Living with Covid-19

S ANANTHANARAYANAN

It is not correct to say Covid-19 has grabbed centre stage. Covid-19 is the only player in the cast and the whole world has become its stage.

Terms like, exponential, immunity, extending the lockdown, relaxing the lockdown – there are many and differing ideas, strategies and visions that are doing the rounds. Europe and the US have got it bad, our numbers appear to be better, but the jury is out on how India will weather the storm.

There is a section that stresses on the speed at which Covid-19 is able to spread. Exponential growth is indeed explosive. High school math can show that one paisa, if it doubles every day, in thirty days, it would grow by a factor of 2^{30}, to Rs 10.74 million. So we know what to choose if we are offered either a lakh or so rupees every day for 30 days, or that fecund single paisa.

The example, however, is unfair to Covid-19. First, the infection does not double every day. Still, based on the growth factor of 2.6, which has been given out, an expert in disease dynamics from Princeton University said that there would be millions of patients in India in less than four months. This mechanical extrapolation however, may not be valid, as the factor of 2.6 applies to an infected person who is surrounded by susceptible persons and without precautions in place. When steps to limit transmission are taken, the factor is much lower and there are prospects of blocking the spread of infection.

A factor that slows the spread of infection is that persons who are immune after infection (or have been vaccinated) become barriers between infective and susceptible persons. As the acquired immunity or vaccination level increases, the rise in infective persons slows, and finally stops. And when infective persons stop being infective, the virus cannot survive, it is eradicated.

This is the phenomenon of "herd immunity", a term used while describing the spread of viral diseases in sheep, cattle, rabies in some animals in the wild, et al. In the 1930s, it was recognised that the spread of measles reversed when sufficient numbers were affected. When this happens, or to what degree the infection needs to spread for herd immunity to set in, depends on the infectivity of the virus.

Infectivity is how many new infections each infective individual causes, on an average. This number is denoted as R_0 (R naught). Pc, the critical percentage of the population that needs to be immune for herd immunity to set in, can then be worked out with the formula, $Pc = 1-1/R_0$. We can see that if R_0, or infectivity is low, or in other words, one person infects just a little more than one other, Pc is a small fraction. But with high infectivity, Pc can be high. If each person infects 10 other persons, for instance, Pc = 1-1/10 = 0.9, or 90 per cent.

In the case of Covid-19, with R_0 = 2.6, Pc works out to be 0.61. This means 61 per cent of the population needs to be infected for herd immunity to set in. This is clearly too high a number to consider. Currently, about 2.5 million people, or 0.03 per cent of the world population of eight billion are infected. We are obviously very far from herd immunity, and the cost, with even low, fractional mortality, is not acceptable. And the world's medical facilities would not be able to cope.

There are, however, two reasons why we need not wait for 61 per cent of the world's population to be infected. The first reason is that R_0 is 2.6 only when an infected person is surrounded by persons with no immunity, and she is, in principle, in communication with all of them. This would be true in the early stages, but the effective infectivity reduces as more persons are infected or become immune. Although we need to reach 61 per cent for the spread to stop, it begins to slow down, starting as soon as person Number two is infected.

The second reason is that the whole world has now put barriers in the way of the virus, by isolating infected persons, using masks and washing hands with soap, lockdown of whole cities, to reduce occasions where the virus can cross from person to person. The value of R_0 is hence much lower and the speed with which numbers are increasing is slowing in many places. When measures are able to slow the spread, there is time for a vaccine to be developed. And once there is a vaccine, each protected person becomes a barrier to the spread.

The next question is how long we need the lockdown. In India, it was ordered for three weeks. As effects are not apparent, it has been extended. The situation is not expected to be much different, two weeks later, and the reasoning is questioned. Unless the virus is eradicated, it is argued, there cannot be a case to relax the lockdown.

The answer to this is that a lockdown is an extreme measure, it could be called a "desperate" move to get a hold on a runaway situation. In the early stages, lockdown mainly keeps healthy people away from other healthy people. In the late stage, it keeps infected people away from other infected people. More to the point would be to detect where there is infection and see that it does not spread. This would call for massive testing and contact tracing steps that have been taken, often considered less extensively than desired, in India. But if the scale of the infection becomes known, we may find that the cost of the complete lockdown is not justified. The testing that is now done in India, incidentally, throws up 4.4 per cent positives. This is against two-digit and higher percentages that are found elsewhere.

