



# Infectious disease scenarios in a post-vaccine view of COVID-19 and future pandemics

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## TO THE EDITOR,

In epidemiology of infectious diseases, we study the possible epidemic and endemic scenarios and define, for each disease, the indicators that should be considered to determine when a disease has reached its control, elimination, or eradication.<sup>(1)</sup>

Control is classically defined as the set of measures, actions, programs, or ongoing activities aimed at reducing the incidence and prevalence of diseases to levels low enough as to be no longer considered a public health issue. The level of control depends on the disease, the availability of resources, and the population's behavior.<sup>(1)</sup> One example is the monitoring of individuals with respiratory symptoms in the community, an effective measure for detecting cases of tuberculosis (TB), aiming to reduce the transmission of pulmonary tuberculosis and, consequently, minimize the number of cases in the community.<sup>(2)</sup>

Elimination follows disease control and is achieved when there are no more cases of illness, or they are minimal in number,<sup>(1)</sup> even though the causes that can potentially produce it persist. For example, TB will be considered eliminated when there is a reduction of 90% in the number of cases and 95% in TB-related deaths by 2035 (compared to 2015); and a low economic impact for families affected by the disease.<sup>(2)</sup> The WHO has defined the following indicators to consider TB as eliminated in Brazil: decreased incidence of TB cases from 34.3 cases/100 thousand inhabitants in 2015 to 10 cases/100 thousand inhabitants in 2035, and TB-related mortality from 2.3 deaths/100 thousand inhabitants to 1 death/100 thousand inhabitants.

The eradication of a disease is accomplished with the application of population measures aimed at achieving a situation of zero cases or deaths,<sup>(1)</sup> *i.e.*, one in which not only have the cases of TB been eliminated, but also the causes of the disease, in particular, the microorganism.<sup>(1,3)</sup> It is important to highlight that the eradication of a disease can only be achieved on a global scale. To date, we have only been able to reach this scenario with the Smallpox virus.

In the case of COVID-19, the world still finds itself in a pandemic situation and far from global control of the disease. In conjunction with the International Science Council,<sup>(4)</sup> the WHO has been conducting research with a panel of experts to map possible paths ahead and inform decisions that will influence the outcome of the pandemic. Nevertheless, we still have a long way to go. Some researchers<sup>(1)</sup> debating COVID-19 global control

scenarios have suggested two sub-scenarios: cohabitation and conflagration.

In cohabitation, control measures guarantee the prevention of severe forms of the disease but do not ensure the interruption of the transmission chain. As global vaccine coverage advances, viral circulation is reduced, although there is a frequent occurrence of local transmission of the virus, especially in the unvaccinated population. In this aspect, vaccination can provide immunity, but it is necessary to reinforce non-pharmacological measures beyond the vaccine in order to maintain low levels of virus circulation.<sup>(1)</sup>

In conflagration, on the other hand, the difficulty in accessing vaccines, low vaccination coverage, and the absence of regulated non-pharmacological control measures lead to a scenario characterized by endemic levels of the disease.<sup>(1)</sup> In this situation, the circulation of the virus with new variants in an unvaccinated population and without effective measures to contain transmission maintains an incidence at moderate to high levels with local transmission of the virus.<sup>(5)</sup>

In Brazil, we are not yet at the control stage but, depending on vaccine coverage, we can contain the progression of the virus, with the possibility of few variants. It is possible that we could achieve control and remain between conflagration and cohabitation for some time to come. Without a national coordination of control measures for states and municipalities to legislate, and with few non-pharmacological options to contain the virus (based not on reducing transmission, but on minimizing the occupation of intensive care unit beds), it seems that we will undergo a long period of conflagration or cohabitation with COVID-19.

Disease control and even the eradication of COVID-19 with only vaccines requires global population immunity to be able to neutralize possible new variants.<sup>(1,3)</sup> Vaccines alone are unlikely to end the pandemic. What comes after vaccination advancements depends on government decisions and new scientific evidence. It is possible that the virus will be controlled and eliminated in areas with high vaccination coverage and continued non-pharmacological measures. However, disease control in these areas will depend on the global control of the virus; otherwise, these areas will be constantly vulnerable to cohabitation and conflagration scenarios. It is essential to align science and governance with decisions that reinforce non-pharmacological measures and that are based on evidence that is demonstrated along the way and, consequently, modified.<sup>(6)</sup>

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The global community will have to prepare for upcoming pandemics in the future. In Brazil, in a post-pandemic scenario, it will be necessary to build a scientific committee composed of researchers independent from the government that can support actions to be carried out by state and municipal Epidemiological Surveillance Services. Keeping these services active, which were restructured in 2020 to respond to the COVID-19 pandemic, is imperative to achieve advances in the control of diseases and other

conditions. Emptying these services post-pandemic will be a fallacy in rapid and effective responses to future epidemics.

### AUTHOR CONTRIBUTIONS

JPC and ELNM contributed to the conception and planning of the study, the interpretation of the findings, the writing and revision of the preliminary and final version, and the approval of the final version of the manuscript.

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