection. Most COVID-19 tests offer extremely high levels of specificity. Most false positives are due to sample contamination or laboratory errors.

Symptoms to results: this corresponds to the average time, in days, between the first appearance of COVID-19-like symptoms and the availability of a test result. The longer this interval, the greater the possibility that an infected person will infect other people, while still unaware of their status. Results that become available 10 or more days after the appearance of symptoms make little or no contribution to epidemic control.

Different interventions

Stringency: The simulator allows you to simulate different kinds of government intervention: a major tightening of restrictions, a minor tightening of restrictions, no change, a minor loosening of restrictions, a major loosening of restrictions. It is also possible to simulate the impact if previously imposed restrictions are reversed. Note that in some cases, small changes can make a big difference to the dynamics of the pandemic. For instance, a small increase in stringency can make the difference between run-away growth in infections and a slow reduction leading towards complete suppression.

Border controls: The simulator allows you to select the level and effectiveness of border controls imposed by the government.
This field offers three options: “Not effective”, “Fairly effective”, “Highly effective”.

Trace and isolate contacts: tracing and isolation of the contacts of people who test positive multiplies the effectiveness of testing. When government intervention is already highly effective, contact tracing can make an important contribution to the total suppression of infection.
This field offers three options: .“Not effective”, “Fairly effective”, “Highly effective”.

Timing of government intervention

Trigger type: In the scenarios we have looked at so far, each phase of the pandemic starts on a specific date. But sometimes governments change their policies (and start a new phase) based on indicators of the way the pandemic is progressing. The trigger type field allows you to choose from six types of trigger.

Trigger value: The trigger value field allows to define a value that will trigger a new phase. For example to ask the system to begin a phase of more stringent intervention when the rate of positive testing reaches 10% you can choose the options shown on the right.

The other trigger types work in the same way.