EPFL Blue Brain Project

FIND Because diagnosis matters

User Guide

Diagnostic Simulator

for COVID-19 Policy Makers

Getting started with the FIND Diagnostic Simulator

What can I do with the simulator?

The FIND diagnostic simulator allows you to explore the interaction between the course of the COVID-19 pandemic in a given country, more or less effective government measures, 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*** 35.156.75.160:8081/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 France.

① Enter your Country Information

You'll see that the system automatically loads some basic country information about France.

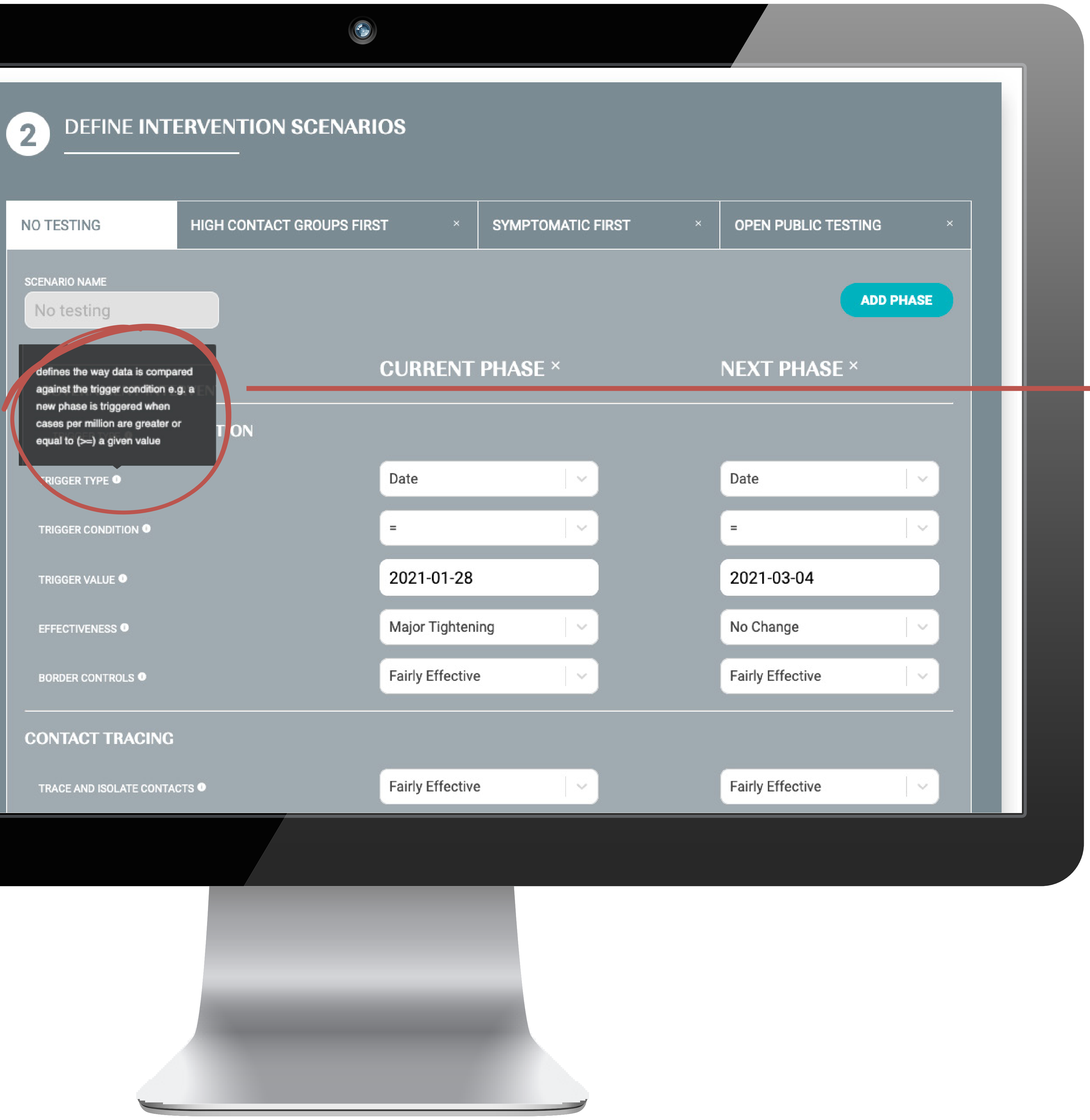
***Click ENTER.** You will see a new page showing the current state of the pandemic:* the total number of people who have tested positive since the start of the pandemic, the total number of deaths, the total number of recoveries (this data is not available for France), and the percentage change in these numbers over the last week. You will also see a score for the effectiveness of recent government intervention in reducing the current death rate.

