



**Department of Health & Family Welfare  
Government of Kerala**



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## Message



I am pleased to see that the Department of Health and Family Welfare is publishing a book on COVID19 testing strategy.

I am informed that the Department is planning to publish series of books on various activities. The first in series was on Sentinel Surveillance. The testing strategy is the second in series. Such systematic efforts will not only inform the various strategies and actions taken during the epidemic but it will also generate response from all the readers. The readers' feedback shall further help the department to strengthen the response.

I appreciate the works done by the team of Kerala Health and I wish all the success to this endeavour.

With best wishes,

**K K Shailaja Teacher  
Minister Health & Family Welfare  
Social Justice  
Woman & Child Development  
Govt of Kerala**



# Strategy for covid-19 testing in Kerala state

## Introduction

The WHO has declared COVID-19 as a pandemic. Kerala had reported the first case in India on January 30<sup>th</sup> 2020. With proper identification of individuals with risk, rigorous contact tracing, ensuring good quality home isolation, testing all eligible individuals and providing high quality care to COVID cases, Kerala state had managed to contain the COVID -19 epidemic till date.

Since January various structures had been put in place for the control of COVID. One of the strong pillars was the setting of testing strategy for diagnosing COVID-19. This report describes the testing strategy of Kerala, which is based on a strong epidemiological and public health approach.

## Importation and transmission-based approach for Testing Strategy

On January 26<sup>th</sup> 2020, even before the first case of COVID-19 was reported in the state, the Kerala state had issued comprehensive guidelines for prevention and control of COVID-19, followed by guidelines on sample collection, transportation and testing of novel corona virus infections on 1<sup>st</sup> February, 2020<sup>2</sup>. The testing, quarantine, hospital admission and discharge criteria for novel corona virus (earlier name-nCoV) were issued on 1<sup>st</sup> February, 2020 just before the second case in the state and in the country, the issue of revised surveillance on 1<sup>st</sup> February 2020, the declaration of two dedicated hospitals for each of the 14 districts in the state for COVID management on 1<sup>st</sup> February 2020 are measures of the farsightedness and preparedness to deal with the pandemic.

The testing approach is based two key factors. One on the nature of importation and second the likely mode of transmission of the disease. The intrusion of the novel corona virus from places of ongoing transmission into a susceptible population could happen predominantly through importation via human cases

and asymptomatic carriers. Though the transmission dynamics (modes of transmission, incubation period, period of communicability etc) of the new disease was not known completely to the world at that time, the knowledge of the diseases caused by the viruses from the family of corona viruses gave clues on its transmission dynamics and suggested possible prevention and control measures. Testing, surveillance and quarantine strategies were designed based on the facts available and the logic of prevention and spread of the virus from cases and asymptomatic carriers who have returned from countries which have reported the novel corona virus.

In the initial phase (January- mid March) the testing was focused on returnees from Wuhan followed by COVID suspects. The number of samples in terms of numbers were low but were appropriate to detect infections among the potential population at immediate risk.

The definition of a COVID suspect was appropriate to identify the population at immediate risk.

**A COVID suspect was defined as person:**

- A person with Severe Acute Respiratory Illness (SARI) with no other aetiology that fully explains the clinical presentation and with any one of the following;
- A history of travel to China or any other affected country by novel corona virus 14 days prior to onset of illness
- A health care worker from a setting where SARI cases were being treated
- Individuals with acute respiratory illness of any degree of severity, who within 14 days of onset of illness had any of the following exposures; close physical contact with a confirmed case, a health care facility where hospital associated nCoV infections have been reported, direct contact with animals (of animal source is identified)

in countries where then nCoV is found to be circulating in animal populations or where human infections have occurred as a result of presumed zoonotic transmission.

**Those eligible to be tested immediately were the following:**

- All Wuhan returnees
- Symptomatic international returnees from countries which reported COVID
- Symptomatic contacts of confirmed cases

Institutional Medical boards were constituted for each district and were empowered to take decisions in complex scenarios.

This enabled the importation risk-based testing approach and avoided indiscriminate use of precious tests at a time when the country was facing acute scarcity of testing kits.

