MITIGATION OF THE COVID-19 EPIDEMIC

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What does 'mitigation' mean? At what stage of an epidemic does it become essential? How do we use the principles of mitigation to combat a new disease? Why does physical distancing and the use of masks help? How do we minimise the risk of infection in those most vulnerable to severe forms of the disease?

COVID-19 emerged in China towards the end of 2019. Since its symptoms superficially resembled those of already known diseases, particularly influenza and pneumonia of various causes, it was only in December 2019 that the disease was recognised as being new to humans. How do we control the spread of a new infectious disease?

Epidemiologists use two different approaches to engage with this question. The first approach is to reduce the incidence of the disease. This requires a recognition of the causes of disease and the origins of the pathogen. In January 2020, a novel coronavirus, called SARS-CoV-2, was identified as the cause of COVID-19. While the origins of the SARS-CoV-2 virus have been assigned to a particular species of bats in China, the circumstances of its entry in humans remain an unsolved puzzle. The second approach is to control the extent and rate at which the infection spreads in human populations. This requires an understanding of the modes of transmission of the pathogen. Social contact (physical proximity) is the only **context** of the person-to-person transmission of SARS-CoV-2. This means that the infection spreads when people are physically close to each other during, for example, work, travel in public transport, or social or religious functions. However, not everyone involved in social interactions with an infected person gets infected themselves. Oral or nasal droplets and 'fomites' act as the **vehicles** of transmission. The seemingly hair-splitting distinction between the context and the vehicle of transmission is important in controlling spread of infection. The first strategy for community-level control of spread is generally known as **containment**. Used at the start of an outbreak, this strategy relies on tracking the dissemination of the infection or disease. Physical isolation or individual quarantines are used to keep potentially infected people and their contacts from spreading the infection to others. Hand-hygiene minimises fomite transmission. Once an outbreak has spread as rapidly as COVID-19, epidemiologists recommend the use of mitigation strategies (see **Box 1**).

Principles and practice of mitigation

Mitigation is aimed at preparing a nation's healthcare system for the challenge of minimising the spread of infection and reducing mortality.

Rapid expansion of an epidemic can overwhelm a nation's healthcare system when the number of hospital beds (particularly intensive care beds) available may be insufficient for all those in need. The high demand for hospital beds is due to the larger proportions of severe cases, and cases with complications arising within a short time span. This is why slowing down the expansion of the epidemic, usually referred to as **'flattening of the epidemic curve'**, is a salubrious and wise course (see **Fig. 1**). This can be achieved through two methods. The first is to encourage people to avoid the context of transmission. This can be ensured if each person keeps a minimum physical distance of 2 m (or 6 feet) from other people. The second method is to minimise risk of contact with the vehicle of transmission. This can be ensured by encouraging people to wear face masks during any social interaction that requires physical nearness of up to 1 m (or 3 feet). Wearing a mask prevents people with SARS-CoV-2 infection (even silent ones) from broadcasting droplets, and protects uninfected people from inhaling droplets that escape from infected people (see **Box 2**).

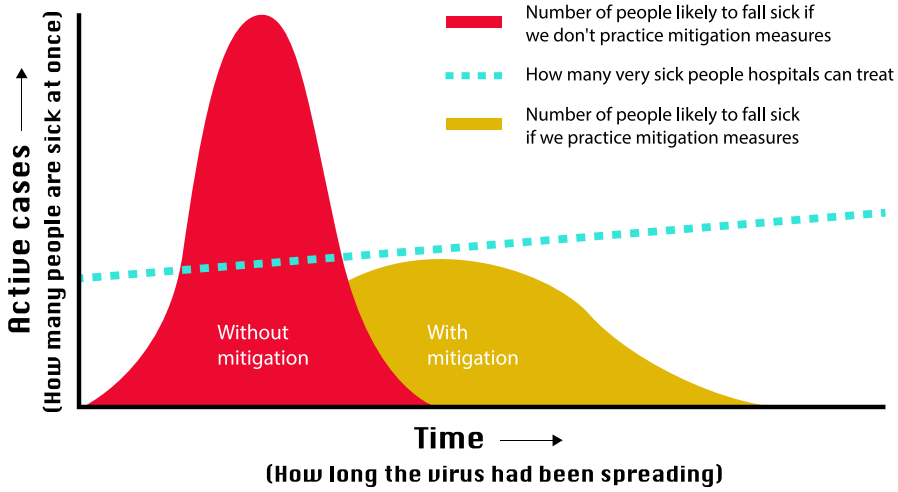

Fig. 1. Mitigation measures can help flatten the epidemic curve.

