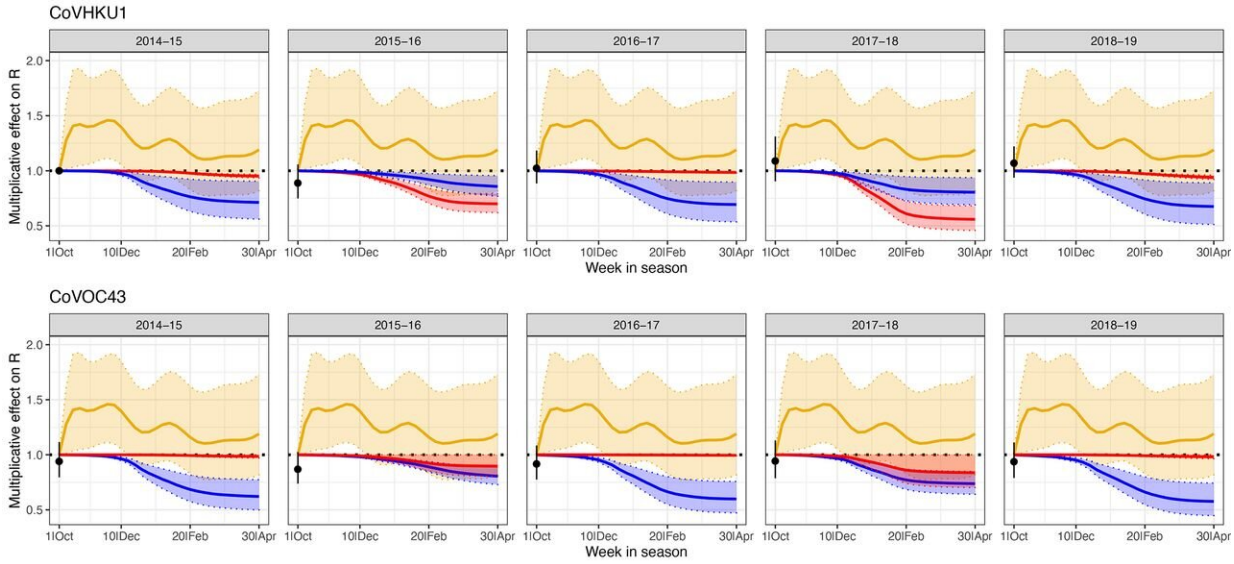
On-off social distancing may be needed until 2022: Harvard study

April 15 2020, by Issam Ahmed



Effects of depletion of susceptibles and seasonality on the effective reproduction number by strain and season. Estimated multiplicative effects of HCoV-HKU1 incidence (red), HCoV-OC43 incidence (blue), and seasonal forcing (gold) on weekly effective reproduction numbers of HCoV-HKU1 (top panels) and HCoV-OC43 (bottom), with 95% confidence intervals. The black dot (with 95% confidence interval) plotted at the start of each season is the estimated coefficient for that strain and season compared to the 2014-15 HCoV-HKU1 season. The seasonal forcing spline is set to 1 at the first week of the season (no intercept). On the x-axis, the first "week in season" corresponds to epidemiological week 40. Credit: *Science* (2020). DOI: 10.1126/science.abb5793

A one-time lockdown won't halt the novel coronavirus and repeated periods of social distancing may be required into 2022 to prevent hospitals from being overwhelmed, Harvard scientists who modeled the pandemic's trajectory said Tuesday.

Their study comes as the US enters the peak of its COVID-19 caseload and states eye an eventual easing of tough lockdown measures.