**Testing strategy based on a public health approach**

The surveillance mechanism deployed by the state played a pivotal role in establishing a tight network. The surveillance mechanism was based on the nature of the risk of importation and the likely mode of transmission of the disease into a native population. Screening of passengers at airports, seaports helped in identifying the symptomatic passengers, travellers from areas of transmission or have reported cases as well as COVID suspects. The symptomatic passengers were taken directly to dedicated COVID hospitals and admitted, tested and treated appropriately. The asymptomatic passengers were advised to follow strict home quarantine or avoid non-essential travel and community/social contact based on their country of origin and contact history. If any individual among the above-mentioned developed symptoms they would be tested. Mass communication campaigns regarding the new corona virus as well as the need for quarantine were initiated to sensitize the population. These measures ensured that the risk of transmission of infection from returnees to

the general population was capped with quarantine. The laboratory testing augmented in clamping the surveillance network.

Contact tracing also played a crucial role. This meticulous activity ensured that the contacts of confirmed cases were identified to the maximum extent possible. This activity enabled those persons exposed to be brought under quarantine and in the surveillance network. Kerala state had gone an extra mile in classifying the contacts as high risk and low risk. This enabled those individuals with high risk exposure to undergo 28 days of quarantine and those with low risk contact to undergo 14 days of quarantine at a time when the dynamics of transmission were quite unknown.

### **The targeted testing strategy based on stratified risk approach**

Another novel epidemiological classification ever to be used in the world for COVID control was that of primary and secondary contact. Primary contacts are those contacts of laboratory confirmed COVID-19 cases and secondary contacts are the contacts of primary contacts. The clinical spectrum of the disease was unknown at the time and it was presumed that there would be a significant proportion of subclinical (asymptomatic) persons and that the secondary contacts would be infected without the primary contact becoming symptomatic. By ensuring both the primary and secondary contacts being put into quarantine it was assumed that a water tight compartment would be created to prevent the transmission of infection into the general population. Only symptomatic persons from the primary and secondary contacts were tested. This also ensured judicious use of testing while ensuring prevention of transmission to the general population to the greatest extent possible.

As the disease spread across the world, the returnees to Kerala also had increased until the nation-wide lockdown on March 24, 2020. They were systematically screened at entry points and put into hospitals or quarantine.

Testing of symptomatic travellers and contacts were being meticulously done along with contact tracing. This led to an increase in the number of tests performed justified by the increase in the number of inbound travellers. During this period adherence to quarantine were being assessed and were found to be good. But there were concerns of the infection spreading to the general population often referred to as community transmission.

Effective isolation is a sound public health approach to ring fence the potential carrier. If it is done effectively the probability of second generation and third generation becomes very less.  $R_0/R$  in Kerala at the end of second wave is 0.4. Low  $R_0$  in Kerala is an evidence of strong surveillance network, contact tracing and break the chain campaign.

## Sentinel Surveillance

In order to detect community transmission a sentinel surveillance activity was launched in the third week of April 2020 to test 1000 samples per week. In the initial phase of the sentinel surveillance activity five groups of populations were identified based on their risk of acquiring infection. The groups were as follows;

Group-1: Patients in general population with Acute Respiratory Infection (ARI) but NOT a COVID suspect

Group-2: Health Care Workers in Non-COVID settings

Group-3: Persons with high social exposure (like community volunteers, policemen, vendors, food delivery personnel etc)

Group-4: Category A COVID -19 Suspects

Group-5: Guest workers.

Later on, two additional groups were added:

Group-6: Epidemiological samples-where a history of travel or contact with a COVID suspect is not identified

Group-7: Asymptomatic expatriates

Group seven was added to allow a sample of asymptomatic expatriates coming to Kerala after May 7<sup>th</sup> to be tested.

The objective of the sentinel surveillance activity was to detect community transmission and not to estimate the prevalence of infection in the community. The nature of testing was modified to pooled sample testing from the second week of May 2020

The results of the sentinel surveillance activity till date did not suggest that there is a community spread in Kerala state. The sentinel surveillance activity gained momentum and has reached to a level of more than 500 sentinel surveillance samples per day from 1000 samples per week.