The score is expressed on a scale from 0 to 1 where 0 is equivalent to a complete absence of government intervention and 1 represents the most effective intervention possible, from a public health perspective. 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.

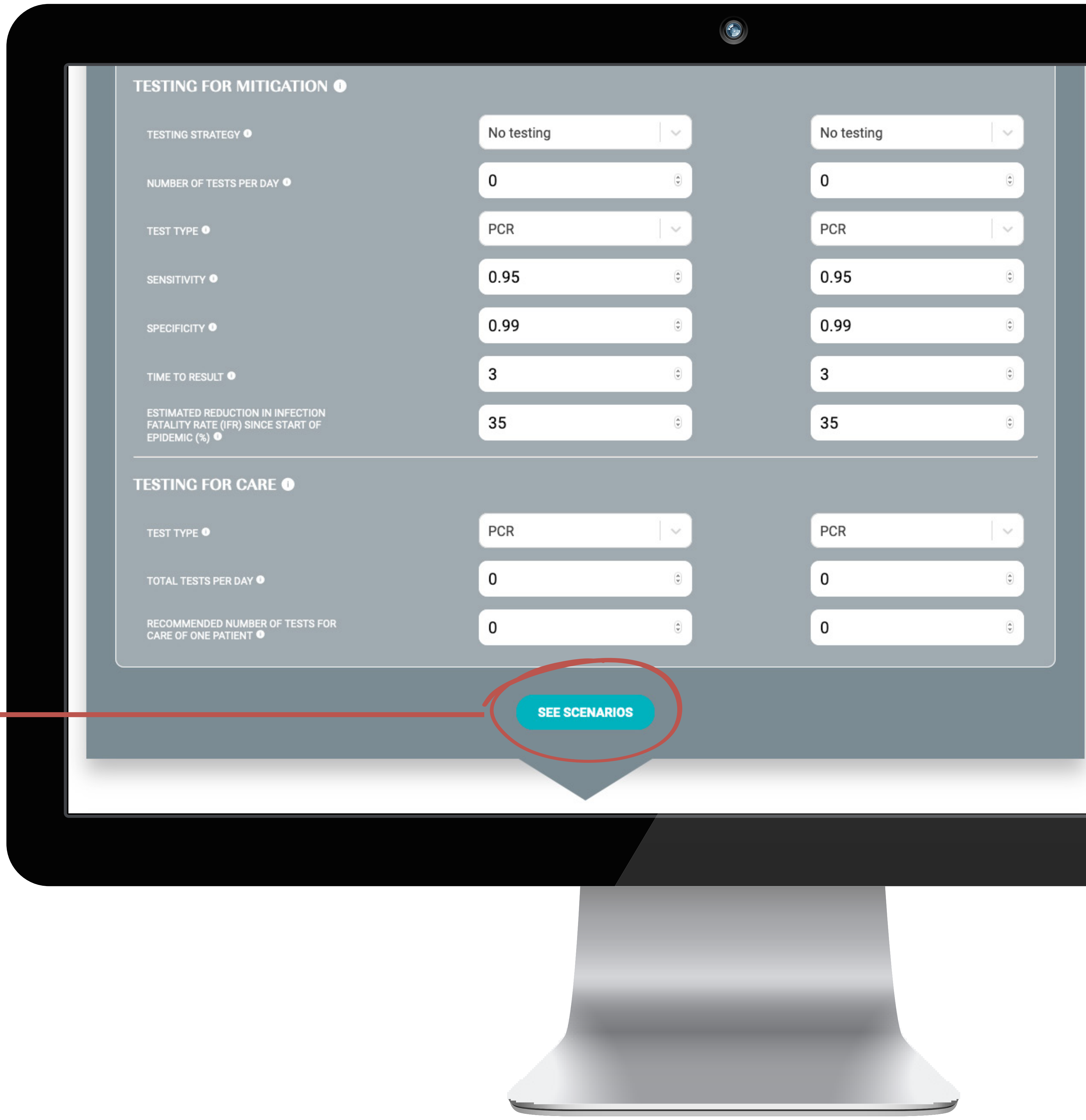
② Define Intervention Scenarios

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 on the left).***

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



③ Select and view Proposed Scenarios

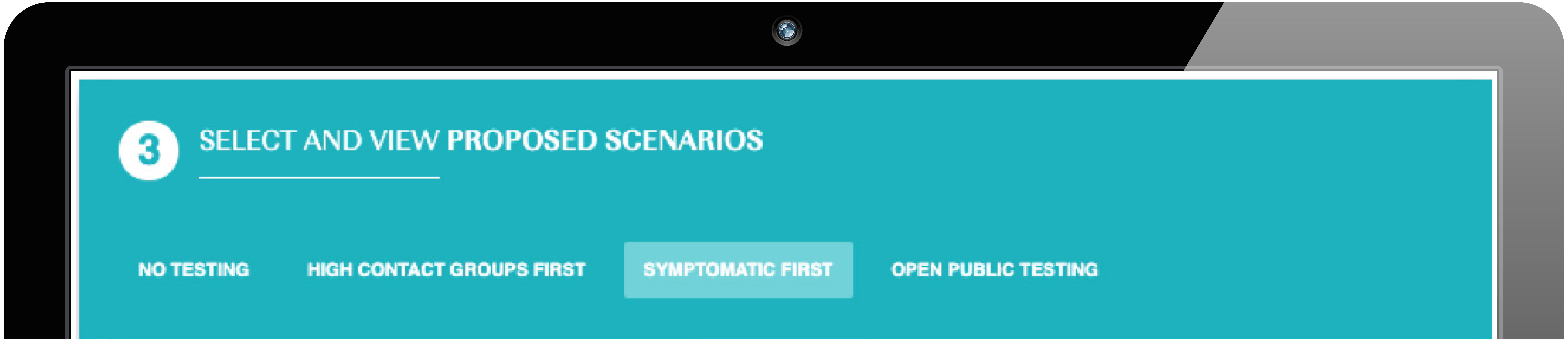
The first tab **(NO TESTING)** simulates the way the pandemic is likely to develop if there is no testing of any kind.

The second **(HIGH CONTACT GROUPS FIRST)** simulates what happens 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 position of the bubble from left to right show how many people are infected; the position 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 with 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.

Beneath the panel, you will see additional results for specific testing policy scenarios.
The numbers at the top show the total number of deaths, infections, positive tests (cases) and tests performed for the scenario. The graphs show the evolution of key indicators for the scenario.

First ***(1),*** *we see* the total number of tests used per day, during patient care (e.g. to decide when a hospital patient is ready for discharge) and for mitigation (to detect and isolate infected people capable of infecting others).

A second panel ***(see (2)*** estimates the number of tests that would be needed to conduct a so-called seroprevalence study where we want to know how many people are infected in a certain number of subgroups (e.g. 5 age-groups). Below this table, additional graphs provide data on the total number of tests conducted per day ***(3),*** 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 ***(4),*** 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) ***(5).***

The last graph ***(6)*** 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".

The data and graphs at the bottom of the page show additional simulation results.