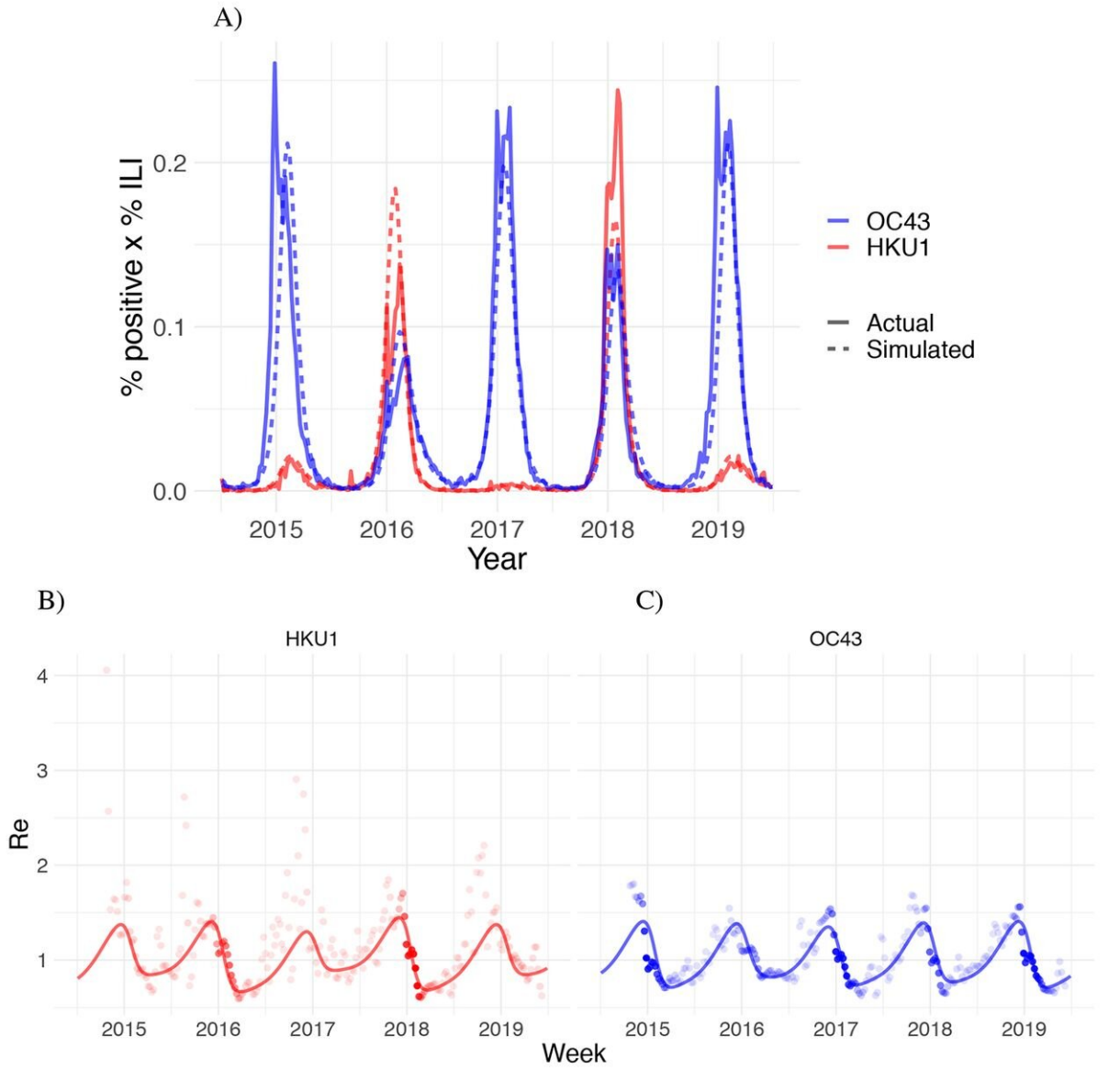
The Harvard team's computer simulation, which was published in a paper in the journal *Science*, assumed that COVID-19 will become seasonal, like closely related coronaviruses that cause the common cold, with higher transmission rates in colder months.

But much remains unknown, including the level of immunity acquired by previous infection and how long it lasts, the authors said.

"We found that one-time social distancing measures are likely to be insufficient to maintain the incidence of SARS-CoV-2 within the limits of critical care capacity in the United States," lead author Stephen Kissler said in a call with reporters.

"What seems to be necessary in the absence of other sorts of treatments are intermittent social distancing periods," he added.

Widespread viral testing would be required in order to determine when the thresholds to re-trigger distancing are crossed, said the authors.



Transmission model fits for HCoV-OC43 and HCoV-HKU1. (A) Weekly percent positive laboratory tests multiplied by percent influenza-like illness (ILI) for the human betacoronaviruses HCoV-OC43 (blue) and HCoV-HKU1 (red) in the United States between 5 July 2014 and 29 June 2019 (solid lines) with simulated output from the best-fit SEIRS transmission model (dashed lines). (B and C) Weekly effective reproduction numbers (Re) estimated using the Wallinga-Teunis method (points) and simulated Re from the best-fit SEIRS transmission model (line) for HCoVs OC43 and HKU1. The opacity of each point is determined by the relative percent ILI multiplied by percent positive laboratory tests in that week relative to the maximum percent ILI multiplied by

