



Fig. 1: General illustration of Contact Tracing based off of CDC-material. | CREDIT - CFCE, CDC

With efficient, speedy and action-oriented contact tracing, we can be step ahead of the virus: K. VIJAYRAGHAVAN

K. VijayRaghavan is the principal scientific adviser to the Government of India. He is also professor emeritus and the former director of the National Centre of Biological Sciences, Bangalore. He has been a part of the ICTS-TIFR Management Board since its inception. Here are excerpts from his speech about Aarogya Setu, an integrated data and decision support platform to fight the COVID-19 pandemic, on the digital platform Digital India Learning.

These are very difficult times and at the outset it is important to be clear that difficult times are best handled with intelligence, calm and resoluteness. And that is what all of us are doing. It is pretty incredible to see how we have all come together to fight this pandemic.

How did this pandemic come about?

The COVID-19 disease is caused by the SARS-Coronavirus2. There are other coronaviruses that we know of – like SARS1. SARS2 is different from SARS1 in many ways. SARS2 seems to have been transmitted to humans via two animal hosts – probably bats and pangolins. We know this because we can analyse the genetic sequence of the virus in humans. We can

go back and ask how is the sequence related to those that are being isolated from other sources of transmission such as a bat or a pangolin. Therefore, with a very high level of accuracy we think this is the route of transmission. We can also look at the variations as the virus spreads from country to country, continent to continent. And then we can track where the spread started from and how it travelled to other countries. We know that it originated in Wuhan, Hubei province, in China in December 2019 and then rapidly went to other places. There are many important points that we must keep in mind – about why this disease has wrecked such havoc and why we are so concerned about it. If you look at the absolute numbers

of deaths by COVID 19, many people argued till a few months ago that the mortality rates expected were similar to those of a major influenza pandemic or of heart disease or tuberculosis. So why are we so concerned about this? The reason for that is not the absolute numbers alone but the exponential growth. The rise from a low number to a very high number in a very short time, which overwhelms each location where this growth takes place rapidly. The resources, the hospital environment, the economy is put under great stress when this exponential growth takes place very rapidly. So imagine there is a manufacturer who can manufacture a very large number of components – let's take the example of Haldiram's or another similar company. If they manufacture a very large number then adding, let's say, 10 per cent of the number may not seem like a huge increase. But if you make a significant and sudden demand at many local outlets, which is huge and disproportionate to the capability of the outlet, then you cripple

the supply system or the ability to handle the demand. That is what is happening with COVID 19 disease. The infections ramps up very rapidly because each person spreads it to a few others, who in turn spread it to a few more. And if you don't do anything then the spread can be very rapid.

So the next question is what do we do?

If the presence of the virus and the symptoms of the disease are very tightly associated in time, then attending to the symptoms would also attend to the spread of the disease. So you can easily isolate someone who has the symptoms and ensure that the disease does not spread. Then if you isolate all those around them who are likely to be infected, then you can be very confident that the disease will not spread. When SARS2 infects people and many of those people have no symptoms at all. Even when they have no symptoms they can infect others. The spread is insidious and therefore looking at only those who have symptoms doesn't