### **Augmented Testing**

In order to further amplify the number of tests, a strategy called augmented test was conducted on 26<sup>th</sup> April 2020. Ten priority groups of persons were identified as follows to be sampled and tested:

Priority group-1: Primary contacts of confirmed cases

Priority group-2: Health care worker in NON- COVID hospital; Doctor, Nurse, paramedical staff etc

Priority group-3: Field level health care workers; JHI, JPHN, HI, PHN, ASHA, LSG Community volunteer

Priority group-4: Elderly persons

Priority group-5: Interstate travellers within the last 14 days

Priority group-6: Pregnant women

Priority group-7: Quarantined persons with co-morbidities and less than 60 years

Priority group-8: Quarantined persons with co-morbidities and less than 60 years

Priority group-9: Secondary contacts of confirmed cases in quarantine

Priority group-10: Others

The augmented testing was an attempt to look at the test positivity in each group for revising the testing strategy if required. That there was no evidence to include any further group based on the results.

### **XpertNAT for Emergency Testing**

5 laboratories in Public sector started using Xpert machines for TB diagnostics for performing Xpress- SARS-Cov Testing. Since the results could be made available within an hour, following categories were given priority for Xpress Testing

1. People undergoing Emergency surgery
2. Severe Acute Respiratory Illness requiring rapid results for clinical decision making
3. Deaths requiring COVID test results for further actions
4. Symptomatic Health Care Worker

### **TrueNAT Testing**

18 TrueNAT laboratories have been set up in the state equipped with 20 machines in the public sector. Those laboratories will be testing the samples from pregnant mothers on a priority basis.

### **Dynamic Testing strategy based on epidemiological insights**

The testing and containment strategy followed by Kerala has been very much appreciated by ICMR and it has been in compliance often beyond the recommendation of ICMR.

Kerala testing guidelines have incorporated all elements of ICMR testing policy. Apart from that the state has added certain other testing groups like testing those with mild symptoms who have attended mass gatherings. Kerala is has also included testing newly incarcerated prisoners, those returning from

parole etc in their testing strategy.

ICMR criteria till recent revision, was not addressing interstate travellers whereas Kerala testing policy had included interstate travellers months back.

As the number of patients in Kerala are increasing and as the number of patients in surveillance network is increasing, Kerala has increased its testing to 3000 tests per day. This is a reflection of the dynamic nature of our testing policy which is based on epidemiological intelligence inputs.

### Summary of Testing Laboratories in Kerala & Plan for Testing

|                       | Number of Testing Laboratories | Number of Testing Laboratories in Private Sector | Samples Per Day | Remarks                                                                                                            |
|-----------------------|--------------------------------|--------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------|
| Routine RTPCR         | 14                             | 5                                                | 1700            | All individuals eligible for testing based on ICMR criteria. In addition, Government of Kerala added a few groups. |
| Xpert                 | 5                              | 4                                                | 50              | Emergency Samples                                                                                                  |
| TrueNAT               | 18*                            | -                                                | 250             | Pregnant Mothers & Emergency Samples                                                                               |
| Sentinel Surveillance | -                              | -                                                | 1000            | 7 groups (Pooled Testing)                                                                                          |

\*8 started functioning, all will be functional by 31<sup>st</sup> May.

## Test done in Kerala

Total COVID tests done in Kerala for COVID in Kerala is 80091. Details are as shown below. This come to around 2355 tests/ million population

