Replicating the Kerala State's Successful COVID-19 Containment Model: Insights on What Worked

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Abstract

Although Kerala was the first state in India to report COVID cases, it was well prepared drawing on its past experience in managing effectively the Nipah outbreak and Kerala floods. It knew and initiated the measures required for containment because of its prior experience with mobilizing community-based groups, involvement of local-self government in decentralized planning, and participation in the containment and relief measure as well as a system-ready health system and infrastructure. The measures taken to "flatten the curve" that is unique to Kerala and the determinants of success are described in detail as "what worked" using the framework we developed post the Nipah outbreak containment experience. These are being shared with the hope that the insights these measures undertaken by the state provide can be used elsewhere to translate and replicate components that work.

Keywords: Community participation, COVID-19 containment, Kerala model, system-ready health system

INTRODUCTION: THE PANDEMIC TIMELINE

India after the postlockdown unlock phase is seeing an explosion in the total number of cases at 2,525,222 and 49,134 deaths, globally standing next to US and Brazil. The alarm bells rang on July 6 when 24,248 new COVID-19 cases and 425 deaths were reported in a single day. Amidst this grim situation, the South Indian state of Kerala has emerged as a model to emulate on pandemic preparedness, response, and mitigation.[1,2]

Paradoxically, although Kerala was the first state affected by COVID-19 in India and till early March the number of cases kept on increasing, Kerala's strategy to fight COVID soon started paying off. In the midst of alarming increase in the number of cases across the country, it now has the highest recovery rate, the least death rate, and slowest progression with 7873 confirmed cases with 4095 recoveries and 31 deaths.[3,4] A distinct feature of this state is health system preparedness backed by a strong primary health-care system.[5]

Kerala's efforts in the first phase are comparable to that of South Korea, in flattening the (epidemic) curve, though unlike the latter, the testing rates are relatively low in the former. Behind Kerala's success so far includes its "Break the Chain"

awareness campaign which included ubiquitously present hand washing facilities across the length and breadth of the state and the extensive efforts to test and isolate infected people and trace and quarantine their contacts.[3,6,7]

The response and containment of the COVID-19 pandemic in Kerala can be delineated into four distinct phases based on timeline – the early Wuhan phase, the Italy phase, the lockdown phase, and postlockdown phase.

The state after handling two successive public health emergencies arising from the devastating floods and the deadly Nipah Virus attack (2017, 2018), responded promptly to the first case in a medical student returning from Wuhan on January 30, 2020, in Thrissur district and subsequent three cases. Within a span of 3 days from reporting the first case, 324 Indian citizens were airlifted from Wuhan. The second phase witnessed local transmission with a family

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from Italy reportedly skipping airport screening and infecting close contacts. Contact transmissions started rising in the northern districts of Kasargod and Malappuram following the influx of passengers from the Middle East. The state witnessed a spike in numbers galloping from double to triple digits – with 100-plus patients on March 24, followed by the nationwide lockdown (March 25th to April 14th). The most challenging phase started postlockdown with massive aerial and maritime repatriation "Vande Bharat Mission," and domestic air travel resumption. All is not well, with the State reporting 1322 cases within just 3 days, confirming community transmission of COVID-19 in two coastal hamlets of the state capital.[3,5] Yet, the state continues to tackle this pandemic head on with remarkable resilience 6 months into the pandemic.

The indicators of transmission of COVID-19 in Kerala as compared to that of national average are depicted in Table 1. Cases per million population are just 1/3rd than that of the national average in Kerala. Against this widely-known background, the authors hope that this article will provide further and deeper insights about what worked on the ground for the success and also seeks to explore the unique circumstances and characteristics that have generated a unique response in the state of Kerala.

