

When should we blow the shofar?

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With COVID-19, we are fighting an invisible enemy

The novel coronavirus (SARS-CoV-2) has already left a large footprint; it has spread itself far and wide. And it is spreading even further. It has killed in thousands. A wartime situation prevails. Strangely, we are fighting an invisible enemy. And yet our ability to return victorious is not obvious. Especially, when we may be able to blow the shofar.

An infected person can transmit the virus directly to many uninfected persons. The larger this number – called the Basic Reproductive Ratio, R_0 , pronounced *R-nought* – the more contagious is the disease caused by the virus. The faster it will spread in the community. *R-nought* can be viewed as the product of three numbers: (1) the number of days an infected person remains infective (that is, can infect others), (2) the number of susceptible persons available to infect and (3) the chance that a susceptible person gets infected. The easiest way to keep *R-nought* low is to keep ourselves distanced from every other person. That way, the chance that a susceptible person gets infected remains low. It is not sufficient to distance ourselves only from those who show symptoms of infection. We have to continue to distance ourselves from every other person. Many apparently normal persons may actually be infected without showing symptoms of infection. Therefore, just as *R-nought* influences the spread of COVID-19, our behaviour also influences *R-nought*.

A person infected with SARS-CoV-2 can remain infective for 10-to-14 days. During the initial phases of spread, there will be a large number of uninfected persons to infect. For SARS-CoV-2, *R-nought* has been estimated to be between 2 and 3. Let us take the best case scenario. Assume *R-nought* to be 2 and the infective period to be 10 days. Then, the

first person will infect two others, each of whom will infect two others (2^2), each of these four persons will infect two others (2^3) and so on. In 10 days, this one infected person will have infected 2,046 persons. A person who is infected or has recovered cannot be infected again. At least not in the next several months or even years. An infection activates the immune system which learns to recognize the virus and remembers it. The next time the virus tries to infect him, his immune defenses are able to recognise and protect him against further infection. Therefore, as the infection spreads, there will be less and less number of uninfected persons to infect. An increasing number of persons in the community will have gained immunity from having been infected earlier. This is called herd immunity. (If there was a vaccine for SARS-CoV-2, it would have helped achieve herd immunity without a large number of persons being infected. A vaccine simulates the effect of an infection and builds immune resistance to the virus. We have eradicated polio in this way.) As herd immunity increases in the community, many infected persons will not find another person to infect during the entire infective period. *R-nought* will then be less than one, on average. Consequently, there will be few new cases arising and existing cases will recover or die. Spread of the disease will slow down and the pandemic will end.

COVID-19 may be long-lasting

There is also a related issue to consider. When there is an outbreak, persons in the community get symptomatically infected one after another. The length of time between appearance of two successive persons with symptoms of infection is called the Series Interval. This interval informs us about the spreadability of the virus. The shorter this interval, the greater the speed of spread through the community. For SARS-CoV-2, the Series Interval is between 5 and 7 days. For influenza, this interval is 1.3 days. Therefore, influenza spreads four to six times faster than COVID-19. Is this good news for us? The answer is no. COVID-19 is spreading through the community slowly. Herd immunity will therefore arise slowly. This means that the COVID-19 pandemic is going to last for a long time.

The current lockdown cannot go on forever. Is there a scientific basis to determine when the lockdown may be lifted? Will the lockdown be lifted

only after everyone in the country becomes immune to the virus? No; we can never be sure that everyone has gained immunity. However, if the chance that an infected person finds a person to infect is sufficiently low, then the virus will stop spreading. Then the lockdown can safely be lifted. This will happen if a certain proportion of individuals in the country is immune. This proportion is called the “herd immunity threshold.” It is calculated as $1-(1/R_0)$. For SARS-CoV-2, R_0 is 2 or 3. An R_0 of 2 would mean a herd immunity threshold of $1-(1/2)$ or 50%. An R_0 of 3 would mean a herd immunity threshold of $1-(1/3)$ or 67%. We should play safe. Therefore, lockdown can be safely lifted if about two-thirds of our population attains immunity to the virus. But how would we know that two-third of our citizens has gained immunity. We need to estimate this proportion by testing our citizens selected randomly and in large numbers. Surveillance testing in communities has now been initiated in India. We hope that the results of these tests will be used to determine when to blow the shofar.

A policy is immediately required

Daily wage earners are now unable to earn their daily bread. Families are going hungry. Enforcement of the lockdown is leading to clashes — of citizens with the police, between groups of villagers and so on. Yet lifting the lockdown before herd immunity threshold is achieved will be disastrous. However, a hungry person does not have the luxury of being mindful about personal and public health problems arising from this virus. Either food has to be provided by the Government and by those of us who can afford, or we will have to soften the lockdown and allow them to work. Certainly, all large gatherings — including religious and political gatherings — must continue to be banned. If distancing can be maintained and the net of symptom-monitoring and community-testing can be cast more widely, then allowing a minority of our citizens to work even during the period of lockdown may be a socially viable option. A policy is immediately required.

<https://www.thehindu.com/sci-tech/science/when-should-we-blow-the-shofar/article31318103.ece>

A compromise

It may be extremely difficult for us to ensure, as science dictates, that two-third of all our citizens have gained immunity. We may identify geographical regions where COVID-19 appears to be affecting people in large numbers. In these regions, lockdown may be extended, surveillance-testing intensified and spread of the infection more strictly monitored. Infected persons should be isolated. Further, contact tracing — identification and listing of persons in close contact with an infected person, testing to identify infected persons among contacts and isolating them or, if testing of all contacts is infeasible, isolating all contacts and following them up for signs of infection — will serve to reduce the likelihood of infection. Thereby *R-nought* will be reduced in that region. If the spread of the infection from these high-intensity regions can be arrested, then there will be an overall reduction of infection in the country. Of course, surveillance-testing and deep monitoring should continue at some level throughout our country to identify new pockets of high-intensity that may arise whether or not the general lockdown is lifted on April 14th.