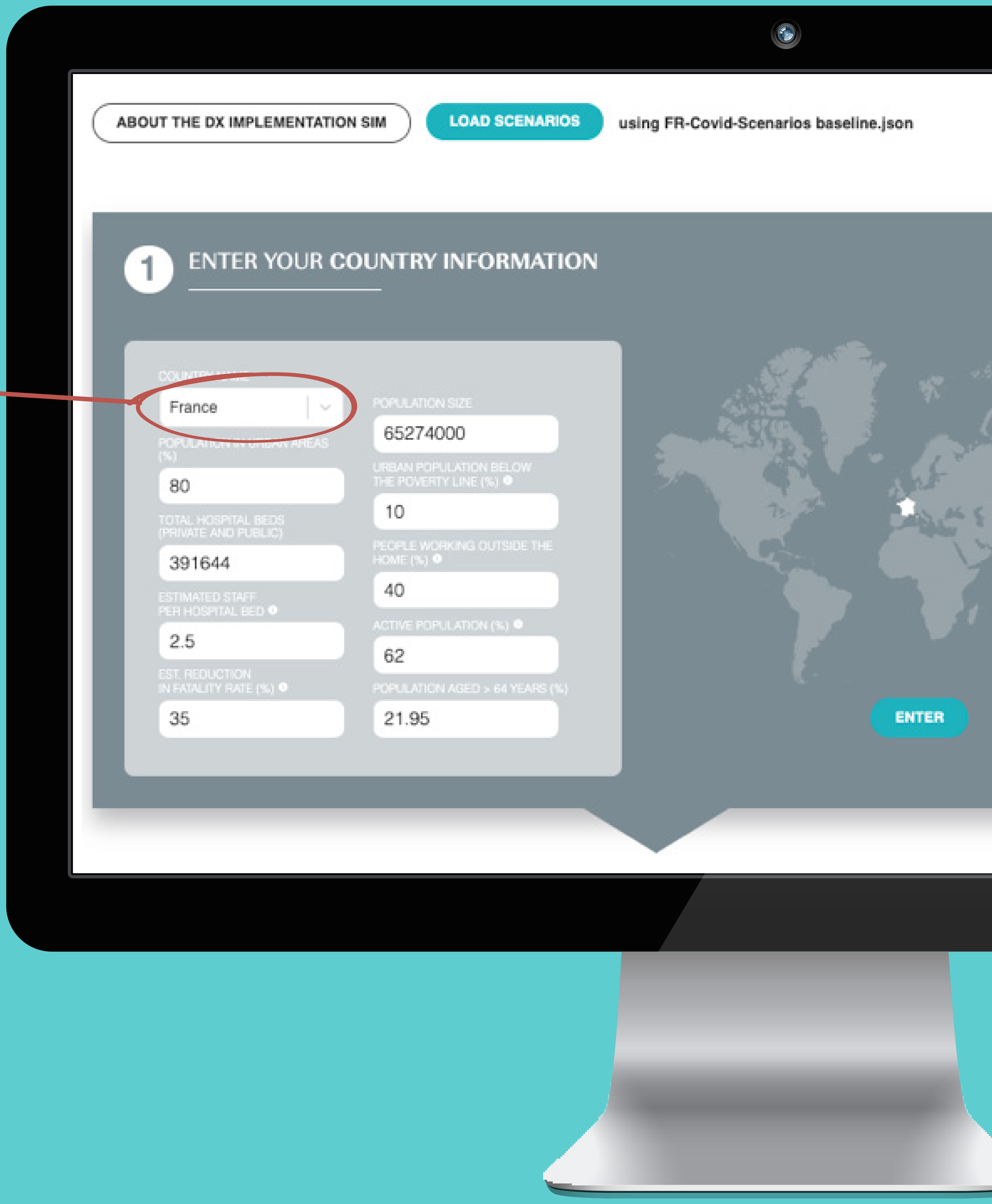
Using the simulator

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. You will need to fill in the data for the % of the urban population living below the poverty line. Suitable values might be 10% for a High Income Country, from 20-40% for Middle or Low Income countries. You will also need to fill in the % of workers working outside the home (during the pandemic). This may go from 40% in a High Income Country to 80% in a Low Income Country. A few countries are also lacking data for hospital beds. Please use national data to fill in this field if it is left empty.

Once you have filled in all the fields, ***click ENTER***, look at the data for the current state of the pandemic, go to the next panel and ***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 write 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.