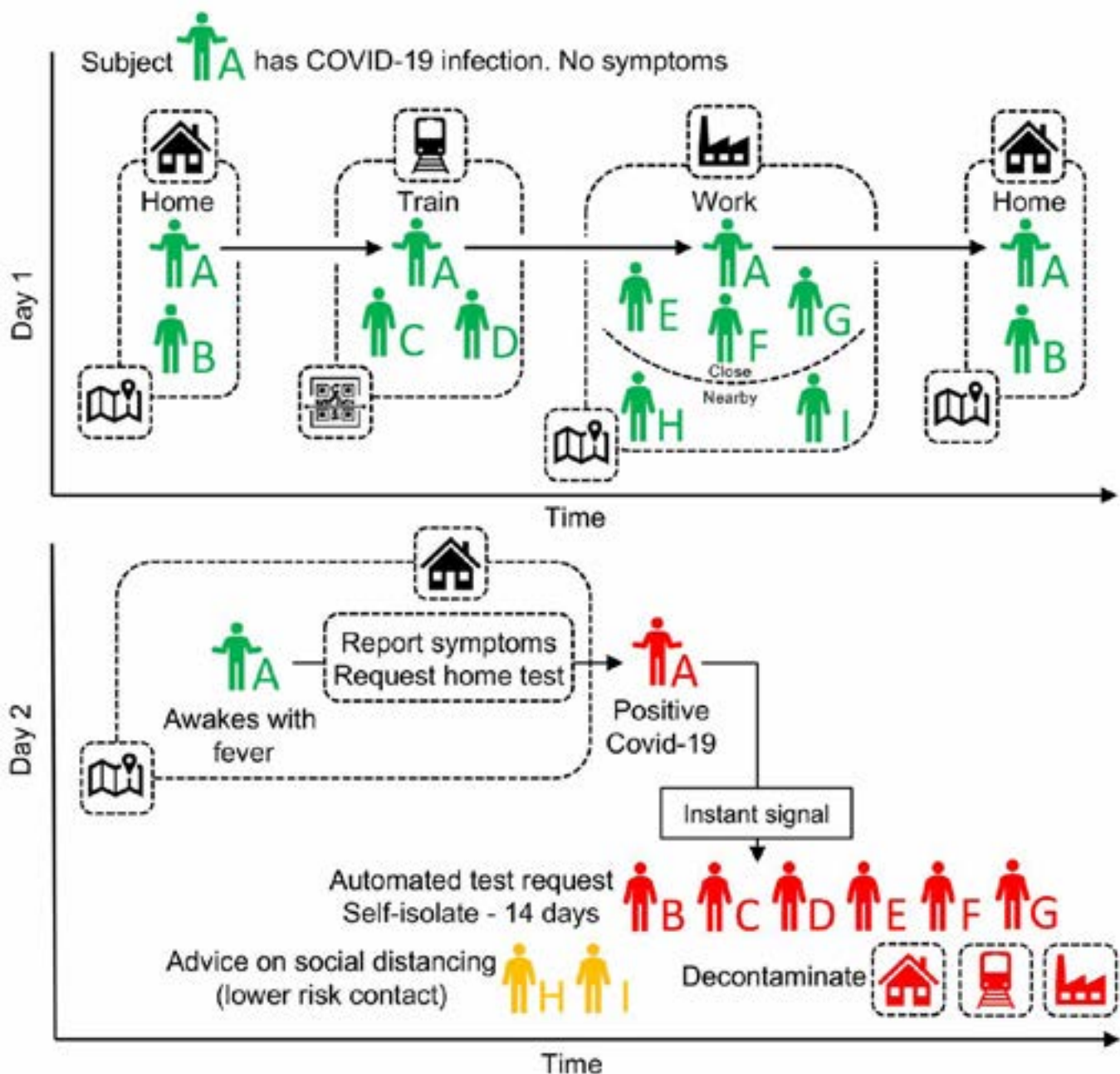


Fig. 2: A schematic of app-based COVID-19 contact tracing [REFERENCE - "Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing", Luca Ferretti, Chris Wymant¹, Michelle Kendall, Lele Zhao, Anel Nurtay, Lucie Abeler-Dörner, Michael Parker, David Bonsall, Christophe Fraser | IMAGE SOURCE - Wikipedia]

CONTACT TRACING:

an alternative to locking everyone up for 18 months or letting millions die

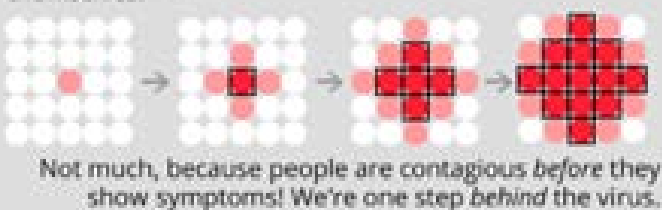
There are 3 kinds of people, as far as COVID-19 cares:



If we do nothing, here's what happens to a neighborhood with one Patient Zero:



Here's what happens if everyone who finds out they're sick (showing symptoms) immediately quarantines themselves:



But here's what happens if, when someone shows symptoms / tests positive for COVID-19, they and their recent close contacts are self-quarantined:

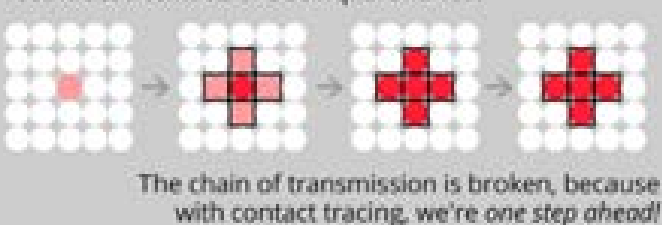


Fig. 3: Contact Tracing helps us break the chain of virus transmission, and stay a step ahead.

quell the pandemic. So you will need to have other kinds of tools to do that.

What are the kinds of tools we have?

Broadly, there are two kinds of tools. One is a defensive tool and the other is offensive. The defensive tools are – because the virus spreads through droplets or there are speculations that it spreads through aerosols (that's why the use of masks are more important than earlier thought necessary) – isolation or social distancing, washing hands thoroughly, not touching your face with unwashed hands, and after touching your face washing your hands again. These kinds of rules allow you to prevent the rapid propagation of the virus. Under these situations, instead

of a rapid rise you can 'flatten the curve' – prolong the disease spread but lower its intensity. But the important point is that the disease is still there. You need to have offensive ways also by which you can remove the disease. Of course it's possible that if everyone were to stay very far away from each other for several months then the disease would die off. But that's not feasible at all.