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This is especially important in interactions with older people, even within their homes. It is highly recommended that older people (as well as each person they interact with) wear masks, and practice good hand hygiene (washing their hands with soap and water after every contact). The greater the number of people who wear masks, the safer social interactions become from high risk of infection. This is one of the most effective ways to flatten the curve, especially in countries with population densities that are as high as in India.

While COVID-19 spreads like influenza (the same vehicles of transmission are at play in both diseases), it carries a 10-30 fold higher risk of death. Hence, another important element of mitigation is

Box 1. The making of a pandemic:

To begin with, no human had prior exposure to the virus. Hence, none of us were immune to it. Since international travel for business or pleasure is popular, people acted as vectors of transmission. The virus spread across all national boundaries. By early February this year, at least seven countries were infected — it was already a pandemic. By early March, people living in many more countries, across all the continents, had been infected. On 11th March, 2020 the World Health Organisation (WHO) declared it a pandemic.

The progression of the epidemic in India is by now common knowledge. In addition to national websites (Ministry of Health, Indian Council of Medical Research), Worldometer Coronavirus, and Wikipedia have detailed data on India's epidemic. While April-May-June were epidemic months in major cities, we saw epidemics in smaller cities in May-June-July, and rural epidemics in June-July-August. Thus, spatially and temporally, many asynchronous epidemics add up to the statistical construct of the one country-epidemic. This epidemic may peak in September, and start declining in October through January-February 2021. Thereafter, the infection will most probably remain endemic to human communities, with low seasons alternating with high seasons.

Box 2. What are silent infections?

Like all communicable diseases, COVID-19 is characterised by a particular set of signs and symptoms. These appear between 2-14 days after exposure to SARS-CoV-2. Also, while SARS-CoV-2 infection can lead to severe and life-threatening disease in some cases, half to two-thirds of people infected with the virus may experience no signs of illness. Such infections, where people can transmit the virus before they develop disease **(pre-symptomatic)** or without developing disease **(asymptomatic)**, are called silent infections. These can result in **'silent transmission'**. Young people are more likely to have asymptomatic infections, or only experience very mild symptoms that are not enough to feel sick. It is also important to remember that quarter to half of the people infected with the virus may test negative for it.

mortality reduction. COVID-19 mortality has four determinants:

- The inherent virulence of the coronavirus (no specific antiviral drug treatment is available);
- The age of the infected (progressively increasing for those in the age group of 55-60 years and above, presumably on account of immunological senescence);
- Predisposing comorbidities (diseases or conditions that occur together) such as diabetes, chronic cardio-vascular, lung or kidney diseases, immunosuppressive diseases or treatment (such as cancers and cancer therapies); and
- The competence and correctness of diagnoses and treatment of severe symptoms (see **Box 3**).

One effective way to mitigate mortality in those most vulnerable to it (the elderly and those with comorbidities) is to prevent it in the first place. This can be done by cocooning them in their homes using a reverse quarantine approach. We, in India, have the advantage of a youngish demography, which can reduce population-level mortality. However, the advantage of a young population is lost if its not possible to provide timely access to quality healthcare to individuals in dire need of it.

Parting thoughts

Given the scale of the ongoing pandemic, awareness and practice of mitigation measures become especially important. One of the primary responsibilities of governments across the world is to ensure that every citizen has access to an accurate

Box 3. Clinical diagnosis of disease:

The clinical diagnosis of any disease is not based on a single lab test. For example, general clinical diagnosis of COVID-19 is based on a set of seven 'major' and six 'minor' criteria (see **Table I**). These are unrelated to major and minor symptoms, and should not be confused with them.

At least three major criteria are necessary to diagnose COVID-19 if they include (3) or (7). In the absence of (3) and (7), COVID-19 is diagnosed by the presence of at least three other major criteria, plus at least two minor criteria. However, these criteria may not be fulfilled in the elderly (≥ 65 years of age) and those with chronic non-communicable diseases. People in these categories may show only subtle symptoms, like low grade fever, delirium, drowsiness or postural instability. Such patients should be tested with pulse oximetry and/or chest imaging, and if the results from either fits major criterion (6) or (7), they must be immediately hospitalised for medical management. The manifestations of COVID-19 in children below 5 years of age may also be different from those described above.

