

JSW SCHOOL OF PUBLIC POLICY

POLICY BRIEF

No. 2020.1

June 2020

Health Policy: Comprehensive Review of COVID Containment Strategies : Successful Interventions and Failures

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Context & Scope of Containment Strategies

COVID-19 pandemic has affected the world adversely by disrupting the lives of masses. COVID-19 has become the single most important problem to tackle due to the nature of the spread of infection. Therefore, it becomes imperative to have processes and policies in place to prevent the spread of this disease. This document aims to understand the existing strategies in place and explore interventions and steps taken by the government. The document further analyses the effectiveness of different interventions, the reasons for their successes or failures and also aims to compare them against benchmarks from other countries. The aim of this document is to analyse and narrate a holistic picture of the government's different strategies to curb the spread of COVID-19.

Residents, along with multiple central, state and municipal agencies are active stakeholders of containment strategies. Some of these strategies such as restrictions on travel, curbing the local transmission by having multiple strategies such as contact tracing, lockdown and establishment of containment zones have proven effective in creating the necessary awareness and preventing the spread of cases. However, the success of such strategies are correlated with the effectiveness of implementation practices in many cases. The document deep dives into each strategy and reviews it from the perspective of implementation and effectiveness after considering the context.

Executive Summary

Due to the nature of the spread of the coronavirus, containment strategies and their implementation becomes extremely important to curb the spread.

From our analysis it can be inferred that proactiveness in the implementation of complementary strategies such as Testing, Tracing and Tracking will help in keeping the pandemic in check. Additionally, a robust

healthcare and technology infrastructure is required to implement different policy actions to tackle the pandemic. Private sector participation can help bridge the demand-supply gap of essential resources. Above all this, a robust implementation tailoring to the local necessities and resource availability is essential to see results.

Recommendations

- Ramp up hiring and training of contact tracers
- Provide incentives to enhance the adoption of the tracing app Aarogya Setu
- Activate lockdown locally if infection rates reach a threshold
- Robust implementation of the containment zone strategy
- Build a scientifically rigorous testing strategy by different testing methods

Research and Benchmark Analysis

International Travel Restrictions

One of the preliminary strategies adopted by many countries to contain the global spread of the novel coronavirus has been the institution of restrictions on international travel. The strategy, though aggressive in its approach and stemming from the fear and uncertainty surrounding the whole situation, has been effective in delaying the importation of the infectious virus into the country. Researchers estimate a 77% reduction in the case imported from China to the rest of the world due to the travel quarantine around Wuhan¹.

An analysis of the timeline of implementation of travel restrictions by different countries suggest that the countries like Taiwan, South Korea and Singapore which had been aggressive in their implementation of travel controls have been able to curb the spread of the virus effectively

whereas countries like Spain, the U.K., and Belgium which had been slow in their policy response saw a surge in confirmed casesⁱⁱ.

Domestic Travel Restrictions

Apart from international travel controls, the majority of the countries affected by the virus, including India, have imposed domestic travel restrictions to minimize inter-state transmission of the virus. This includes suspension of public transport facilities like buses, railways, metros, and airlines.

Inter-state travel restrictions are helpful in keeping a check on the flow of infections from high risk regions to low risk ones. In India's context, unchecked movement of people from one state to another is likely to affect the rural belt of the country which were largely spared during the travel controls.

It is not conclusively known whether public transport systems aid the spread of the virus. However, according to a paper from the Massachusetts Institute of Technology, the spread of the virus in the city of New York was seeded by the city's subwaysⁱⁱⁱ. Regulation of public transit, therefore, becomes very important during initial stages of the spread. In the long-term, however, it is important to reimagine the entire public transit system to ensure safe travel.

