

Coronavirus vaccines: key questions

Do people develop immunity?

Most researchers assume that people who have recovered from SARS-CoV-2 infection will be protected from reinfection. But evidence is needed. In studies, laboratory animals do not seem to become reinfected when exposed to the virus for a second time. Researchers will be looking for evidence that humans react in the same way. How long any immunity might last is another big unknown.

What kind of immune response should vaccine developers look for?

A clinical trial that began last week focuses on a vaccine developed by Moderna, a company based in Cambridge, Massachusetts. The vaccine consists of an RNA molecule that is designed to train the immune system to make antibodies that recognize and block the protein that the virus uses to enter human cells. However, a successful SARS-CoV-2 vaccine might also need to prompt the body to generate antibodies that block other viral proteins, or make T cells that can kill infected cells.

How do we know whether a vaccine will work?

Normally, vaccines go into human trials after tests for safety and effectiveness in animals. But vaccines being developed by US drug firms Moderna and Inovio Pharmaceuticals are being tested in animals in parallel with human phase I trials. Vaccinated animals will be infected with the virus to see whether they are protected. As researchers learn more about the infection from human and animal studies, they will get a better sense of which vaccines are likely to work best.

Will it be safe?

Researchers' main safety concern is to avoid 'disease enhancement', in which vaccinated people who do get infected develop a more severe form of the disease than people who have never been vaccinated. Larger human studies of the Moderna vaccine will begin only once human and animal studies confirm that the vaccine is safe.

By Ewen Callaway



Health departments around the world are struggling to test for coronavirus.

measures crucial because they reveal chains of transmission, and close them down before people have time to spread infections.

Analyses of successful coronavirus responses in China, Singapore, Hong Kong and South Korea suggest that these regions curbed their outbreaks largely because of rapid testing, contact tracing and quarantine.

But US health officials seem to be deprioritizing this targeted approach in favour of social-distancing measures, as is the United Kingdom. Such behaviour is a matter of concern for the WHO, which recommends both strategies. "We have not seen an urgent enough escalation in testing, isolation and contact tracing, which is the backbone of the response," said director-general Tedros Adhanom Ghebreyesus at a press briefing on 16 March. "We cannot stop this pandemic if we don't know who is infected," he said.

Policy on investigating contacts and quarantining them varies from city to city in the United States. In Denver, Colorado, where there were 49 confirmed cases as of 19 March, health officials reach out to people who might have been exposed only if they are elderly or have health conditions; they recommend that these people stay at home if they can. Health departments in at least two counties in California – Sacramento County and Placer County – have decided not to quarantine contacts who show no symptoms, despite a growing body of evidence that asymptomatic carriers might transmit the coronavirus. And in Seattle, Washington, the health department is no longer routinely investigating contacts, because cases are proliferating rapidly and contact tracing is labour-intensive.

Once a population is saturated with the virus, it might no longer make sense to identify contacts, says Jonathan Eisen, a microbiologist

at the University of California, Davis, but he doesn't believe that the United States has reached that point yet. One study estimates that there had been as many as 53,000 cases of COVID-19 in the United States by 14 March, more than the number of cases officially confirmed so far (see go.nature.com/3dsmgiu). But even if the estimate is correct, testing people and tracking their close contacts to the greatest extent possible prevents a significant number of people from spreading the disease further, says WHO spokesperson Margaret Ann Harris. "China had shown that even with greater numbers, this is doable," she says.

One root of the problem is a lack of rapid diagnostic testing, and a shortage of people to investigate confirmed cases. Ranu Dhillon, an epidemic-response specialist and physician at Harvard Medical School, who is based in the San Francisco Bay Area in California, says test results are taking up to three days to come through – longer than they did in 2015 in West Africa during the Ebola outbreak, even though the basic methods are the same.

If the United States forgoes contact tracing – or does it very poorly – in favour of aggressive social-distancing measures alone, the country risks the outbreak worsening, and lockdown measures such as school and business closures dragging on for longer than they would otherwise. And that, says Dhillon, will seriously damage people's livelihoods and the economy.

Meanwhile, the geneticists who learnt of their exposure through Twitter are taking their own temperatures. Another attendee at the recent meeting, a population geneticist in Oregon, tweeted: "we are all now self-quarantined. a few are showing symptoms."

Additional reporting by Elizabeth Gibney and Giuliana Viglione