

containing both the original spike and spikes altered to mimic variants of concern.

J&J reported similar bottom lines from a far larger study of its vaccine, made by its Janssen Pharmaceuticals division. The candidate, which like several two-dose COVID-19 vaccines uses a harmless adenovirus to deliver the gene for spike, was tested in 44,000 people in the United States, Latin America, and South Africa. The single-dose vaccine had an overall efficacy of 66% against symptomatic disease, rising to 85% against severe symptoms, regardless of a person's age or underlying medical conditions, the firm said.

The vaccine's efficacy against mild disease was 72% in the United States and 66% in Latin America, dropping to 57% in South Africa. But no one who received it anywhere required hospitalization for COVID-19 or died. "This represents a dream vaccine for a doctor," says Glenda Gray, a co-chair of the J&J study and head of the South African Medical Research Council. In South Africa, COVID-19 now is the No. 1 cause of death, eclipsing HIV/AIDS and tuberculosis.

J&J plans to file for emergency use authorization from the U.S. Food and Drug Administration (FDA) this week and projects it can produce 1 billion doses this year at about \$10 per dose—one-sixth or less of the price of two doses of the mRNA vaccines. Novavax is discussing with FDA whether to wait for a readout from a larger efficacy trial underway in the United States, but says it can make 150 million doses per month as soon as May. It has not announced a price.

Gray and other researchers say the mRNA vaccines' spectacular efficacy against any COVID-19 symptoms may have become a misleading benchmark for a successful vaccine given SARS-CoV-2's evolution. Faced with mutant strains like the one in South Africa, those vaccines might not do much better than Novavax's and J&J's products did, they suspect. To many, solidly preventing severe disease, regardless of strain, is a significant win. "Do you want a vaccine that prevents coughs or do you want a vaccine that prevents death?" asks Lawrence Corey of the University of Washington, Seattle, who co-leads a trials network testing the J&J, Novavax, and other vaccines bankrolled by the U.S. government's Operation Warp Speed.

And as the emerging variants show, delivering COVID-19 vaccines into more arms is urgent, and the more options, the better. "What I take away from this week," says Nahid Bhadelia, an infectious disease physician at Boston Medical Center, "is that we have two more tools in our toolbox at a very precarious time." ■

With reporting by Meredith Wadman.

COVID-19

Danish scientists see tough times ahead as variant rises

Some say the country should reopen—even if it causes cases to surge—once vulnerable populations are vaccinated

By Kai Kupferschmidt

On its face, the curve of COVID-19 infections in Denmark looks reassuring enough. A nationwide lockdown has led numbers to plummet from more than 3000 daily cases in mid-December 2020 to just a few hundred now. But don't be fooled. "Sure, the numbers look nice," says Camilla Holten Møller of the Statens Serum Institute, who heads a group of experts modeling the epidemic. "But if we look at our models, this is the calm before the storm."

That's because the graph really reflects two epidemics: one, shrinking fast, that's caused by older variants of SARS-CoV-2, and a smaller, slowly growing outbreak of B.1.1.7, the variant first recognized in England and now driving a big third wave of the pandemic there. If B.1.1.7 keeps spreading at the same pace in Denmark, it will become the dominant variant later this month and cause the overall number of cases to rise again, despite the lockdown, Holten

Møller says. "It is a complete game changer."

The same is likely happening in many countries without being noticed. But a massive virus-sequencing effort has allowed Denmark, a country of 5.8 million, to track the rise of the new COVID-19 variant more closely than any other country. "All eyes are on Denmark right now," says Kristian Andersen, an infectious diseases researcher at Scripps Research who is advising the Danish government. "When it comes to B.1.1.7, is there a way in which ... we can prevent the kind of calamity that we have seen in the U.K. and Ireland, for example?" he asks.

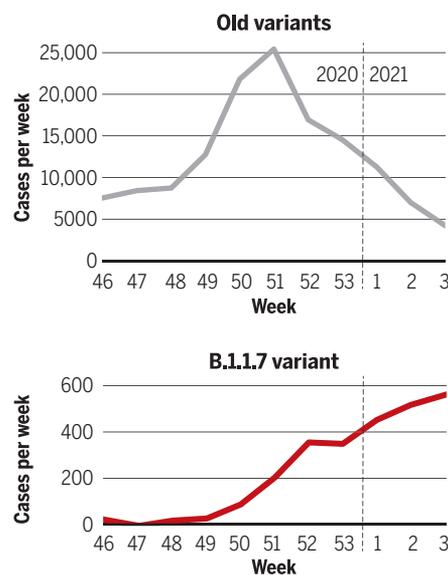
The data aren't reassuring. Danish scientists' best guess is that B.1.1.7 spreads 1.55 times faster than previous variants, Holten Møller says. To keep it from spiraling out of control, the country will have to remain in lockdown—or even add new control measures—until a large part of the population has been vaccinated. That prospect is so unappealing that some epidemiologists say Denmark should consider an alternative: Reopen once the most vulnerable people are vaccinated, even if that means a big new surge in cases.

Denmark reported B.1.1.7 within its borders in December 2020, soon after the United Kingdom put the world on notice, and has since stepped up an already impressive virus-sequencing operation. Mads Albertsen, a bacterial genome researcher at Aalborg University, leads a team that has sequenced virus genomes from more than half of all COVID-19 patients so far this year and hopes to reach 70% soon.