DETERMINANTS OF THE KERALA MODEL OF SUCCESS

Health system preparedness

The credit to Kerala's flattening the curve in the initial phases goes to the path-breaking planning and action armed with the lessons from Nipah containment. As early as January, n-Corona guidelines were framed for the hospitals with constitution of state medical board, rapid response team, and state control cell. Multidisciplinary teams were constituted for monitoring field surveillance, hospital admissions, logistics, etc., A reference guide for converting hospitals into dedicated COVID hospitals was drafted and isolation beds were earmarked anticipating a surge.[5,8] Value addition to the capabilities of the health system was provided by inputs from the "Aardram" mission started in 2016.[9,10]

Capacity building of health-care professionals

Keeping in sync with the axiom "Risk reduction as much as possible," training programs for capacity building started in the early phase to health-care professionals in all settings using a

combination of instructional methods with inputs of infection control experts from medical colleges.[11,12]

Screening, decentralized case reporting, surveillance, and quarantine

At the core of the initial containment measures has been the screening of travelers launched on January 23. All international passengers were screened by the health staff at four airports, all symptomatic transferred to health facility for swab collection followed by admission and asymptomatics placed under home quarantine. COVID-19 guidelines for exclusive arrangement for the foreign tourists coming to Kerala were charted out, which worked well.[13,14]

Through a strong decentralized system of daily case reporting and surveillance, appearance of symptoms was ascertained through twice-daily telephonic inquiry and suspects were transported to the facility in designated ambulance available in the toll-free number through "DISHA," the 24-h tele-health helpline.[11-13]

Aggressive surveillance and contact tracing

Armed with expertise in the concept and practice of contact tracing, the health teams in all the districts including community medicine departments of government medical colleges reached out to the reference point namely the infected person and contacts. On the ground, the health department-led surveillance system took on a community-based character with the involvement of elected representatives, particularly village panchayats, members of the self-help group (SHG) system called "Kudumbashree," and the citizens themselves. In addition, in view of the scattered nature of the nonresident Keralite housing of their dependents and the large number of tourist resorts in the hills, attention had to be spread across the whole state including interior rural areas. The police department actively got involved in this process.[5,8]

Laboratory support

Recognizing the urgency in testing and diagnosis, the Center approved National Institute of Virology (NIV) Alappuzha in addition to NIV Pune in February to test samples. Currently, there are 38 private labs and 28 government labs approved to test for real-time polymerase chain reaction, 22 TruNAT, and 14 CB-NAAT facilities.[15,16] Sample collection and treatment facilities are also available in 22 hospitals in the state, which includes 14 district hospitals, eight medical colleges, and 200 taluk hospitals.

Testing and containment strategy

The State has adopted a testing policy based on infection importation and transmission-based approach [Table 2]. Orders were issued for testing COVID-19 using (Molbio diagnostics) in the private and public sectors.[17,18] Of particular note is the aggressive surveillance strategy by the State which extended the incubation period to 28 days compared to the central guidelines of 14 days' quarantine. More than 3000 samples are tested per day as part of the augmented testing policy by April in a move to detect community spread.

Table 1: Current Scenario of COVID-19-Kerala and India Comparison

Parameter	Kerala	India
Total cases	5622	697,412
Case per million population	165	505
Total active cases	2252	253,287
Case fatality rate (%)	0.5	2.8
Test per million population	8033	7224
Sample positivity rate (%)	2	7

Source: 4

Post lockdown from June 8, it was decided to conduct 15,000 antibody tests per week using ICMR kits to check community spread.[19]

Surveillance using chemiluminescent assay-based serology and ICMR-approved StandardQ COVID-19 Ag kit was added to the rapid point-of-care surveillance at airports and cluster containment zones in July.[20] The state is constantly monitoring the positivity rates among all categories of people, with the positivity rates in general community negligibly low [Table 3]. A few clusters have been identified and containment measures are in full swing.