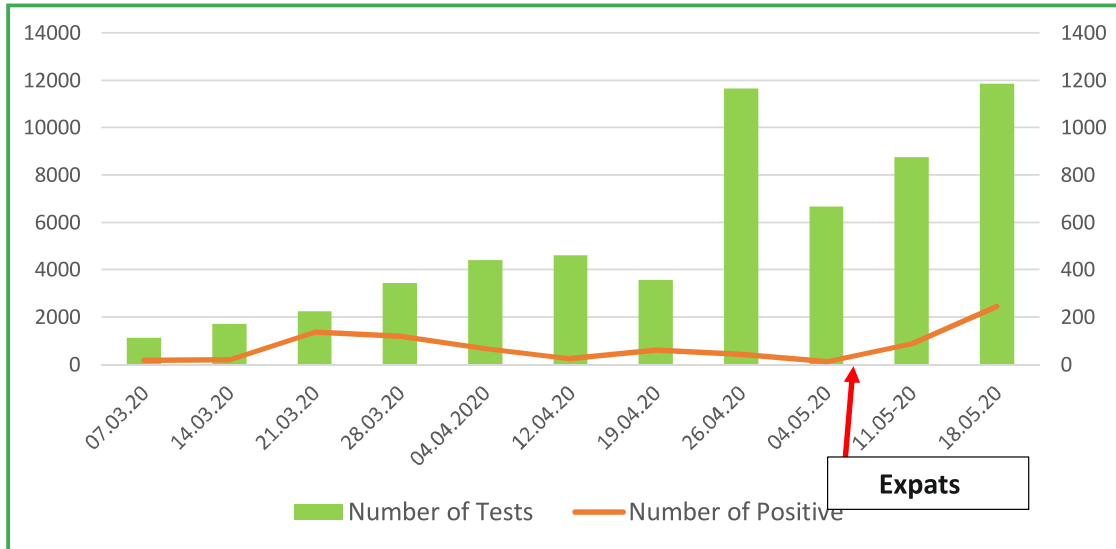
### Summary of Tests Done in Kerala

|                                                         | Sample Received | Tested Positive | Under Processing |
|---------------------------------------------------------|-----------------|-----------------|------------------|
| Routine samples                                         | 66978           | 1039            | 1915             |
| Xpert samples                                           | 818             | 12              | 0                |
| Sentinel surveillance                                   | 4414            | 4               | 0                |
| Augmented surveillance                                  | 3128            | 4               | 0                |
| Sentinel surveillance (pooled) with Expatriates samples | 4753            | 29 (Expats)     | 720              |
| <b>TOTAL</b>                                            | <b>80091</b>    | <b>1088</b>     | <b>2635</b>      |

Figures will vary on daily basis.

## Number of Cases did not increase proportionately with number of tests in Kerala

Week wise Trend of number of tests performed and Number of Positive Cases (Secondary Axis)



Contrary to the conventional belief that number of cases increase with the number of tests, that has not happened in Kerala.

### Effort to detect cases through testing

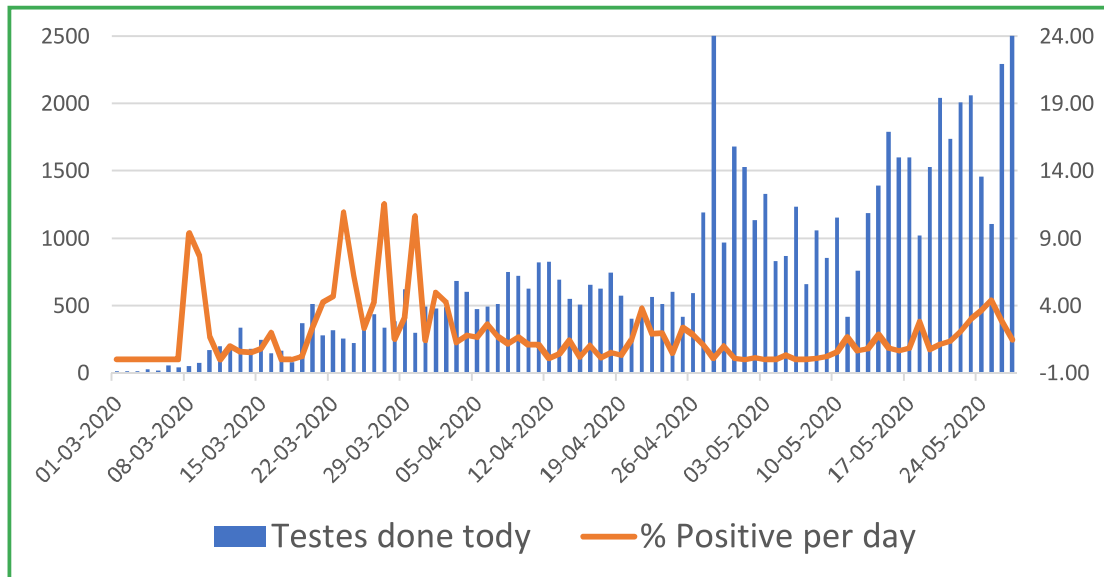
***To obtain 1 positive case, Kerala has tested 71 COVID cases total, whereas at national level to get 1 positive case only 23 tests are done. The effort of Kerala to find out ONE case through testing is 3 times higher than the national average.*** On week starting with 26<sup>th</sup> April (just before the expatriates' arrival), the state has to test around 500 samples to get one positive case. Kerala is the state doing one of the highest number of tests to find out **one** positive case. This shows the effort to find out cases.