It was clear by early January that B.1.1.7 was roughly doubling in frequency every week, says Lone Simonsen, an epidemiologist at Roskilde University. At that point, Denmark had already closed schools and restaurants; to combat the new threat, the lockdown was tightened by cutting the number of people allowed to gather from 10 to five, for example, and doubling the recommended distance between people from 1 to 2 meters. That helped bring the overall reproductive number (R) to a healthy 0.78, according to the most recent estimate. But B.1.1.7 still has an estimated R of 1.07; in

A new virus gathers steam

Previous SARS-CoV-2 variants are rapidly declining in Denmark (top), but B.1.1.7 is on the rise (bottom).



other words, it's growing exponentially.

The country could take further steps such as requiring people to work from home when possible and improving contact tracing, which becomes easier as the numbers dwindle. Rolling out rapid tests could also help, and more can be done to encourage patients to isolate, says Michael Bang Petersen, a political scientist at Aarhus University; currently, 15% of those who receive a positive test do not self-isolate.

By doing more, Denmark can still rid itself of B.1.1.7 and avert a third wave, says Andersen, who points out that case numbers are falling in the United Kingdom, where B.1.1.7 now dominates: "It can be done, but it requires a tremendous amount of effort." (He says Denmark should attempt to end its epidemic altogether, New Zealand

be hard to sustain as time goes on, he says. "There's a huge pressure on the government to reopen the country," adds Thea Kølsen Fischer, a virologist at the University of Copenhagen. In a small first step, the government is reopening schools for children in first to fourth grade on 8 February.

Simonsen says the cost of extending the lockdown for many more months may prove too high. Instead, Denmark should consider opening as soon as people over age 50 and other vulnerable groups have been vaccinated—an effort that is underway. Reopening might trigger a sharp increase of cases among the unvaccinated, but few would presumably die. At that point, society could start to think of SARS-CoV-2 more like influenza, which also occasionally kills healthy young people, she



A shopping street in Copenhagen, Denmark, during the lockdown in January. Keeping the B.1.1.7 variant of COVID-19 at bay may require additional control measures, scientists say.

style, through aggressive measures and border closures.)

Others are not convinced the tide can be turned. The drop in the United Kingdom may partly be due to the fact that so many have been infected already and are no longer susceptible, says Viggo Andreasen, a modeler at Roskilde. At best, Denmark could push R for the variant just below 1, he says, leading to a very slow decline—although better weather by April could help.

So far, the public has accepted the government's message that the lockdown needs to remain in place despite the declining cases, says Petersen, who coordinates a project to study how the government and the public are reacting to the pandemic: "What has been amazing during January is that the numbers have substantially dropped, but at the same time, people have reduced their contacts even further." But that will

says: "We don't close down birthday parties for this."

Andreasen disagrees. Accepting a new surge might have been a good strategy before other countries saw variants emerge that appear to partially evade human immunity. More infections raise the risk of further viral evolution, he says. "It's a nasty mix to have a population where half of the population harbors the virus, and the other half is like a big experimental vessel for the virus to learn how to escape immunity."

Letting the virus go would have another downside, says Devi Sridhar, a global health scientist at the University of Edinburgh: More people with mild infections might develop long-lasting health problems. "Given what we know about long COVID and the associated morbidity we might see," Sridhar says, "I just think the risks are high with that." ■

ASTRONOMY

Speedy robots gather spectra for sky surveys

Telescopes retrofitted with hundreds of optical fibers dissect the light of stars and galaxies

By **Daniel Clery**

It was one of the stranger and more monotonous jobs in astronomy: plugging optical fibers into hundreds of holes in aluminum plates. Every day, technicians with the Sloan Digital Sky Survey (SDSS) prepped up to 10 plates that would be placed that night at the focus of the survey's telescopes in Chile and New Mexico. The holes matched the exact positions of stars, galaxies, or other bright objects in the telescopes' view. Light from each object fell directly on a fiber and was whisked off to a spectrograph, which split the light into its component wavelengths, revealing key details such as what the object is made of and how it is moving.

Now, after 20 years, the SDSS is going robotic. For the project's upcoming fifth set of surveys, known as the SDSS-V, plug plates are being replaced by 500 tiny robot arms, each holding fiber tips that patrol a small area of the telescope's focal plane. They can be reconfigured for a new sky map in 2 minutes. Other sky surveys are also adopting the speedy robots. They will not only save valuable observation time, but also allow the surveys to keep up with Europe's Gaia satellite, the upcoming Vera C. Rubin Observatory in Chile, and other efforts that produce huge catalogs of objects needing spectroscopic study. "It's driven by the science of enormous imaging surveys," says astronomer Richard Ellis of University College London.

COVID-19 has delayed the SDSS's robotic makeover. The survey's northern telescope at Apache Point Observatory in New Mexico began to take SDSS-V data in October 2020 using plug plates. It aims to switch over to the robots by mid-2021. The southern scope at Las Campanas Observatory in Chile will follow later in the year. "It's bananas," says SDSS-V Director Juna Kollmeier of the Carnegie Observatories, "but we're seeing the end of the tunnel."

Science

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Kai Kupferschmidt

Science **371** (6529), 549-550.
DOI: 10.1126/science.371.6529.549

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