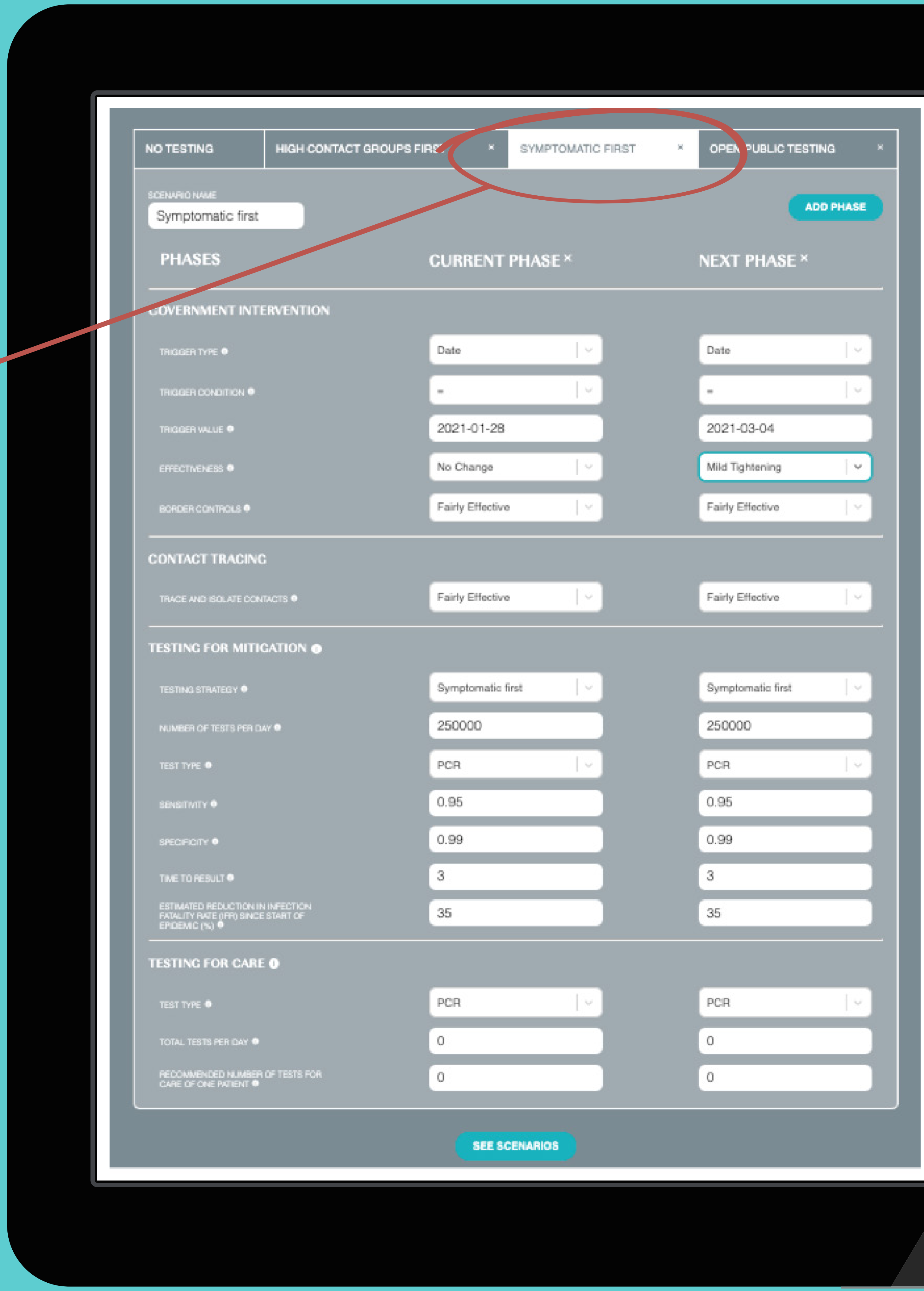


Defining a new scenario

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

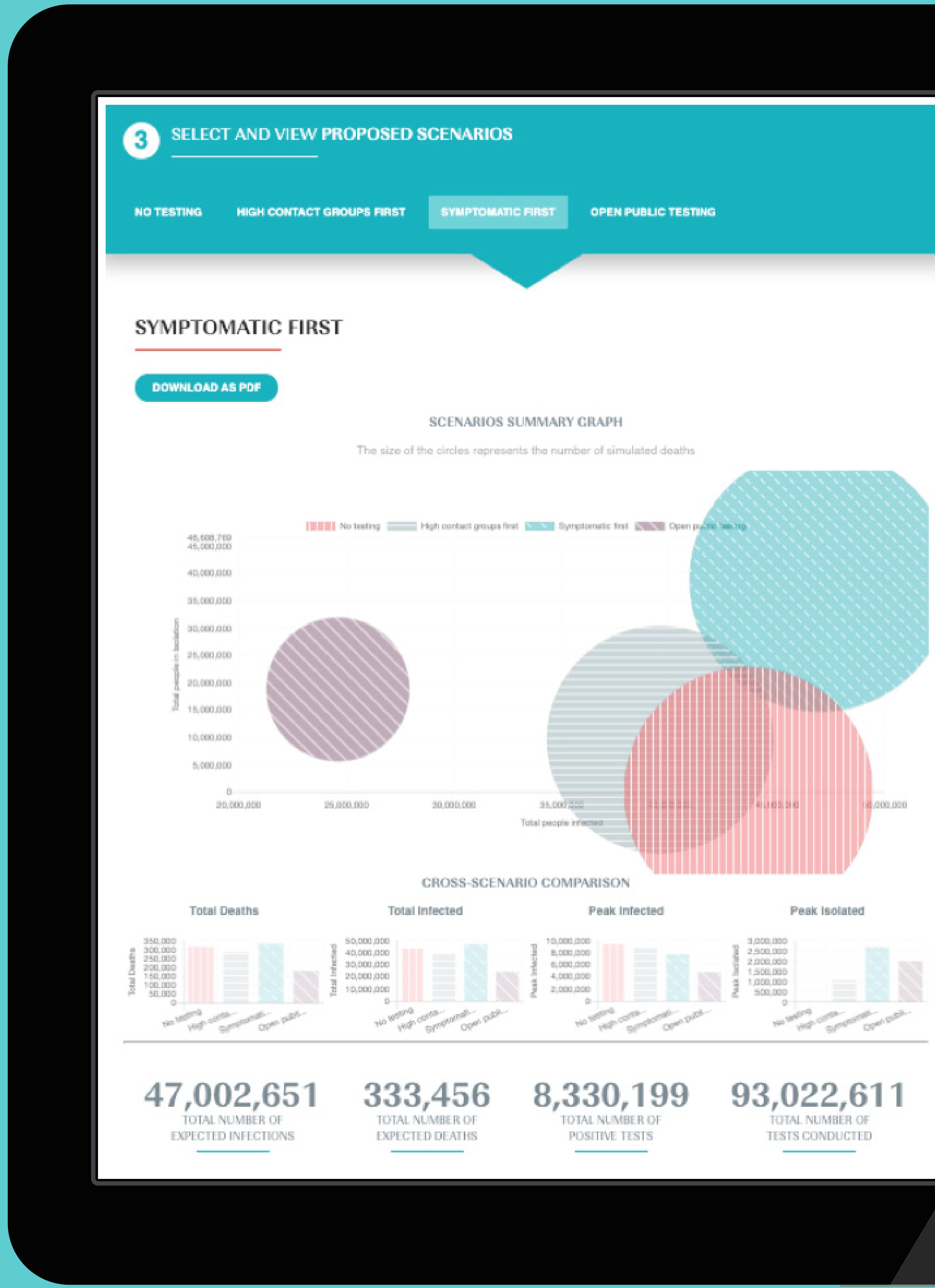
The most important factor determining the dynamics of the pandemic in your country is the effectiveness of government intervention. This depends on several factors: in particular the **"stringency"** of the rules the government imposes, and the degree to which the population follows the rules.