## Test Positivity Rate

Test Positivity Rate in Kerala is 1.5 %. National average is 4.3%. Aim of any country is to have a test positivity rate of <2.0 like in south Korea.

The test positivity rate needs to be studied by disaggregating test positivity among the people coming from abroad and other state and the positivity among the primary , secondary contacts of the positive cases. The imported cases percentage among the positive cases in the month of May.

## Day wise distribution of number of tests performed and positivity rate



When TPR of Kerala is less than 2.0, test, test and test strategy will result only in wastage of finite resources. High case fatality rate and Test Positivity Rate are indicative of the fact that a state is only testing the sickest and is not doing enough screening tests. Whereas data from Kerala with a Test Positivity Rate

of 1.5 and Case Fatality Rate of 0.5 is the best example of intelligent use of resources based on a dynamic testing matrix which takes into account the inherent strength of Kerala's health system in contact tracing and quarantining.

### Measuring the adequacy of testing across the states

Comparing the tests conducted per million populations (TPM) between the states does not consider the size of the outbreak in these states, hence it is not a suitable indicator of measuring the adequacy of tests between the states.

***The appropriate statistical indicator for this, which is globally used now is to relate TPM with the case per million (CPM). This indicator is directly related to the test positivity ratio and is calculated as Test Per Million (TPM) divided by Case Per Million (CPM).*** The comparative figures of these indicators between major states (with large number of total cases, i.e. above 500) are given in the table below. (Sorted in the descending order of number of times the Test per Million is higher than Case Per Million)

|   |                   | Tests/Million | Case/Million | Positivity per 1000 tests | Test Per Million/ Case Per Million |
|---|-------------------|---------------|--------------|---------------------------|------------------------------------|
| 1 | Andhra Pradesh    | 6903          | 65.5         | 9                         | 105.5                              |
| 2 | Karnataka         | 4126          | 41.5         | 10                        | 99.5                               |
| 3 | Assam             | 2328          | 27.5         | 12                        | 84.8                               |
| 4 | Odisha            | 3319          | 39.5         | 12                        | 83.9                               |
| 5 | Jammu and Kashmir | 12515         | 165.9        | 13                        | 75.4                               |
| 6 | Haryana           | 4132          | 59.3         | 14                        | 69.7                               |

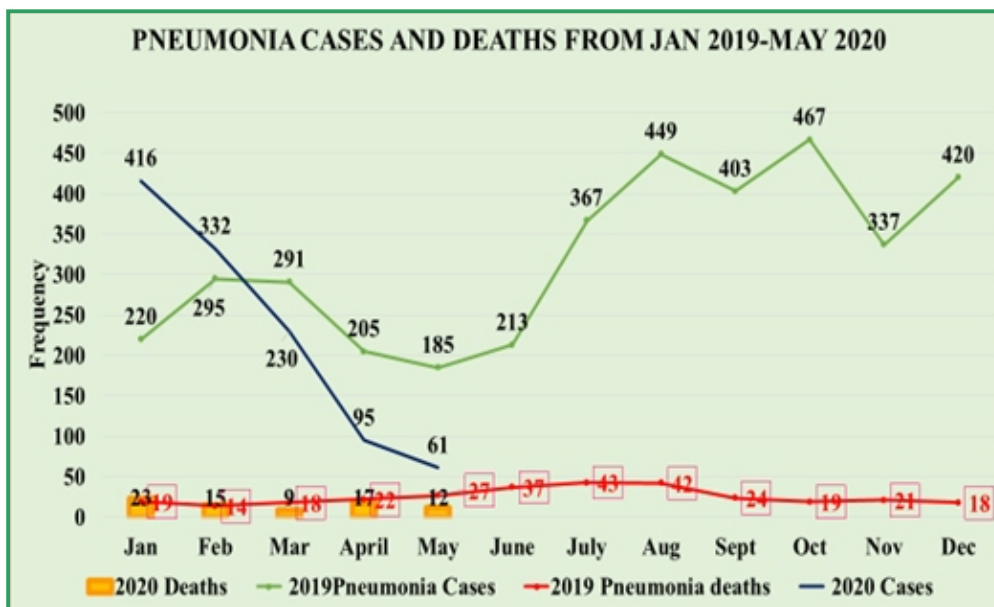
|                  |                | Tests/Million | Case/Million | Positivity per 1000 tests | Test Per Million/ Case Per Million |
|------------------|----------------|---------------|--------------|---------------------------|------------------------------------|
| 7                | Kerala         | 2114          | 32.6         | 15                        | 64.9                               |
| 8                | Uttarakhand    | 2377          | 49.6         | 21                        | 47.9                               |
| 9                | Rajasthan      | 5115          | 117.7        | 23                        | 43.5                               |
| 10               | West Bengal    | 1926          | 49.7         | 26                        | 38.8                               |
| 11               | Uttar Pradesh  | 1204          | 35.0         | 29                        | 34.4                               |
| 12               | Punjab         | 2612          | 77.8         | 30                        | 33.6                               |
| 13               | Tamil Nadu     | 6310          | 268.5        | 43                        | 23.5                               |
| 14               | Bihar          | 675           | 29.7         | 44                        | 22.7                               |
| National (India) |                | 2441          | 119.8        | 49                        | 20.4                               |
| 15               | Madhya Pradesh | 2082          | 102.6        | 49                        | 20.3                               |
| 16               | Gujarat        | 3208          | 257.7        | 80                        | 12.5                               |
| 17               | Delhi          | 10982         | 969.8        | 88                        | 11.3                               |
| 18               | Telangana      | 668           | 63.3         | 95                        | 10.6                               |
| 19               | Maharashtra    | 3742          | 529.9        | 142                       | 7.1                                |