If found necessary, doctors may carry out an RT-PCR test on a deep nasal swab or throat swab. Remember, an RT-PCR test detects only infection, not disease. Even with infection detection, there is a need to be cautious in interpreting RT-PCR results. Deep nasal swabs from two-thirds of cases, and throat swabs from nearly half the cases will test positive in an RT-PCR test. The rest may be false negatives. This means that even when a clinical diagnosis shows the presence of disease, the patient may test negative in an RT-PCR test. While tests for rapid detection of viral antigens are now available, analysis of their performance characteristics are awaited.

Table I. Major and minor criteria for clinical diagnosis of COVID-19:

Major Criteria	Minor Criteria
1. Fever ≥ 3 days	a. Headache/body aches/myalgia
2. Cough	b. Severe fatigue/lassitude
3. Loss of smell (with or without loss of taste)	c. Diarrhoea with or without vomiting
4. Breathing rate at rest ≥ 25/minute (normal rate is 12-16 breaths/minute)	d. Pink eye (conjunctival redness with or without secretions)
5. Crepitations (crackling or rattling sound made when breathing) when the chest is auscultated (examined for internal sounds) with a stethoscope	e. Skin lesions (that can be non-itchy, maculopapular, erythematous, urticarial, or vesicular)
6. Oxygen level of ≤ 94%, measured by finger pulse oximeter	f. Normal or low normal total count of White Blood Cells (WBCs) with ≤ 20% lymphocytes (one type of WBCs).
7. Patchy pneumonia, in a computerised tomography (CT) scan or X-ray. Shown as streaky shadows or ground-glass appearance in both lungs. But this is not localised to a section or a lobe as seen in lobar pneumonia, and does not involve the replacement of lung tissue with cavities as seen in cavitary lesions.	

Note: This is put together by the author and is yet to be validated by research.

Box 4. Lockdowns:

A lockdown is an extreme form of ensuring physical distancing between people outside households. More than 100 countries across the world have used complete or partial lockdowns to enforce physical distancing between people outside households.

A complete lockdown severely affects the economy and, more importantly, the lives and livelihoods of people. Its worst impacts are experienced by the poor, daily wage earners, small-volume traders, farmers, and children. In some cases, it can also have the exact opposite effect than that desired. For example, blocking all services during the lockdown in India caused a huge surge in panic-buying for stocking essential supplies. Keeping shops selling essential items open minimises the need to hoard. Similarly, some 30 million people who had migrated (many with families) for work/employment to southern and western states were caught unawares by the lockdown. These workers became carriers of the virus when they trickled back to their home states. This led to a rapid expansion of the pandemic in their home states from April through June. In contrast, a partial lockdown could involve closure of schools and non-essential assemblies for recreation, exercise, partying, religious meetings, eating in restaurants etc, while keeping essential services such as food shops, groceries, and open-air parks etc., open.

understanding of the problem. The other is to educate and facilitate the behavioural changes involved in effective mitigation so that the imposition of excessively harsh measures such as lockdowns can be minimised (see **Box 4**). Bringing about the kind of behavioural changes needed for effective mitigation, through an approach that combines access to accurate information, communication, and behaviour change education is called **'social vaccination'**. We, in India, have the advantage of being able to make use of our institutional and cultural memory of similar, and very successful, efforts against the AIDS epidemic during the 1980s and 1990s. But this is not enough. Each individual has the responsibility of taking every precaution against getting infected and, by corollary, minimising the chances of spreading the infection to others.

Key takeaways

- Epidemiologists use two approaches to control the spread of a new infectious disease — reducing its incidence, and controlling its human-to-human transmission.
- Controlling the extent and rate at which the infection spreads requires an understanding of the modes (context and vehicles) of transmission.
- Mitigation measures are aimed at 'flattening the epidemic curve' by preparing healthcare systems for the challenge of minimising spread of infection and reducing mortality.
- While physical distancing minimises the context of transmission, wearing masks can minimise contact with the vehicle of transmission.
- Encouraging reverse quarantines of people most vulnerable to severe forms of disease, as well as competent and correct diagnoses and treatment of severe symptoms can reduce mortality.
- Governments are responsible for ensuring access to accurate understanding of the problem, as well as education and facilitation of behavioural changes involved in effective mitigation.
- Each individual has the responsibility of taking precautions against getting infected and spreading it to others.

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