The FIND diagnostic 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 simulated a major tightening of government restrictions in January.

Now we can simulate the likely course of the epidemic if government restrictions do not change at all

Now the number of deaths is nearly three times higher.



Using what you have learned it is easy to test the effect of government policies with different levels of effectiveness. As we will see below, the FIND diagnostic simulator allows you to explore many other possibilities. For full information use the tooltips you will find if you hover the cursor over a specific field. Here we will summarize the possibilities

Exploring other scenarios

To explore other scenarios, you will need to use other values for the date and effectiveness of government intervention or 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.

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 right

The other trigger types work in the same way.

Contact tracing

Effectiveness: this is the effectiveness of government intervention mentioned earlier. 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 differences in effectiveness can completely change the dynamics of the pandemic. For instance a small increase in effectiveness can make the difference between run-away growth in infections, and a slow reduction leading towards complete suppression.

Border controls: when the epidemic has been completely suppressed within a country's borders or where it is under tight control, the possibility of a new wave of infection depends largely on the effectiveness of border controls. 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 effect, highly effective contact tracing can make an important contribution to the total suppression of infection. This field offers three options: This field offers three options: ."Not effective", "Fairly effective", "Highly effective"

Testing for mitigation

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 the percentage of infected people a test is capable of detecting. Different types of test have different levels of sensitivity. Many modern tests offer a sensitivity of at least 95% under laboratory conditions. Under field conditions sensitivity may be lower.

Specificity: specificity is a technical term, describing the proportion of positive test results that are “true positives” . Most COVID-19 tests offer extremely high levels of specificity. Most false positives are due to sample contamination or laboratory errors.

Time to result: this is the average time that elapses between the first appearance of COVID-like symptoms and the availability of a test result. The longer the time to result, the greater the possibility that an infected person will infect other people, while still unaware of his/her status. Results that become available 10 or more days after the appearance of symptoms make little or no contribution to epidemic control.

Expected reduction in infection fatality rate (IFR) since start of the epidemic: although there is currently no cure for COVID-19, there has been great progress in the treatment of patients. As a result fatality rates are now significantly lower than in the early phases of the pandemic. This field allows you to simulate this effect.

Testing for care

Test type: This is the type of test preferably used for testing patients who have already been diagnosed with COVID-19. Such tests have several applications. One of the most important is to test whether a patient is ready for discharge (i.e. whether or not the patient is still capable of infecting others).

Total tests per day: this is the average number of tests used for care on any given day

Recommended number of tests for care of one patient: this is the average number of times each patient is tested during her hospital stay.