

# Mask use, social distancing leads to shorter lockdown, lower death rate

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University of Michigan researchers have developed a mathematical model that allows public health officials to determine how various levels of lockdown affect both the economy and the mortality rate of COVID-19.

The factors that end lockdowns the quickest, with the smallest loss of life? The use of masks and social distancing in everyday life.

Additionally, their model finds that the United States might reach herd immunity about 200 days into the pandemic—compared to a potential 18-month timeline for a vaccine. The Centers for Disease Control and Prevention estimates herd immunity occurs when 60% of people have contracted the disease and recovered, thereby stopping the exponential transmission of the virus.

"There are some personal behaviors that affect the transmission of the virus, and if you combine a lockdown with people being more careful—all these things help with slowing the spread of the virus, which means our lockdowns can be shorter," said April Nellis, a doctoral candidate in the U-M Department of Mathematics.

"We also found that if we predict the vaccine will take a year-and-a-half from the start of the outbreak to arrive—which might be a little conservative at this point—it is pretty likely that we might reach herd immunity earlier. Of course, the vaccine will be important because immunity fades over time, but we wanted to know 'Could this happen in a safe manner before the vaccine arrives?' Our model says yes."

Their model, called a macroeconomic susceptible-infected-removed, or macroeconomic SIR, model, combines epidemic dynamics and macroeconomic cost modeling to simulate the costs of the current epidemic. The underlying SIR epidemiology model predicts the spread of disease by taking into consideration the number of susceptible individuals, the number of infectious individuals and the number of removed individuals—whether by death, recovery or resistance.

In their model, when individuals use personal caution in response to increased infection levels, there is less economic loss and lower

mortality. Their paper is posted online in preprint, currently submitted for peer review.

The U-M researchers' model includes two levels of lockdown—lockdowns for those ages 65 and above who are more vulnerable to COVID-19, and lockdowns for those ages 20 to 64 who are less vulnerable to COVID-19—and their effect on the economy.

The model also includes a number of other factors, including recovery rate, base mortality rate of COVID-19, rate of ICU admittance, interaction level between groups, timeline for a vaccine or cure and proportion of workforce that can work remotely, among other parameters.

"We're taking these two populations and trying to determine the best level of lockdown for each of them that can reduce deaths, keep infection levels from becoming too high and also help maintain our economic productivity during this time," Nellis said. "In a way, our paper is an investigation into seeing how changing different parameters in this model can help us see how the virus evolves."

Different levels of lockdown for different groups can protect high-risk individuals while allowing low-risk individuals to resume work, the researchers say. There also are [economic benefits](#) to incorporating herd immunity into models considering lockdown measures: it shows lockdowns could end earlier and people can go back to work before the arrival of a vaccine.

For example, if no one social distances or wears masks, herd immunity would be reached before the arrival of a [vaccine](#). Lockdown would last 249 days for those 65 and above and 219 days for those ages 20-64, with a 10.67% loss of economic output and a death rate of 0.37% of the total U.S. population.

If the parameter which determines the ability of individuals to slow viral transmission were set at 10 in the model—that is, if the country can reduce transmission by 95% by practicing personal caution—[herd immunity](#) would still be reached and lockdown would last 189 days for those 65 and above, and just 24 days at an intensity of 4.1% for those ages 20-64. In this case, the output loss would be 0.16% and total deaths would decrease by 30.47%.

**More information:** Erhan Bayraktar et al. A Macroeconomic SIR Model for COVID-19, (2020). [DOI: 10.1101/2020.06.22.20137711](https://doi.org/10.1101/2020.06.22.20137711). [www.medrxiv.org/content/10.1101/2020.06.22.20137711v1](https://www.medrxiv.org/content/10.1101/2020.06.22.20137711v1)

Provided by University of Michigan

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