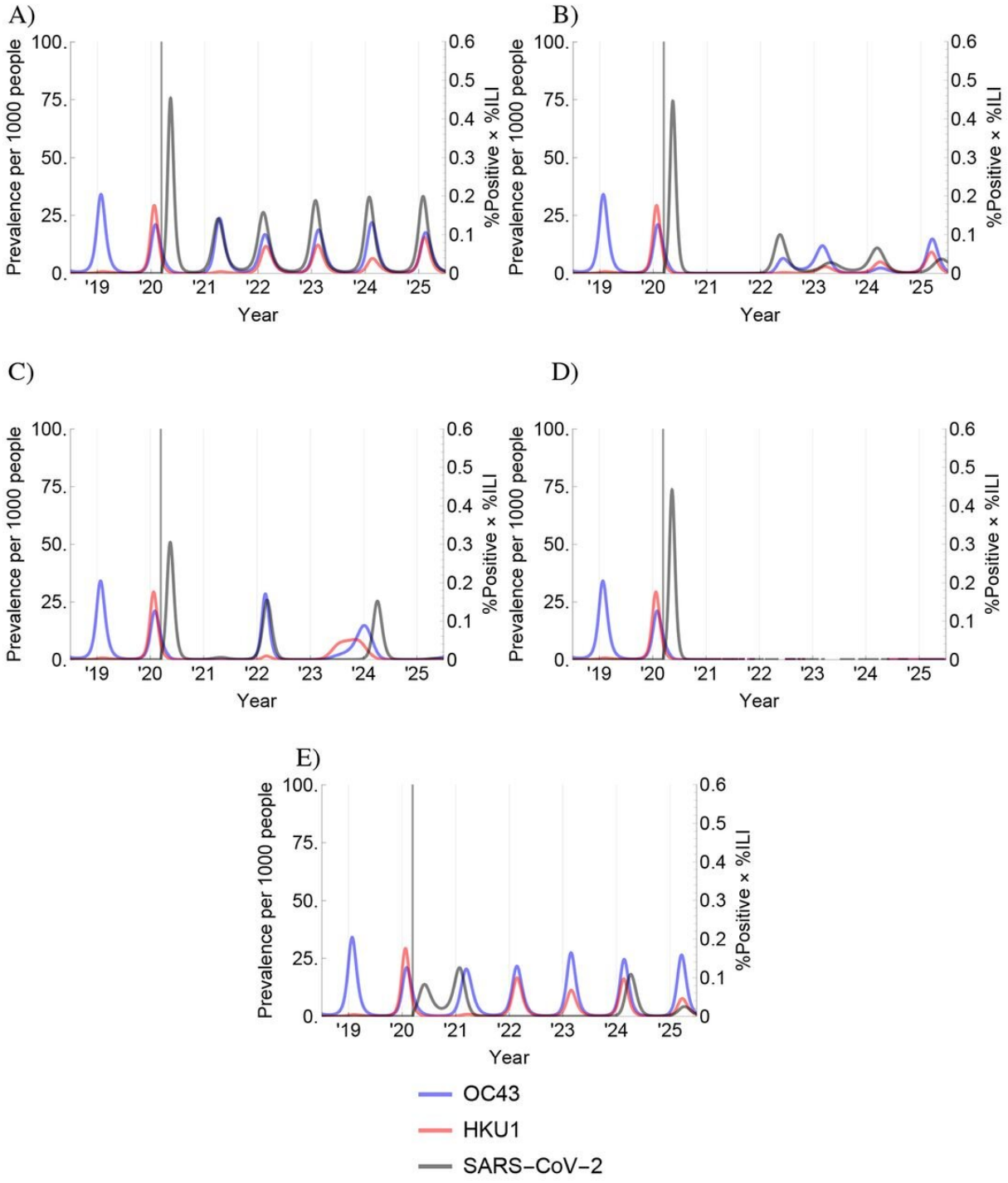
percent positive laboratory tests for that strain across the study period, which reflects uncertainty in the Re estimate; estimates are more certain (darker points) in weeks with higher incidence. Credit: *Science* (2020). DOI: 10.1126/science.abb5793

The duration and intensity of lockdowns can be relaxed as treatments and vaccines become available. But in their absence, on and then off distancing would give hospitals time to increase critical care capacity to cater for the surge in cases that would occur when the measures are eased.

"By permitting periods of transmission that reach higher prevalence than otherwise would be possible, they allow an accelerated acquisition of herd immunity," said co-author Marc Lipsitch.