From the table 1 it is clear that while at the national level the Tests Per Million is just above 20 times the case per million, in Kerala it is 65 times and this figure is well above majority of the states barring 6 states. Of these states only Assam is having a lesser case per million than Kerala. This indicates that the performance of the state in case of testing adequacy is far better than almost all major states and this has much to do with the containment and testing strategy of the state.

Active case per lakh population in Kerala is 1.2, whereas the same at National level is 6. In population norms (per lakh), the state has only 1/5<sup>th</sup> of the cases than national average, still then the state has done almost same number of tests per million as the national average.

### **Severe Acute Respiratory Illness**

Meaningful community transmission will be captured by surrogate markers like increase in pneumonia deaths, increase in hospital admissions due to SARI/ILI and increase in those attending OPDs due to ILI. The PEID cell data from March and April in 2020 compared to same in 2019 and 2018 shows declining numbers of ILI/SARI admissions. This could partly be explained by the widespread acceptance and success of Kerala's break the chain campaign which could have resulted in decreased respiratory infections. But that cannot account for the decrease in Pneumonia death rate in 2020 compared to that in March, April 2019 and 2018. Meaningful community transmission should result in increased number of undiagnosed COVID-19 cases in the community. For every 100 undiagnosed case of COVID-19 in the community, even by the lowest estimate at least 5 cases should be moderately severe requiring hospital admission. Since this is not getting reflected from hospital surveillance data, it is an indirect pointer to the fact that meaningful community transmission has not occurred in Kerala.



## Testing at Private Laboratories

Private labs have tested 6994 samples in Kerala. These labs tested samples from people with Respiratory Infections presented to various private hospitals in Kerala. Only 4 (0.05%) with a definite history of travel/contact turned out to be positive.

This data also tells us that no community transmission is happening in Kerala and testing rate is adequate.

| Laboratory            | Cumulative Samples Received | Samples Tested | No. Of Positives Detected So Far | Under Process |
|-----------------------|-----------------------------|----------------|----------------------------------|---------------|
| ASTER MIMS, KZD       | 1582                        | 1529           | 4                                | 0             |
| DDRC, SRL Kochi       | 4298                        | 4138           | 0                                | 160           |
| AIMS, Kochi           | 723                         | 699            | 0                                | 24            |
| Dane Diagnostics, PKD | 17                          | 11             | 0                                | 6             |
| Medi vision, Kochi    | 374                         | 320            | 0                                | 76            |
| <b>Total</b>          | <b>6994</b>                 | <b>6697</b>    | <b>4</b>                         | <b>266</b>    |

### Xpert Tests for Emergency Samples

703 Xpert tests were done among people who underwent Emergency surgery and deaths before autopsy in selected centres in the state. None of the cases in these categories without any travel history turned out to be positive till date.

