

Vaccinating socially active people first

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In the long run, it might make more sense to vaccinate people under 60 against COVID-19 first—for example, in countries that have just started vaccination or in future vaccination campaigns in places where large parts of the population have already been immunized against the SARS-CoV-2 coronavirus. As scientists from the Max Planck Institute for

Dynamics of Complex Technical Systems in Magdeburg and the Technical University of Ilmenau have calculated, contact restrictions that prevent overloading intensive care units are more likely to be lifted if younger people are vaccinated first given an observation period of more than eight weeks.

In many countries, especially in the Southern hemisphere, only a few people have been immunized against COVID-19 so far. And in Israel, people are already being vaccinated for the third time. At the same time, the Israeli government is again imposing contact restrictions. A similar interplay of vaccination and restrictions in social and economic life could become necessary in many places if viral variants that can undermine the protection of previous vaccinations develop. However, in order to prevent the intensive care units (ICU) from becoming overloaded and still be able to lift contact restrictions as quickly as possible, a vaccination strategy different from the one currently being pursued in most countries may make more sense.

"Our calculations show that you should not base a vaccination strategy on short-term goals," says Sara Grundel, Research Group Leader at the Max Planck Institute for Dynamics of Complex Technical Systems in Magdeburg. As she and a team, which also included researchers from the Technical University of Ilmenau, demonstrated in simulations, the need for intensive care beds decreases rapidly if people over 60 are vaccinated first. However, even with a consideration period of more than eight weeks, the calculations suggest that it would be more sensible to immunize people under 60 first. Because the younger generation has more social contacts, this will help to prevent overloading of the ICU and if [social contact](#) is reduced by at least 30%, the fewest people will die of COVID-19 with the same strategy. At the same time, restrictions in social and professional life could be lifted six months earlier than if people over 60 were prioritized for vaccination. "Because the restrictions in social life, in schools, and in the economy have many negative

consequences, they should be limited as much as possible," says Grundel. "That's why it's important to take a long-term view of how vaccination and contact restrictions can be optimally coordinated."

A model with various adjusting screws

The model can be used to determine the number of people infected with coronavirus and the associated number of patients who need intensive care treatment under various conditions. The number of people in the ICU is, in turn, linked to the number of deaths. The transmission of the virus depends on the number of contacts between people; this can vary considerably between different age groups. Transmission can be reduced by contact restrictions; these can vary in duration and severity. The model also takes into account the vaccination progress in different age groups. The researchers assumed that the vaccination was 90% effective. They did not take into account the influence of tests on the incidence of infection. "Tests probably have the same effect on both strategies—but we have not investigated that," says Grundel. With the help of the various mathematical adjusting screws, the group investigated how different approaches to vaccination affect the number of people to be treated in intensive care and how long relaxed or severe contact restrictions have to be maintained in order not to exceed a predefined capacity limit of the ICU. They also carried out these calculations for different planning horizons. "We can thus answer different questions with the model," says Grundel. "For example, which age group should be vaccinated first, how contact restrictions can be relaxed continuously as vaccinations progress, and what period of consideration is needed to optimally coordinate vaccinations and contact restrictions in the long term."

The researchers are aware that vaccination campaigns are quite far along—at least in many industrialized countries—and that vaccination strategies are unlikely to change during ongoing campaigns. "But the

coronavirus will not disappear. And we will still need vaccinations in the future, especially if there are mutations against which currently available vaccines are not effective," says Grundel. "Our calculations show that a long-term trade-off between vaccinations and contact limits as well as prioritizing [younger people](#) for vaccinations could help minimize the psychological, social, cultural, and economic impact of the restrictions."

More information: Sara M. Grundel et al, How to Coordinate Vaccination and Social Distancing to Mitigate SARS-CoV-2 Outbreaks, *SIAM Journal on Applied Dynamical Systems* (2021). [DOI: 10.1137/20M1387687](#)

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