Early ensuring of logistics and supplies
Anticipating the surge, adequate PPE gear were procured and stocked in the mid January itself. Masks and hand sanitizers were produced locally by Kudumbashree. At the same time, local research and development (R&D) efforts were made to improve testing systems and facilities and express readiness to attempt advanced technological interventions such as plasma therapy.[5]

Treatment protocols and drug procurement leading to better clinical outcomes
Uniform clinical management guidelines including standard treatment for critical care contributed by an expert state team helped in reducing the mortality of patients in the COVID hospitals across Kerala. The estimated case fatality rate (CFR) and lagged case fatality rate (LCFR) in Kerala is around 0.5% and 2.01%, respectively, well below the national average of 2.8% and 5.9%. A significant predictor of low mortality rate could be the swift hospitalization and early treatment, which happens on an average within 2.4 days of symptom onset. Lopinavir/ritonavir and remdesivir are being tested and tocilizumab, steroids, and convalescent plasma, used on a case-to-case basis with consensus from the State medical board.[21,22]

Systemic investment in strengthening health infrastructure
Resorting to dynamic planning, anticipating an extreme scenario, all government medical colleges set up isolation wards and intensive care unit (ICU) facilities, while the district hospitals earmarked isolation wards alone. A total of 3600 beds out of 28,000 were devoted for COVID-19 patients to start with. Support of the private hospitals was sought and even empty houses owned by nonresidential Indians were mapped. Now, the state has identified around 100,000 hospital beds, with potential for ramping it up to 200,000 in the event of an emergency.[5] A total of 300 COVID care centers and around 29 CFTLC's (first-line treatment centers) are functioning currently.[23]

Social security measures and support to migrant workers
In the early March itself, the state came up with a Rs. 20000 crore relief package. Social security pensions, welfare fund assistance to 51 lakh beneficiaries, interest-free loans to SHG members, free ration through public distribution system, and food at doorstep for Anganwadi beneficiaries are some of the key assistance measures. Around 300,000 meals a day was prepared by Kudumbashree workers to around 2.5 million guest workers across 20,000 camps. Helplines are available for elderly people to access medicine and food materials through volunteers. Thus, the policy of "No one left behind" has been operationalized.[5,6,8]

Successful garnering of community support
The stakeholders in the community's fight against the pandemic primarily include the local government leaders. Religious leaders, local bodies, and civil society organizations also participated in policy design and implementation.[24] Ward-level rapid response teams functioned efficiently under the leadership of the elected ward member who served as a link between the incoming travelers and contacts quarantined and the health system, with a key role designated to accredited social health activist workers.

Massive and effective risk communication strategy
Communication strategies included "Break the Chain"

Table 2: Testing strategies with counts - Kerala state (as on 12.7.20)			
Testing strategies			
Routine testing	240218	Pooled Sentinel	71661
Sentinel	4414	True NAAT	7575
CB-NAAT	2280	Antigen Assay	18709
CLIA	1479		
Total Positive		7873	
Source : 20			

Table 3: Positivity rates among testing categories (June 1-30)			
Category of sample	Number of samples tested	Number of positives detected	Test positivity rate (%)
Travelers	51,400	2855	5.5
Contact of confirmed case	32,279	140	0.43
Health-care workers	14,932	77	0.51
Other frontline workers	7736	12	0.15
SARI	4734	3	0.06
ILI in general population	4047	13	0.32
Pregnant female in the general population	3194	3	0.09
Others (air crew, CISF, etc.)	21,359	69	0.32
Total	139,681	3172	2.2

Source: 27. SARI: Severe Acute Respiratory infection, ILI:Influenza like illness, CISF: Central industrial security force

awareness campaign for the promotion of hand hygiene, physical distancing, and cough etiquette. Kerala Arogyam portal, DHS website, and Kudumbashree WhatsApp groups disseminated comprehensive COVID-19 information.[25] Transparent communication centered on peoples' participation with daily updates by the chief minister enhances trust in the government.

Access to innovative technologies

Technological innovations rooted on a multifaceted, interdisciplinary approach brought together universities, industries, and government to co-create innovations in the state. Coronasafe Network – a crowd-sourced innovation, QuikDr – a mobile application helping avail free medical advice and consultation over video conferencing, and COVID-19 examination walk-in KIOSK's are noteworthy innovations.[26]

Psychosocial support to the needy

A telemedicine portal e-sanjeevani and psychosocial support are in place, and 1143 mental health professionals including psychiatrists, psychiatric social workers, clinical psychologists, and counselors have been deployed to provide support to people in quarantine. The government has adopted an inclusive approach, catering to the special needs of 1168,950 mentally ill patients, children, migrant laborers, and elderly people living alone.[25]

Multi-sectoral collaboration

In the daily task force review convened at the state and district level, representatives from several organizations participate [Figure 1].