### Misnomer of Test-Test-Test

World Health Organisation's Tests-Test-Test really means Test all eligible- Test all eligible- Test all eligible. It should be evaluated as "Has the state tested all eligible individuals? And Not as number of tests performed.

The mantra of test-test-test is often over rated and it does not consider the effect and significance of public health measure for containment. The analogy can be drawn to a bucket of paint in a well. Here paint indicates the covid 19 cases imported (including potential cases) since January. Now in a scenario where we allow the paint in the bucket to completely mix with the water in the

well (means ineffective isolation and quarantine) then after that to filter out the paint (here the cases) entire well has to be filtered (tested). That's the logic of the western mantra of test test test as the public health machinery in many of these nations (and of many states in India) are much weaker than the state of Kerala.

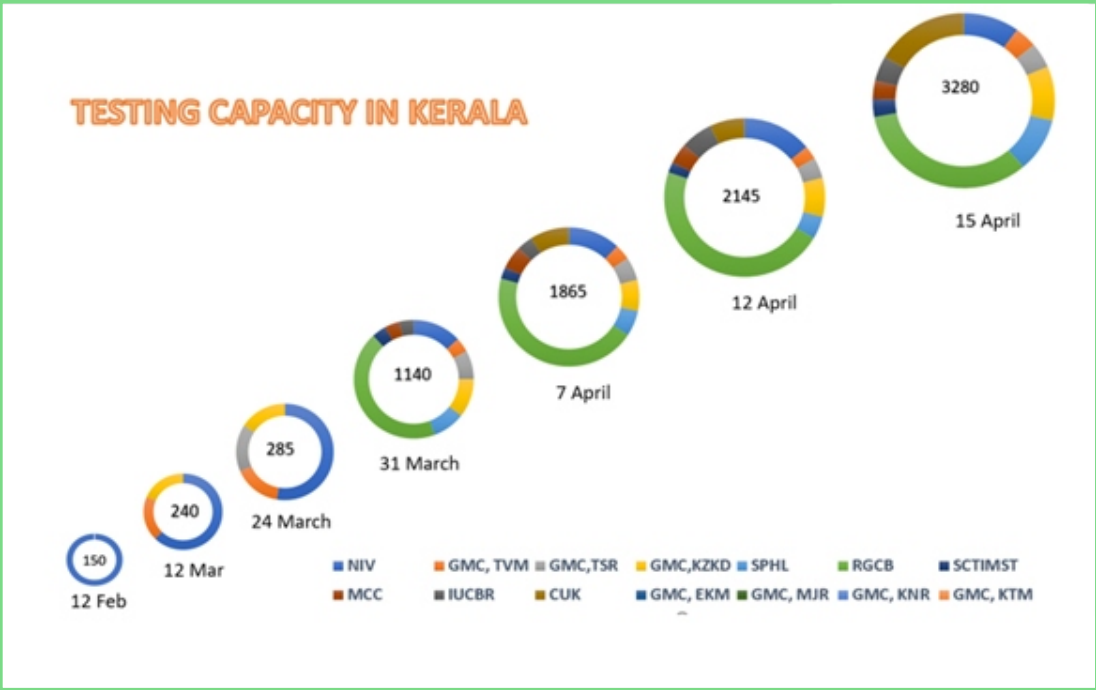
In this context, our approach to testing from the beginning has been strongly supported by decentralised public health system with compulsive isolation, quarantine and vigorous contact tracing. In the analogy above, it is like not allowing the paint in the bucket to mix with the water in the well, and if at all any spillage occur that is dealt specifically. While we continue to take samples from different parts of the well (analogy to sentinel Surveillance and Augmented sampling) to ensure that there is no leak in the bucket which we missed.

The first mover advantage: For such a strategy (as mentioned above) to work the response in the initial days of the epidemic is too crucial. It is in this context the strict public health approach with targeted testing, tracing and treatment strategy helped the state to decrease the infection rate, flatten the curve and to reduce to percentage of active cases in the state to about 3% in the first week of May (before the new phase of influx of imported active cases in expatriates and from other states)

## **The network of Laboratories**

In the month of January and February first week there was no laboratory set up to do testing of COVID19 in Kerala. The samples were sent to NIV Pune. For that extensive arrangement of collecting samples from all over the state having primary and secondary contacts was done. The samples were sent to Ernakulam and from there by flight were sent to Pune. Later on, the Government of India took decision to set up 7 laboratories in India and one was established in NIV Alappuzha. Subsequently series of Laboratories were set up in Kerala in Government sector and private sector. The available machines were mapped and KMSCL was entrusted with to do transfer of the equipment

to the ICMR approved Laboratories in Government set up to ramp up the testing facilities.