What would be the feasible way then?

In the long term we hope to have vaccines and drugs against the disease. The route to the vaccination seems to be going reasonably well right now. Drugs of course are much more difficult for viruses. This is because viruses, especially this kind, use the host's cell machinery almost entirely for its growth. So any drug designed to attack the virus is very likely to attack the host's machinery. Therefore, it is difficult to get a unique drug. Even if you manage to get a unique drug that damages the host minimally, you need to attack the virus at the early stages of the infection. At the later stage the virus will have multiplied in large numbers. So it is important to hit early, but it's difficult to know when. These are the challenges – but a vaccine and perhaps a drug will surely come.

So what is the offensive way we have now?

We have a two-component offensive weapon and that's called 'testing and tracking'. If we can trace every single contact of a person who tests positive and do that backwards in time, we need to do this because asymptomatic people can also infect. When a person was asymptomatic they may have infected some people. Later when they test positive you can go back and say look when you were asymptomatic, you were close to these many people, these people have to watch out and we have to monitor how they are doing. If this method of contact tracing which is a variation of the classical manual contact tracing, is done we can isolate people who are likely to have been infected. The speed at which the disease spreads and the suspected speed at which asymptomatic people can transmit it, means that contact tracing must be done very rapidly. For it to be effective, it needs to be done on scale and really well. Contact tracing then allows people to be tested if needed. Testing also needs to be robust and effective and on scale. Both these are happening. The government has rolled out a new way of contact tracing called Aarogya Setu. It's an app available on Android and Apple stores. And this is not only for smartphones. Today a feature phone version was rolled out in Tamil Nadu and will be available all over the country very soon. This will allow contact tracing along the lines that I have just told you. If you download the app and do a self-assessment – age, gender, history of diseases, recent international travel – then you get an assessment of where you stand in terms of vulnerability. The app will have all this information on the phone and when its Bluetooth, GPS are on. If you come close to variety of people that information is not used until someone turns positive amongst your proximal contacts, and then you are told that a

few days ago you were close to a person who became positive and you need to do certain things – look after yourself, isolate, need to get tested or be careful depending on the nature of the contact. Your phone number and contact details are known to no one, nor are the details of those who turn positive known to you. There is high security, high privacy, yet there is a high level of ability to trace and deal with the disease. If necessary people will be tested, and then they will be contacted. This scale and quality of contact tracing is really unusual, it's been done on a national level. But for it to be effective a very large number of us should use it. Everyone who has a smartphone or a feature phone should be using this app in one way or another. This is very important.

This is an integrated data and decision support platform. Unlike many other diseases, asymptomatic people can transmit so a way to track every close contact of those who are positive is needed. And like I said this needs to be done backwards in time.

How does contact tracing work?

Imagine someone, say Person A, leaves by train to work and then comes back home again. All is well. The next day this person reports symptoms and requires a test, which turns out to be positive, then there is an instant signal which goes to all those people who were close to that person during commuting, at work or at home. And the people who were a little far away are warned. Keep in mind why this is so important and why you should not look at only those who are showing symptoms. There are three kinds of people – those who are not infected yet, those who are infected and contagious but don't show any symptoms and those who are infected and show symptoms. And if we do nothing then this is what happens [slide] – a person who is asymptomatic but positive becomes symptomatic, infects other people who also later on become symptomatic and the epidemic spreads. Now if you quarantine everyone who has symptoms and nothing else, then you will be quarantining only the red people [see slide]. There will always be the asymptomatic people who will still be spreading the disease. You don't know who they are and it's not possible to

test the entire population. You need to have a way of focusing as this pink person travels over various distances, over time. We need to find out who all were close to that person and warn the others after the person is identified as positive. This is what contact tracing is – it will find the symptomatic person and also identify all the asymptomatic people around him in the past two days and quarantine them too.

So contact tracing and testing are both very important, so that you don't needlessly quarantine those who are not positive but you test those who are proximate to the person who is positive.

With efficient, speedy and action-oriented contact tracing, we can be step ahead of the virus. With the defensive tools of mask wearing, face covers, hand washing and social distancing, we are one step behind the virus. But when we combine this with contact tracing and testing we can go one step ahead effectively. Only digital tools can make this possible, in the time, quality and scale needed, and India excels in this. Therefore, the wide use of Aarogya Setu allows alternative to long-term lockdowns and can prevent the health system from being overwhelmed. It has great speed and quality in collection of data, in analysis, decision making and action. It is on a national scale and integrates every single body on the ground – integrates disease surveillance system, the National Centre for Disease Control, state health systems, public health systems and feeds the information along with the data from Aarogya Setu go rapidly back to decision making. The collected data will be used only for COVID19 and not for anything else. The security tests have been thoroughly done, the security is assured.

By combining the efforts of our extraordinary health workers with a digital tool, we will stay one step ahead of the virus while we work hard nationally and internationally to develop a vaccine. □

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