Curbing local transmission:

Apart from restricting the flow of people from one place to the other, breaking the chain of transmission in any region is also crucial. To achieve it, identification and isolation of COVID-19 infected people and their potential contacts are vital. Various strategies are devised for the same. However, the implementation and effectiveness largely depend on the seriousness of the infection spread and the resources available in the region.

a) Contact Tracing

Contact tracing involves tracing individuals who might have potential contact with infected people.

Though effectiveness of contact tracing is highly dependent on the testing infrastructure, quarantine enforcement and continuous follow up, contact tracing still stands as one of the most crucial steps in curbing the transmission.

Contact tracing is done through two modes - Manual tracing and App based tracing

i) Manual tracing:

Manual tracing involves identification of potential contacts through interviews of the infected followed up by detection of the contacts and continuous follow up.

The process is highly labour and resource intensive, requiring a sizable army of knowledgeable people to coordinate and carry out this undertaking. Hence, manual tracing can be a hectic process especially in the countries with large populations and huge number of cases. However, researchers still regard manual tracing to be the most important step in flattening the curve of COVID-19 cases^{iv}.

Many countries have kept contact tracing at the centre of their containment strategy. For example, South Korea flattened its curve by rigorously tracing the prospective cases. It has improvised the contact tracing process by sourcing additional information such as CCTV footage, GPS location data, and credit card transaction records^v. The German government has also announced to hire a minimum of five contract tracers for every 20,000 citizens^{vi}.

For an effective contact tracing system, speed is critical for two reasons. First, infected individuals may begin exhibiting symptoms of COVID-19

only after having been contagious—and shedding virus—for four or five days, and perhaps even longer. Second, the disease is highly transmissible, so an infected individual can transmit the disease to a significant number of people in a relatively short time before being diagnosed. Hence, an entirely manual system would quickly sag and collapse under the strain of tracing large numbers of contacts for each infected individual, or it would require very large, continuous capital investments.

ii) App based tracing:

The app-based tracing has a potential to subside the shortcomings of manual tracing. In order to be effective, the app needs to have the following capabilities

- Proximity: Ability to detect encounters within 2 meters over a two-week period
- Location: Ability to identify encounters with COVID-19 infected people to track the spread of the disease and to identify the hotspots
- Interoperability: Ability to connect seamlessly with the public health system. For example, it must allow users to enter symptoms or request tests from health care providers and send the app official test results that confirm infection
- Security: Considering privacy and practical concerns, the technology must include a secure encryption feature and strong data governance

Although, devising an app with the above capabilities may not be much difficult, widespread adoption of the app is highly critical for its success.

Only a few nations have achieved an adoption rate of 60% or above, and those that have succeeded did so by imposing credible civil or criminal penalties for noncompliance.

Barriers to adoption of the app include smartphone penetration in the country, operational obstacles such as communicating about the importance of participation and privacy issues. This is because the app requires a detailed account of individual details^{vii}.

Therefore, efficient contact tracing should involve both manual and app-based tracing to negate the shortcomings of both the methodologies.

b) Lockdown

Lockdown is an emergency protocol imposed on the people to prevent them from leaving a designated area. In the wake of the coronavirus outbreak, lockdown has been viewed as a pre-emptive strategy to reduce the rate at which the virus spreads in the community and has been implemented by a majority of the affected countries, though with differing severities.

High risk countries, like Italy and Spain, had implemented widespread lockdown to restrict social contact and community spread of the virus. Studies suggest a decrease in R0 (average number of new infections caused by each infected person) for these countries^{viii}.

Many developed countries like Sweden, Norway, Denmark, and Germany had a relatively lesser R0 compared to countries who had implemented harsher lockdown rules. These countries, with their robust health sector and overall socio-economic and political resilience were able to curb the spread more effectively^{ix}.

Hence, there does not exist a clear relationship between R0 and lockdown stringency. Thus, lockdown can be used as a reactive measure to restrict the surge of cases, but it must be supported by other proactive strategies.

c) Cluster Containment zones*

Cluster containment strategy involved identifying affected clusters and containing the transmission within the defined geographical area by detecting and breaking the chain of transmission to new areas by isolating the affected area.