Conversely, too much social distancing without respite can be a bad thing. Under one modeled scenario "the social distancing was so effective that virtually no population immunity is built," the paper said, hence the need for an intermittent approach.

The authors acknowledged a major drawback in their model is how little we currently know about how strong a previously infected person's immunity is and how long it lasts.



Invasion scenarios for SARS-CoV-2 in temperate regions. These plots depict the prevalence of SARS-CoV-2 (black, cases per 1,000 people), HCoV-OC43 (blue, % positive multiplied by % ILI), and HCoV-HKU1 (red, % positive multiplied by % ILI) for a representative set of possible pandemic and post-pandemic

scenarios. The scenarios were obtained by varying the cross immunity between SARS-CoV-2 and HCoVs OC43/HKU1 (χ3X) and vice-versa (χX3), the duration of SARS-CoV-2 immunity (1/σ3), and the seasonal variation in R0 (f), assuming an epidemic establishment time of 11 March 2020 (depicted as a vertical grey bar). Parameter values used to generate each plot are listed below; all other parameters were held at the values listed in table S8. (A) A short duration (1/σ3 = 40 weeks) of SARS-CoV-2 immunity could yield annual SARS-CoV-2 outbreaks. (B) Longer-term SARS-CoV-2 immunity (1/σ3 = 104 weeks) could yield biennial outbreaks, possibly with smaller outbreaks in the intervening years. (C) Higher seasonal variation in transmission (f = 0.4) would reduce the peak size of the invasion wave, but could lead to more severe wintertime outbreaks thereafter [compare with (B)]. (D) Long-term immunity (1/σ3 = infinity) to SARS-CoV-2 could lead to elimination of the virus. (E) However, a resurgence of SARS-CoV-2 could occur as late as 2024 after a period of apparent elimination if the duration of immunity is intermediate (1/σ3 = 104 weeks) and if HCoVs OC43/HKU1 impart intermediate cross immunity against SARS-CoV-2 (χ3X = 0.3). (A) χ3X = 0.3, χX3 = 0, 1/σ3 = 40 weeks, f = 0.2. (B) χ3X = 0.7, χX3 = 0, 1/σ3 = 104 weeks, f = 0.2. (C) χ3X = 0.7, χX3 = 0, 1/σ3 = 104 weeks, f = 0.4. (D) χ3X = 0.7, χX3 = 0, 1/σ3 = infinity, f = 0.2. (E) χ3X = 0.3, χX3 = 0.3, 1/σ3 = 104 weeks, f = 0.4. Credit: *Science* (2020). DOI: 10.1126/science.abb5793