We need to recognise that the world is now highly connected – there is almost no pocket that can be considered self-sufficient. A gated society in a metropolis can manage the lockdown for a month and may believe it can tolerate more. But supplies must come and if something breaks down, a repairperson must come in from outside. A city may consider itself working well without imports, but most machinery will soon need spares, or hospitals the supplies that the city does not have!

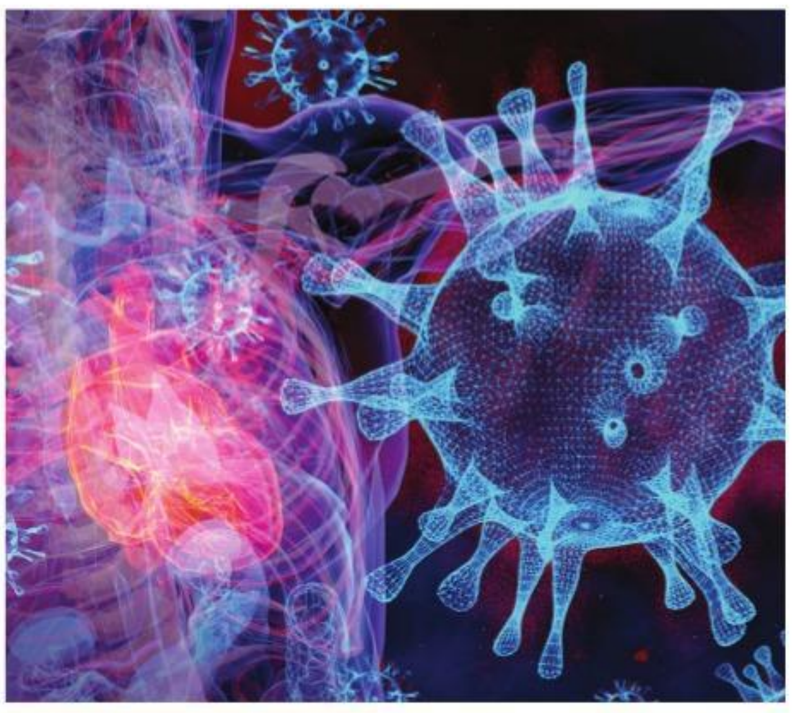
And then, there are sections of society that states cannot support for long. These sections would break the lockdown, "to choose between Covid and starvation," somebody said. The response was that when they choose Covid, it is not only their choice, it is the choice for everybody. But this apart, all sections of society play a role, which only an economy in motion can sustain.

The answer seems to be that we keep sensible, but educated, responsible and disciplined social distance, hygiene and alertness, simplicity and sustainability, and expect to stay like this for many months, maybe a few years.

The writer can be contacted at response@simplescience.in

Controlling co-morbidities

Covid-19 can be especially severe for people with heart conditions and also, smokers



SUBHENDU MAITI

Doctors across the world are concerned with the management of cardiac patients once they have contracted Covid-19. Not only for patients with respiratory illnesses, people suffering from cardiac conditions are also especially at risk.

Covid-19 can aggravate the condition of patients with co-morbidities like ailments in the lungs and heart. As more data comes in from China and Italy, as well as Washington and New York in the US, more cardiac experts are of the belief that the Covid-19 virus can infect the heart muscle. An initial study found cardiac damage in as many as one in five patients, leading to heart failure and death even among those who showed no signs of respiratory distress.

Special attention to heart health can enormously impact outcomes of care of elderly individuals who are admitted to the hospital for exacerbation of various diseases related to heart health, including heart failure. Patients with heart failure often merit not only intense attention during their hospital stay but enhanced vigilance and post-acute care after being discharged. This care is provided in transitional settings such as a skilled nursing facility or in-home health care.