Similar large-scale containment strategies were successfully deployed in South Korea, Singapore, China, Germany, France and Italy.

Formation of the containment zone would be triggered by identifying a cluster of cases with symptoms of Influenza like Illness (ILI) or Severe Acute Respiratory syndrome (SARI), or by other informal means of reporting. A positive case would put a series of steps into action as a part of containment strategy.

A Rapid Response Team (RRT) traces the cases and contacts to delineate the containment and buffer zones. Once the area is identified, a perimeter is established, and surveillance is placed into action to monitor the situation closely for households within the containment zone. In parts of the country (e.g. Chennai), technology (such as drone-based surveillance) is successfully leveraged for the monitoring.

d) Testing

Testing is one of the most important and proactive measures against the spread of any communicable disease. It provides a window onto the extent of infection and how it is evolving.

Testing strategies employed against the coronavirus can be measured against three parameters – Availability of testing kits, Scale and intensity of testing and Timeliness.

Availability of testing kits

Large scale testing for the virus necessitates an adequate supply of quality testing kits. Model testing strategies employed by countries like South Korea involved leveraging small biotech players in the country to produce testing kits at a mass level^{xi} within a week of its first case.

Local production of testing kits can also be done at a regional level with the Indian state, Kerala being one of the standouts. Scientific laboratories in Kerala made low-cost testing kits available which were then manufactured on a large scale by private companies locally^{xii}.

Scale and intensity of testing

Countries like South Korea, Singapore, and Taiwan have been able to control the pandemic through their aggressive testing regimens. South Korea was able to ramp up its testing capacity by using innovative solutions like drive-through test centres which have since been replicated in numerous places.

Countries like Germany and Israel have been able to scale up their testing capacity by employing the pooled testing method. Pooled testing is useful for determining the prevalence of infection in a community or group and can be helpful in expanding the testing capacity rapidly in places where the infection rate is low.^{xiii}

Countries like the UK and US have been able to ramp up their testing efforts by using rapid antibody tests to identify pockets of infection at a larger scale. The US FDA has also authorized at-home tests through collection of saliva and not relying on nasopharyngeal swabs only to augment its sample collection efforts^{xiv}.

In India, states like Kerala and Punjab have been able to conduct tests at a larger scale by using innovative solutions like testing kiosks and mobile testing vans^{xv}.

Timeliness

An aggressive testing strategy will do more to control the outbreak if conducted earlier when there are fewer infections rather than later when the infections are already widespread. Early and mass testing makes a lot of difference due to the asymptomatic nature of many cases.

Comparing South Korea, which began widespread testing very early on, with countries like Italy and US, which discovered their first cases during the same time but were slow in ramping up their testing rates, sheds light on how

an early testing program can influence the course of the outbreak^{xvi}.

One novel solution in pre-emptive community testing is being tried out by Netherlands by analysing wastewater to identify traces of the coronavirus in sewage systems^{xvii}. This approach has previously helped in detecting outbreaks of norovirus, poliovirus and measles and could be used as a non-invasive early-warning tool to alert communities to new COVID-19 infections.

How are Indian policies faring: An Evaluation

International Travel Restrictions

In an effort to restrict the importation of the virus from foreign countries, India issued travel advisories for travel to and from China as early as January. It soon followed up by banning entry of foreign nationals travelling from China to India. However, it was not until March when the country imposed a blanket ban on international travel. The response was delayed relative to countries which have been able to curb the transmission of the virus with their aggressive policies. A quicker response could have pulled the total number of infections down in the earlier stages of transmission, buying the government more time to rapidly implement effective preparedness measures.

Domestic Travel Restrictions

India had imposed a nation-wide lockdown with transportation permitted only for essential items and services. With the relaxation in lockdown measures, online e-passes had been made mandatory for inter-state travel in the worst affected states. Quarantine norms have been imposed on people travelling between states. These, however, vary for different states.