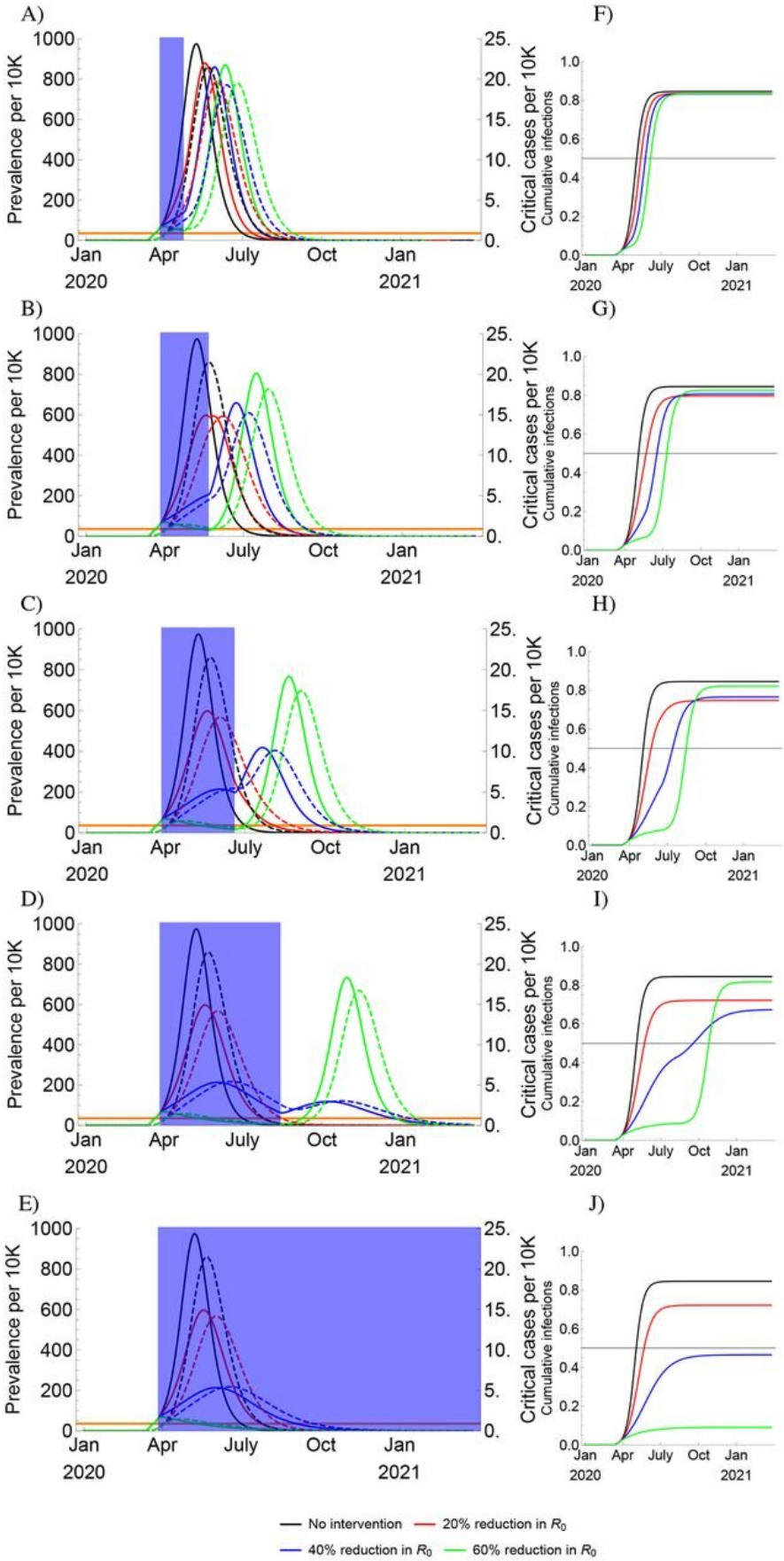
Virus likely here to stay

At present the best guesses based on closely-related coronaviruses are that it will confer some immunity, for up to about a year. There might also be some cross-protective immunity against COVID-19 if a person is infected by a common cold-causing betacoronavirus.

One thing however is almost certain: the virus is here to stay. The team said it was highly unlikely that immunity will be strong enough and last long enough that COVID-19 will die out after an initial wave, as was the case with the SARS outbreak of 2002-2003.

Antibody tests that have just entered the market and look for whether a person has been previously infected will be crucial in answering these vital questions about immunity, they argued, and a vaccine remains the ultimate weapon.

Outside experts praised the paper even as they emphasized how much remained unknown.


A)
B)
C)
D)
E)
F)
G)
H)
I)
J)
Prevalence per 10K
Critical cases per 10K
Cumulative infections
Jan
Apr
July
Oct
Jan
2020
2021
No intervention
20% reduction in R_0
40% reduction in R_0
60% reduction in R_0

One-time social distancing scenarios in the absence of seasonality. (A to E) Simulated prevalence of COVID-19 infections (solid) and critical COVID-19 cases (dashed) following establishment on 11 March 2020 with a period of social distancing (shaded blue region) instated two weeks later, with the duration of social distancing lasting (A) four weeks, (B) eight weeks, (C) twelve weeks, (D) twenty weeks, and (E) indefinitely. There is no seasonal forcing; R0 was held constant at 2.2 (see fig. S12 for R0 = 2.6). The effectiveness of social distancing varied from none to a 60% reduction in R0. Cumulative infection sizes are depicted beside each prevalence plot (F to J) with the herd immunity threshold (horizontal black bar). Of the temporary distancing scenarios, long-term (20-week), moderately effective (20%-40%) social distancing yields the smallest overall peak and total outbreak size. Credit: *Science* (2020). DOI: 10.1126/science.abb5793

"This is an excellent study that uses mathematical models to explore the dynamics of COVID-19 over a period of several years, in contrast to previously published studies that have focused on the coming weeks or months," Mark Woolhouse, an infectious disease epidemiologist at the University of Edinburgh said.

"It is important to recognize that it is a model; it is consistent with current data but is nonetheless based on a series of assumptions—for example about acquired immunity—that are yet to be confirmed."

More information: Stephen M. Kissler et al. Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period, *Science* (2020). DOI: 10.1126/science.abb5793