Agility of shift in pandemic containment strategies

With a spike in daily number of cases in double digits to over 100 cases for 11th day in June, the state has rolled out the cluster containment strategy. As on July 6, there are 157 containment zones which are identified wards and specified as "LSG Needing Special Attention," with antigen tests being conducted for members of each household.[1]

MOVING FORWARD: CHALLENGES AHEAD

Threat of emerging community transmission

Out of 166 epidemiologically unlinked cases reported, sources of 125 cases were identified. Imminent threat is the 41 cases with apparently no known source of infection.[27]

Gaps in health infrastructure

The health infrastructure in the northern districts of Malappuram and Kasargod, with the highest influx of expatriates, retains massive gaps. The existing hospital capacity of Kerala's health sector in terms of hospital beds, ICU beds, and ventilators is estimated to be around 5.2%. Existing bed capacity is mostly saturated at government hospitals. Accommodation of influx of COVID-19 patients will require rapid expansion of the current capacity or modifications in admission policy for routine patient care. The admission and discharge policies are being revised to address this concern.[28]
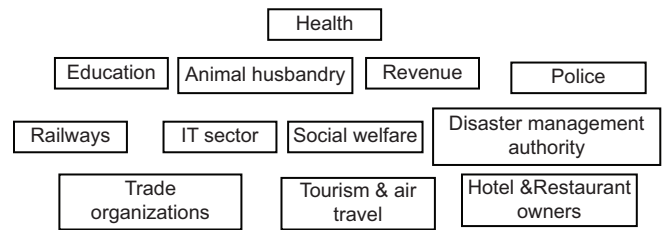

Figure 1: COVID-19 containment – collaborating departments

Problems with private sector engagement

A major challenge faced is that almost the entire treatment burden of the affected people falls on the governmental health system. Due to the spike in cases, government's strategy to include the private sector in Karunya Arogya Suraksha Paddhati package was rejected by the private sector managements.[29]

Inadequate testing numbers

Though Kerala was in the forefront of testing numbers in March, the State started to lag behind other states in April. Presently, Kerala lags far behind most of its peers in the number of tests – both in absolute and per-million (1.36 lakh and 3,871), placing it in the 12th position.[30] The counterargument presented is that the state is doing strategic testing, maintaining the sample positivity rate at 1.8, which is lesser than the global figure of 2%.[31]

The increasing number of cases among health-care workers picked by hospital- and community-based sentinel surveillance is worrying. There is a need to augment workforce to deal with the burnout due to the patient load and fear of infection.

With the onset of monsoon, a gamut of communicable diseases such as dengue and leptospirosis also is expected. The management of non-COVID cases which has been ignored till now, is equally important.

Replicability of the Kerala model – does one size fit all?

Experts opine that pandemic response models are area specific and cannot be replicated. One size doesn't fit all in a diverse country like India.[32] The biggest learning that needs to be nationally replicated on an emergency mode is the strengthening of the primary health-care system focused on care and welfare.[5]

CONCLUSION

Kerala's success story in containing COVID-19 is built on the solid foundation of a successfully created infrastructure to support social and human development including efficient public health-care delivery system that places it far ahead of the rest of India on many key indicators. On this foundation, political commitment coupled with decentralized governance, transparency, and governmental accountability prevented the state from going into the stage of "denial" that other states suffered from. Literacy has a major role to play in the populace behaving responsibly, cooperating with authorities, and seeking prompt treatment, thereby limiting community transmission. The State's social fabric reflects extremely high levels of trust in institutions and elected representatives.

How long Kerala will be able to hold on to this success with the recent surge in COVID cases this week to 1322 in just 3 days sparking fears of community transmission, remains to be seen. The key take-home message from the Kerala experience is that the best way and time of preparing for an epidemic is well before it begins and its continued resilience in the face of adversities. It offers clear lessons for the rest of India, both in responding to the current crisis and in preparing for the next one.

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