The travel controls had been effective in checking the spread of infections from the highly affected regions like Mumbai, Delhi, Chennai, Pune, and Ahmedabad. However, in the wake of the mass exodus of the migrant workers stranded in big cities, the Indian government

started running “Shramik” trains. This has led to a marked increase in cases in states like Uttar Pradesh, Bihar, Odisha, and Bengal^{xviii}.

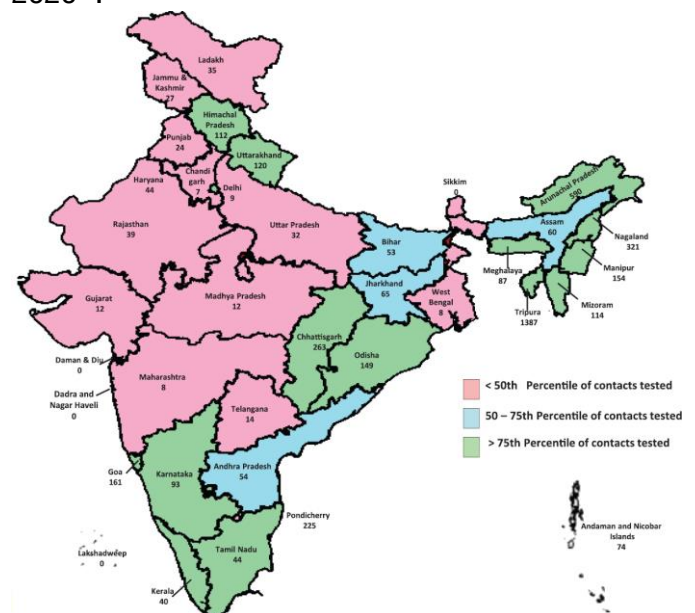
Curbing local transmission:

a) Contact Tracing

India had formulated a contact tracing strategy right after the infection had spread to the country. However, the strategy faltered from the very beginning. By April 30th, when the total no. of cases in India stood at 40,184, sources of the transmission for 44% of cases were not identified. Whereas, South Korea, where the Covid-19 curve is flattened, had only 9% of cases for which transmission source is unidentified^{xix}.

Also, from the map below, highly infected states such as Maharashtra, Gujarat have tested very less number of contacts which has eventually aggravated the situation further whereas Kerala which was highly infected in the beginning was able to flatten its curve partially due to the better tracing and testing of contacts.

FIGURE 1: Contacts tested per confirmed COVID-19 case in India, January 22 - April 30, 2020^{xx}.



The numbers above clearly highlight the importance of ramping up contact tracing to reduce the transmission rate quickly.

Also, the contact tracing app ‘Arogya Setu’ launched by the central government is mandated to be used by all the employees, passengers and people living in containment zones.

The app is alleged to have major privacy and security concerns related to the data of the individual^{xxi}. On the positive side, the app is capable of tracing contacts and alerting individuals on potential contact. Also, the app is downloaded by more than 10 crore people which is about 10% of the population. The achieved adoption is good enough given low internet penetration and smartphone penetration.

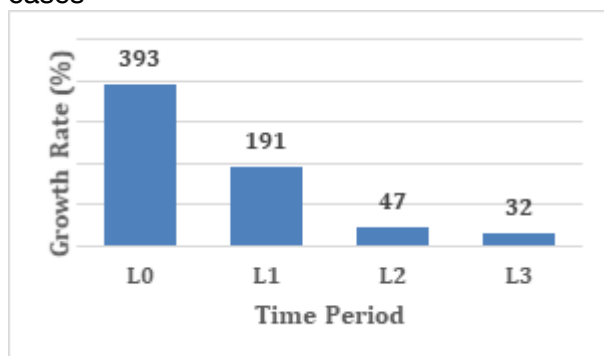
However, the effectiveness of the app for contact tracing can further be increased by improving the adoption by using security loopholes and communicating the importance of downloading the app to the public.

b) Lockdown

India had imposed one of the most stringent nation-wide lockdowns in the world to curb the spread of the virus. The lockdown was effective in arresting the growth numbers in the post-lockdown period.