The testing capacity has reached to 3200 per day provided all Laboratories function optimally.

## Laboratories and testing capacity

| LABORATORY    | TESTING CAPACITY |
|---------------|------------------|
| NIV Alappuzha | 300              |
| GMC Tvm       | 120              |
| GMC, KZKD     | 300              |
| GMC, TSR      | 140              |
| PHL           | 300              |
| RGCB          | 1000             |
| IUCBR         | 140              |
| MCC           | 120              |
| SCTIMST       | 100              |
| CUK           | 200              |

| LABORATORY       | TESTING CAPACITY |
|------------------|------------------|
| GMC, EKM         | 90               |
| GMC Manjeri      | 90               |
| GMC Kottayam     | 60               |
| GMC, Kannur      | 60               |
| ASTER MIMS, KZD  | 30               |
| DDRC, SRL Kochi  | 100              |
| AMRITA           | 35               |
| MEDIVISION       | 36               |
| DANE DIAGNOSTICS | 35               |
| <b>TOTAL</b>     | <b>3221</b>      |

The Laboratory network was efficiently supported by Kerala Medical Service Corporation by providing all required infrastructure and consumables such as PCR Test kits, RNA extraction kits, Dacron Swabs and VTMs etc. The supply chain management was maintained properly on day to day basis. ICMR has been very supportive and provided all the technical support and consumable support.

Other than RT PCR Laboratories the Department has also set up XpertNAT test at 5 institutions and TrueNAT test facilities at 18 institutions to supplement efforts of testing some of the categories such as emergency operations, pregnant mothers, etc.

The Department has also taken decision to procure Antibody test kits, ELISA test kits as and when ICMR approves them. So as to supplement the sentinel surveillance. The Department through NHM has also issued order to deploy

extra human resource to ensure continuous functioning of the Laboratories. All the human resource was trained with the involvement of Senior Doctors from the Department of Microbiology and experts from NIV Alappuzha, ICMR laboratory.

## Summary

State of Kerala has a testing policy driven by rigorous epidemiological Analysis. It is based on Importation and transmission-based approach. The testing strategy focusses on risk approach, at the same time it has inbuilt system for sentinel surveillance among general public. Comprehensive testing strategy of the state is backed up by the strong public health approach. This makes the testing strategy of the state smart and intelligent with effective utilisation of resources.

## Acknowledgement

Right at the start, after declaration regarding COVID19 as a health emergency by the WHO on 18<sup>th</sup> January 2020, the Department of Health and Family Welfare issued advisory on 19<sup>th</sup> Jan, received the first Wuhan returnee with a complaint on 23<sup>rd</sup> Jan and on 26<sup>th</sup> January 2020, we have issued a detailed comprehensive guidelines covering all the aspects from field activities, patient admission, investigation, care and support, discharge and post discharge activities. The detailed planning, well in time has helped us to apply to ICMR, set up laboratories, give procurement orders and finally setting up the laboratories in the public sector and in the private sector.

As we have a well laid down structure in the form of State Medical Board, we could develop series of protocols including the one related to the testing. The department of health and family welfare has developed a well thought out strategy for the testing. This booklet along with Sentinel Surveillance report, if read together will give the information to the reader regarding the testing strategy and the output.

I take this opportunity to thank Dr Tony, Dr Rakesh and Dr Asheel for their valuable contribution in bringing out this volume. I also thank Dr Santhosh Kumar Chairman of State Medical Board & Superintendent SAT Hospital and other members of the State Medical Board for their continuous guidance for developing testing guidelines. I thank Dr Ekbal Chairman Expert Group and Member Planning Board for facilitating availability of PCR machines from various institutions.

The guidelines will be futile unless are practiced in the field uniformly. For that, the credit goes to all the field teams, treating clinicians' teams and their supervisory officers. As we move forward, we request the technical suggestions to improve the testing strategies and response to the epidemic.

**Dr Rajan Khobragade**  
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**Government of Kerala**  
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**OUR HEALTH IS OUR RESPONSIBILITY**