



Science of Covid-19 Spread

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Why in News

The **novel coronavirus (SARS-CoV-2)** has already left a large footprint and is still spreading itself. Fighting this **pandemic** needs an understanding of how it works and spreads and preventive measures to stop it.

Key Points

- **Basic Reproductive Ratio (R0)**
 - It tells the **average number of people who will catch the disease from one contagious person.**
 - It is pronounced as **R-nought.**
 - The **larger this number, the more contagious** is the disease caused by the virus and the faster it will spread in the community.
 - R-nought can be **viewed as the product of three numbers:**
 - The number of days an infected person remains infectious (that is, can infect others).
 - The number of susceptible persons available to infect.
 - The chance that a susceptible person gets infected.
 - The **easiest way to keep R-nought low** is by observing **social-distancing.**
 - **However,** maintaining distance from those who show symptoms of infection is not sufficient.
 - It is suggested to keep distance from **every other person as many apparently normal persons may actually be infected** without showing symptoms of infection.
 - Therefore, just as R-nought influences the spread of **Covid-19, human behaviour also influences R-nought.**

- **How R-naught works?**

- A person infected with SARS-CoV-2 can remain infective for 10-14 days.
During the initial phases of spread, there is a large number of uninfected persons to infect.
- For **SARS-CoV-2, R-naught has been estimated to be between 2 and 3**. For example:
Assuming R-naught to be 2 and the infective period to be 10 days, the first person will infect two others, each of whom will infect two others (2²), each of these four persons will infect two others (2³) and so on. In 10 days, one infected person will have infected 2,046 persons.
- As **herd immunity increases** in the community, many infected persons stop infecting others. Then, R-naught becomes less than one, on average.
- Consequently, there are **few new cases arising** and existing cases either recover or die, slowing down the disease spread.

- **Herd Immunity**

- It **happens when so many people in a community become immune to an infectious disease that it stops the disease from spreading**.
- 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 a person, her/his immune defenses are able to recognise and protect against further infection.
- Therefore, with the spread of the infection, there is less and less number of uninfected persons to infect. An increasing number of persons in the community gains immunity from having been infected earlier.
- However, **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 stimulates the effect of an infection and builds immune resistance to the virus.
 - **India has eradicated polio** by using vaccines against it.

- **Series Interval**
 - During an outbreak, people 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 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 normal influenza, this interval is 1.3 days.
 - However, Covid-19 is spreading through the community slowly and herd immunity will therefore arise slowly which implies a **longer duration of the pandemic.**
- **Herd Community Threshold and Lockdown**
 - The **proportion of individuals in the country who are immune to the disease 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%.
 - **Lockdown can be safely lifted if about two-thirds of the population attains immunity to the virus.** Then the chances of an infected person finding another person to infect are sufficiently low and the virus stops spreading.
 - However, **estimating the number of those who have gained immunity is a tough task.** It can be done by **testing the citizens randomly and in large numbers** through surveillance testing in communities.

Preventive Measures

- **Contract tracing reduces the likelihood of the infection** thereby reducing R -naught in the region.
 - Contact tracing:**
 - It is the 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.
- **Identification of most affected geographical regions and extending lockdowns** there, **intensifying surveillance-testing, more strict monitoring** of cases and isolation of infected people is required.
 - There will be an overall reduction of infection in the country if the spread of the infection from these high-intensity regions can be arrested.
- All large **gatherings, including religious and political gatherings, must continue to be banned.**

- **Government needs to provide food and basic amenities** to the people whose life has come to a halt due to the lockdown.
 - The lockdown needs to be to soften and daily wage earners should be allowed to work.
 - A **policy should be framed on allowing a minority of citizens to work.**
However, it should only be done if social distancing is maintained and the net of symptom-monitoring and community-testing is casted more widely.
- Surveillance-testing and deep monitoring should continue at all levels throughout the country to identify new pockets of high-intensity.

Source: TH