Figure 1 clearly illustrates a decrease in the country’s average weekly growth rates since the pre-lockdown period (L0).

FIGURE 2: Weekly growth rate of positive cases^{xxii}

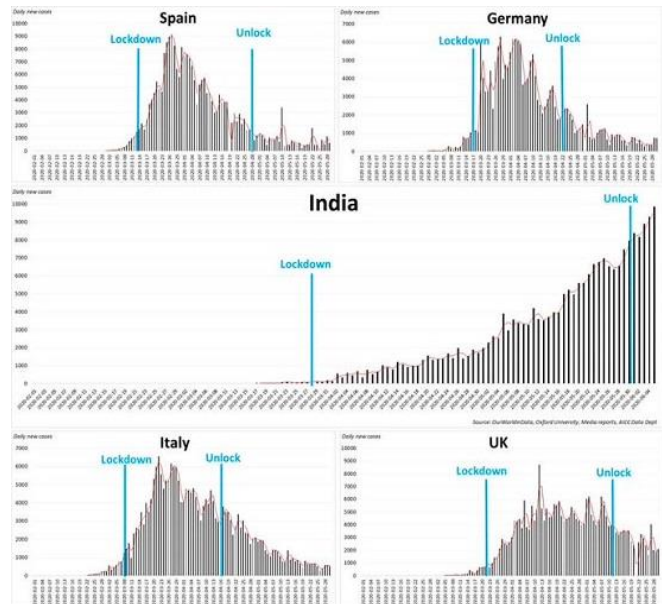


The lockdown has also been effective in improving the doubling time over the three-month period and in reducing the death-to-recovery ratio from 0.28 to 0.08.

Despite the reduction in growth rate of positive cases, the growth rate is still positive. To be able

to contain the pandemic, a negative growth rate is required.

FIGURE 3: Graph of newly infected case count per day for various countries^{xxiii}



From the graph above, though India has implemented a more stringent lockdown than the other countries, the growth rate is still positive post-lockdown whereas the growth rate of other countries became negative.

This can be attributed to two reasons. Firstly, the lack of robust supporting strategies like tracing and testing the infected.

Secondly, the early life of lockdown while the new case count is still in an upward trend which is opposite for other countries. Though the decision to end lockdown is majorly to revive the falling economy, a stringent exit strategy with higher emphasis on tracing, testing and isolating is essential to prevent the surge in growth rate.

c) Cluster Containment Zones

Multiple preventive measures such as strict social distancing, clinical management of confirmed cases are enforced within the containment zone.

The following example provides a good understanding of one of the successful cluster containment plans.

One of the most effective instances of containment strategy was observed in Bhilwara, also famously known as ‘Bhilwara model’^{xxiv} or ‘ruthless’ containment strategy.

The Health Department constituted nearly 850 teams and conducted a house to house survey to identify people with influenza-like symptoms.

In the initial phase, more than 50,000 houses (constituting over 250,000 people) were surveyed and nearly 2,000 people were observed to have Influenza like Illness (ILI) symptoms and were home quarantined. Intense contact tracing was followed, and strict curfew was followed to isolate and contain the disease.

More than 3000 police personnel were deployed to ensure strict curfew. Even essential services were suspended, and the Government ensured door to door delivery of such services for effective containment.

Many cities have followed the containment zone strategy. However, new cases are emerging in non-containment zones that are leading to an increase in the number of containment zones.

A strict implementation framework needs to be in place that advocates for active surveillance to contain the spread of COVID-19.

d) Testing

India’s response to the outbreak has been handicapped by the lack of adequate testing. This can be attributed to a lack of availability of testing kits, narrow testing protocols and a delay in widespread testing.

