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THIS month, UK Prime Minister Boris Johnson announced an ambition to increase the country’s capacity for coronavirus testing to several million tests a day. Billed as Operation Moonshot, the idea was received with widespread incredulity. The UK is currently failing to meet demand for coronavirus testing, with roughly half a million daily requests outstripping supply by up to fourfold.

Yet there are also reports of new technologies in development that could make testing faster and cheaper. If the UK had the capacity to test not just those with symptoms of covid-19, but to regularly test symptomless people too, it could be a game changer in the ability to control the disease.

From the beginning of the pandemic, many countries have struggled to provide enough coronavirus tests for all those who need them. A lack of tests is disruptive because anyone with symptoms that resemble those of covid-19 has to stay at home and isolate, and must also be treated as infectious within hospitals. Insufficient tests also make it impossible to accurately track how the epidemic is progressing in a region, whether cases are rising or falling. “Without testing, which is our eyes and ears, we don’t understand where this is going,” says Stephen Griffin at the University of Leeds in the UK.

The UK faced this problem initially in its first wave of covid-19, when even hospitals were going short of tests. To expand capacity, five large facilities known as Lighthouse Labs were set up to process polymerase chain reaction (PCR) tests, a well-established technique. In this case, the tests are used to compare samples from a nose or throat swab to the genes of the new coronavirus. The labs are dotted around the UK and, for a few months, capacity seemed largely sufficient.

As UK cases have begun to increase again in recent weeks, though, demand has risen. The drivers seem to be people socialising and returning to work and school. Although children are generally less affected by the coronavirus, schools are known hotbeds for spreading coughs, colds and flu, which have similar symptoms to covid-19 and so can trigger test requests.

Media reports have been full of stories of testing centres with empty car parks, while people trying to book online are being offered appointments hundreds of kilometres away. The bottlenecks aren’t at the testing centres where swabs are taken, but at the Lighthouse Labs where they are sent. If labs fall behind on processing, they tell testing centres not to release more appointments.

Although the UK’s current capacity for tests is around 250,000 a day, some are reserved for hospitals, so only about 160,000 are available to the public. Based on estimates of phone requests and website usage, about three or four times as many people are seeking tests as are able to get one, according to comments made to members of parliament by Dido Harding, head of England’s test-and-trace scheme.

Two further Lighthouse Labs are opening in the next few weeks, which should increase testing capacity to 500,000 a day by the end of October. However, Harding admitted to MPs that, by then, it...
still won’t be enough to meet rising demand. Official documents leaked earlier this month suggest that Operation Moonshot is aiming for a capacity of 10 million tests a day by early next year. This is around the same number that would be needed to eliminate the virus from the UK, by testing everyone in the country once a week, although the government hasn’t stated that elimination is the goal. Instead, it has focused on testing as a means for people to return to regular activities.

New testing methods could help. One option is a small machine called NudgeBox that can process a sample on the spot and give a result in 90 minutes, instead of it having to be sent to a lab. Developed by UK biotech firm DNANudge, the device is already being used in eight hospitals, and the UK has ordered 5000 more. Recent research shows it is almost as sensitive as standard lab testing. “It allows you to start therapy much more quickly,” says Graham Cooke at Imperial College London, who led the study.

While this kind of machine can help in hospitals, it can only process one sample at a time and so turn around at most 16 samples a day. That means it can’t raise testing capacity enough to screen millions of people daily unless hundreds of thousands of devices are manufactured. What is needed are mass-testing devices that process multiple samples at once.

Various other kinds of PCR tests are in use or in development around the world that could help. Some of these are cheaper or easier than the standard lab tests, or use different chemicals to get round any shortcomings of the commonly used ones. But if testing capacity is to be boosted to the levels mooted in Operation Moonshot, other approaches may be needed.

Earlier this year, Julian Peto at the London School of Hygiene & Tropical Medicine proposed a plan in medical journal the BMJ to use mass testing to eliminate the coronavirus from the UK. To achieve the necessary level of testing, he proposed commandeering all the PCR equipment in research labs at universities and hospitals.

Peto now says that increased capacities for other tests – for example, a genetic test called RT-LAMP – could make mass screening easier. Unlike PCR, this doesn’t need sophisticated lab equipment, but merely a heater to warm the sample to about 65°C. It gives a result in 20 to 45 minutes. It might be possible to speed up testing further by switching from looking for the virus’s genes to hunting for molecules on its surface, known as antigens. These can be detected using artificial versions of the antibodies of our immune system that normally recognise viral antigens. This is the same mechanism as home pregnancy tests and, like these, coronavirus antigen tests can produce fast results.

Antigen tests aren’t generally as sensitive as genetic ones, but that has both pros and cons. They can fail to spot some people whose infection is waning and so have relatively few virus particles in their nose or mouth, but still have enough viral genetic material to be picked up by PCR. However, such people are less likely to be spraying virus into the air from their lungs, so antigen tests might be good for quickly picking out only people who are infectious.

For now, UK mass-testing schemes are sticking with genetic tests. There are two large trials combining saliva testing with the fast RT-LAMP method in two cities. In Salford, screening of people at indoor and outdoor venues is due to begin next month. In Southampton, children at several schools are starting weekly checks.

It was initially thought that saliva tests wouldn’t catch as many positive cases as swab tests because mucosal fluid from inside the nose or the back of the throat should in theory contain more virus particles. So the first tests approved were swab ones. But it now seems that testing people’s saliva is effective. The US Food and Drug Administration granted emergency approval last month to two saliva tests. Such tests would be especially useful in schools because administering the invasive swab tests is particularly hard with small children.

A ready supply of tests to enable mass screening would allow for a radical new containment strategy, as testing would include people who are infected but have no symptoms and so can spread the virus unknowingly. If enough people are reached and all infected individuals self-isolate, it should reduce the virus’s prevalence.

There are big questions around false positives (see box, left) and who would pay for the tests, and it would also be vital to test visitors and returning travellers, as is happening in Germany. But done properly, these two strategies together might be able to more or less eliminate the virus from a nation without a vaccine in sight.