Frontline work is being done by Dr Ravikanth Yalamuri, who has been a strong advocate for utilising the concepts of hospice in the care of terminally ill patients. Dr Yalamuri, an alumnus of Guntur Medical College, is currently medical director of multiple rehabilitation centres in San Antonio in Texas and Buena Vida, Hunters Pond and River City Nursing and Rehabilitation in the US. In the backdrop of the Covid-19 pandemic, Dr Yalamuri who is also an expert in multiple palliative and hospice care felt that the direct discharge of a heart patient to their home environment is a superior step in the current situation. It can be coupled with aggressive heart failure education for family members. Not only does it impact hospital readmission rates due to emerging events in the post-acute care timeframe, it prevents social clustering and transmission of microorganisms.Apart from lung injury taking centre stage, heart damage is a major grim outcome of Covid-19. Because of the myotropic nature of the virus, not only the skeletal muscles but heart muscles and smooth muscles of the walls of blood vessels (including the coronary arteries) may be affected. Thus, myocarditis, acute-onset heart failure and acute coronary syndromes are all possibilities in the spectrum of Covid-19 illness. Cognisance needs to be exercised regarding these conditions for individuals under hospice care.

Using his vigorous clinical efforts, Dr Yalamuri advised to feel the pulse and identify the tell-tale symptoms of dangerous cardiac conditions. He said that they can go a long way in the prevention of these complications and cataclysmic outcomes. Previous research has unambiguously demonstrated that heart attacks can occur by respiratory infections such as the flu. A similar trend is being seen with the new respiratory virus. Fever and inflammation can destabilise the current cardiac condition and unmask silent cardiac symptoms. Dr Yalamuri stressed the importance of social distancing as fulminant inflammation of the heart from viral illnesses can lead to rhythmic disturbances. He also emphasised on compliance to blood pressure medications, and other cardiac care medicines including cholesterol-lowering drugs like statin and antiplatelet drugs like aspirin to maintain optimal state of heart functioning. He advised that these life-saving medications with well-established benefits are key in the care of our elderly.

Research on respiratory syncytial virus has demonstrated that inhaled tobacco smoke also increases the rate of transmission and severity of viral respiratory tract infections. Hence, it has been postulated that smokers are at increased risk of contracting Covid-19. Notably, smoking involves repetitive hand-to-face movements, which provide a route of entry for the virus.

Dr Yalamuri stressed on the positive importance of cessation of smoking not only of tobacco but also marijuana. Smoking has many negative effects on heart function and circulation and there is solid evidence that smoking cessation even at advanced ages can lead to significant health benefits.

Homegrown solution

An institute in Kerala has successfully developed a low-cost diagnostic technique for Covid-19

BIJU DHARMAPALAN

Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, an institute of national importance under the department of science and technology, has developed a diagnostic technique that could considerably reduce the cost of Covid-19 testing. As per the press release from director Asha Kishore, it could be used for large scale testing in the community as results can made be available in less than two hours.

The Chitra GeneLAMP-N technique was developed by researchers from the biomedical technology wing of the institute under the leadership of Anoop Kumar Thekkuveettil. The test is based on Reverse Transcription Loop-mediated Isothermal Amplification (RT-LAMP), an isothermal nucleic acid amplification technique. In contrast to the polymerase chain reaction technology, in which the reaction is carried out with a series of alternating temperature steps or cycles, isothermal amplification is carried out at a constant temperature, and does not require a thermal cycler.

Chitra GeneLAMP-N will help detect the N-gene of the Covid-19 genome. N-gene codes for nucleoprotein, which is associated with RNA and is highly conserved. The machine will amplify the N-gene c-DNA using isothermal amplification method. Since the results are made using the variation observed in fluorescence, it can be handled by all laboratory technicians.

The diagnostic tests currently employed in India for Covid-19 uses Reverse Transcription Polymerase Chain Reaction (RT-PCR) test, which detect the E-gene. The E-gene codes for enveloped protein and is not as highly conserved as the N-gene. So even if the virus gets mutated from person to person, the N-gene could be identified. Validation of the technique was carried out at the National Institute of Virology Centre in Allapuzha and showed 100 per cent accuracy and similarity with test results obtained using RT-PCR.