Availability of testing kits

India’s testing strategy during the initial days of the outbreak was crippled due a shortage of testing kits owing to its dependence on external suppliers.

India has been able to ramp up its domestic production of testing kits by approving the kits from domestic suppliers. However, these kits are

being repackaged which requires sourcing of components from external suppliers. This has been causing variations in the kits leading to quality issues.^{xxv} A shortage of kits has therefore been hindering the testing efforts of many states. Many states have also started to buy testing kits on their own from ICMR approved companies to bridge the demand-supply gap.

Scale and intensity of testing

There are currently over 100,000 tests being carried out by India every day. This number must increase multifold to accurately estimate the true number of cases in the country and achieve an epidemiologic understanding of the prevalence of the virus.

India’s lack of aggressive testing is due to its narrow testing criteria and its sub-optimal use of resources. Inadequate collection of samples has been leading to reduced utilization and faster depletion of kits. Sample collections have been limited because of high test prices and the stigma attached to the virus.

India has used RT-PCR tests as its key diagnostic testing method and has not used antibody tests adequately. RT-PCR tests are conclusive but are complex and require more time to yield results whereas antibody tests are less reliable but are rapid and can be used to identify pockets of infection at a large scale.

Adequate use of antibody tests could help India ramp up its testing rate and understand the overall spread of the virus in communities.

Timeliness

India’s testing strategy during the early days of the outbreak was slow to take off due to a shortage of testing kits owing to procurement delays from external suppliers and a delay in domestic production of testing kits.

Way Forward

Ramp up hiring and training of contact tracers

Efficient contact tracing is required to keep the pandemic spread in check. Especially with ever

increasing cases post-lockdown, containment strategy is now highly dependent on quick tracing of the contacts and taking pre-emptive measures to spread the infection. States like Maharashtra and New Delhi with a larger number of infected cases, have become the centre for efficient tracing. Hence, it is recommended that enough people are hired and trained to interview the infected and detect contacts.

Incentives to enhance the adoption of the tracing app Aarogya Setu

As discussed earlier, governments need to leverage technology to speed up the process of contact tracing. Therefore, improving the adoption of tracing app, Aarogya Setu, is highly critical. Certain activities - for example, entry to certain public spaces, stores or public transit - could be limited at the door via a QR reader to people who are using the app and are in the no risk category. Not using the app would curtail access to those venues. Additionally, to encourage the adoption, governments must address technology accessibility barriers, including offering people financial or social incentives to upgrade phones to induce app adoption.

Activate lockdown locally if infection rates reach a threshold

Lockdown can be avoided when there is enough labour and resources to identify, test and isolate the infected. However, when the cases grow rapidly exhausting the resources, lockdown is the most viable option. Hence, lockdown to be activated in a region when the infected cases reach a fixed threshold of cases per 1,00,000 inhabitants in the region. The threshold can be determined by the resource available to tackle the infected in a region.

Implement a holistic containment zone strategy

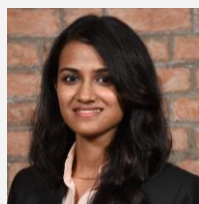
India needs a holistic approach to its containment strategy. The country needs to identify the models that have worked and tailor them to suit the local context. Some of the steps such as bringing essentials to the containment zone instead of allowing people to leave the

containment zone can turn out to be game changers. Additionally, use of technology (such as monitoring by drone) should also be considered as a part of the strategy. The success of containment zone strategy lies in the implementation.

Build a scientifically rigorous testing strategy

India should scale up its testing strategy by using a combination of PCR tests, antibody tests and at-home testing. It should leverage the extensive reach of its private lab network to scale up at-home sample collections. The pooling of RT-PCR samples in regions with less infection rate can help boost India's testing efforts with the resources available.

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