The time taken for a laboratory to collect the swab sample till the final result is over five hours now. RT-PCR is an expensive test as the machines required are imported and in private laboratories, the test costs Rs 4,500. Covid-19 testing using Chitra GeneLAMP-N can be done within a time span of two hours and with less than Rs 1,000 per test. The machine can handle 30 samples at a time. This is probably the first successful application of N-gene in Covid-19 detection across the globe. The group has developed this technique within a span of three weeks and it includes Amal Wilson Varghese, Aneesh, Rasitha SK, Swathi S Nair and Anjana.

The writer is assistant professor and head, School of Biosciences, Mar Athanasios College for Advanced Studies Tiruvalla, Kerala

PLUS POINTS

Saliva 'glucose'

Saliva could be used instead of blood to monitor diabetes in a method proposed in research. The test has been developed as an alternative to the current prevalent practice of monitoring blood glucose, which can be invasive, painful and costly.

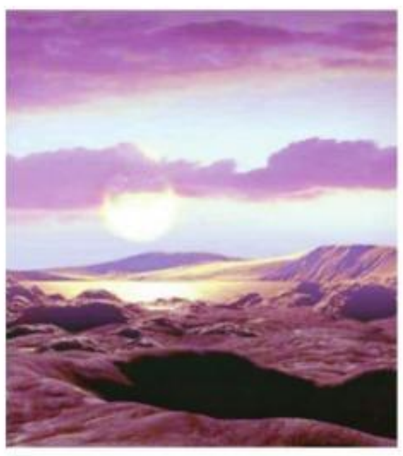
Lab tests of the saliva process had an accuracy rate of 95.2 per cent. The research shows promising results for monitoring diabetes, which affects an estimated 425 million people worldwide — around half of them undiagnosed. It has been published in the journal *PLOS One* and involved researchers from the University of Strathclyde, UK, Federal University of Uberlandia in Minas Gerais, Brazil, University of Vale do Paraíba in Sao Paolo, Brazil, and University of Saskatchewan in Canada.

Matthew Baker, a reader in Strathclyde's department of pure and applied chemistry and lead researcher in the project, said, "Saliva reflects several physiological functions of the body, such as emotional, hormonal, nutritional and metabolic, and so its biomarkers could be an alternative to blood for robust early detection and monitoring of diabetes. It is easy to collect, non-invasive, convenient to store and requires less handling than blood during clinical procedures, while also being environmentally efficient. It also contains analytes with real-time monitoring value which can be used to check a person's condition."

The lab tests used a scientific system known as Attenuated total reflectance Fourier transform infrared (ATR-FTIR) spectroscopy. This has been used in the diagnosis of several diseases, although its applications in the monitoring of diabetic treatment have begun to emerge only recently. Samples were assessed in three categories — diabetic, non-diabetic and insulin-treated diabetic — and two potential diagnostic biomarkers were identified.

The researchers are hopeful that the process they have developed could be used for both Type 1 and Type 2 diabetes, although further study will be required to confirm the same.

Earth 2.0?



Nasa has found an "intriguing" planet that could be home to life in old data from a retired space telescope. The Earth-sized exoplanet orbits around its star's habitable zone, meaning that the temperature is mild enough to allow a rocky planet to support liquid water.

The distant world was discovered when scientists were picking through old observations that came from the Kepler space telescope, which stopped its work in 2018 but provided a vast trove of data from the stars before it did. The planet had previously been discarded by a computer algorithm that misidentified it. But as part of new research, scientists were able to have another look at the information in the Kepler data and see that it really was a previously undiscovered planet.

In fact, it is the most similar to Earth of any planet discovered by the Kepler space telescope, in terms of its size and estimated temperature. While other exoplanets may be more similar in size or temperature, no world has been discovered that has quite such a combination of those two qualities, as well as lying in the habitable zone. The planet is 300 light-years from us, just a little larger than our Earth and receives about 75 per cent of the light that we get from our own Sun. That means the temperature could be similar, too, allowing for the conditions required for life.

Scientists are concerned, however, that its star is a red dwarf, unlike our own more stable Sun. Such stars are known for throwing out stellar flare-ups that could destroy any potential life before it takes hold on the planet.

Scientists now hope to learn more about the planet, including any information about its atmosphere and to get more specific knowledge of its size and conditions.

The independent