COVID-19 MANAGEMENT AND CONTROL: THE KERALA STORY

SHORT STUDY IN FULFILLMENT OF THE INTERNSHIP AT SOCIETY FOR COMMUNITY HEALTH AWARENESS, RESEARCH AND ACTION (SOCHARA), BENGALURU

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MAY 11th 2020 – JUNE 27th 2020

FOREWORD

This report was done as part of an internship in collaboration with SOCHARA. The authors are currently pursuing their Masters in Public Health (MPH) degree at Achutha Menon Centre for Health Science Studies, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram. The internship was a mandatory requirement for the completion of the Masters program.

At SOCHARA, the authors were guided by Dr Thelma Narayan. The internship was conducted in a virtual manner. The data used in the report is secondary data available from public source and no institutional ethics clearance was obtained.

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ABBREVIATIONS

COVID-19	Coronavirus Disease – 2019
WHO	World Health Organisation
SARS	Severe Acute Respiratory Syndrome
PHEIC	Public Health Emergency of International Concern
MoHFW	Ministry of Health and Family Welfare
PDS	Public Distribution System
PHC	Primary Health Centre
CHC	Community Health Centre
FHC	Family Health Centre
NORKA	Non-Resident Keralites Affairs
CDC	Centres for Disease Control
RP-PCR	Reverse Transcriptase – Polymerase Chain Reaction
LSG	Local Self Government
DHS	Directorate of Health Services
IEC	Information Education and Communication
CSR	Corporate Social Responsibility
HCWs	Health Care Workers
ASHA	Accredited Social Health Activist
PPE	Personal Protective Equipment
GPS	Global Positioning System
DISHA	District Intervention System for Health Awareness
SPEM	State Poverty Eradication Mission
NHGs	Neighbourhood Groups
CDS	Community Development Society
MoRD	Ministry of Rural Development
SRLM	State Rural Livelihood Mission
GoK	Government of Kerala
ERSS	Emergency Response Support System
SC/ST	Schedule Caste/Schedule Tribe

Executive Summary

During the current year, 2020, countries of the world have been doing everything in their power to combat the highly dreaded Corona Pandemic. The novelty of the virus has made it difficult to control the rampant spread of the virus. Currently, corona is not only a health crisis, but has also become an economic and human crisis. Lessons from the different successful endeavours to tackle the Covid-19 disease, undertaken in different contexts, could be used as a guide to contain the spread of the disease of which very little is known. Since the 1970s, one Southern Indian state that has stood out and been internationally acclaimed for its health indicators is, Kerala. The Nipah outbreak of 2018 in Calicut, Kerala has been a previous learning experience that has equipped Kerala with knowledge of various public health measures like contact tracing, epidemiological linking, quarantine, etc. Awareness of these measures are a requisite to deal with emergency outbreak infections like Corona. This article, "COVID-19 MANAGEMENT AND CONTROL: THE KERALA STORY" aims to review the strategies that Kerala undertook to manage the burden of Covid-19 disease.

COVID-19 MANAGEMENT AND CONTROL: THE KERALA STORY

INTRODUCTION

The beginning of the third decade of the 21st century, 2020, started with a series of unfortunate, uncertain and unexpected events, one of which is, the highly dreaded- Corona Pandemic. Corona, "corona virus infection", corona virus disease-CoViD, 2019 novel coronavirus (as it was first found towards the end of 2019) or COVID-19 etc. are the different terminologies that are used to describe this novel virus. Currently, what we are aware of, includes, the mode of person to person transmission of the disease through droplet infection, the transmissibility (R0/Rt), the incubation period-around 14 days, the clinical symptoms, the vulnerable groups affected, and more or less the complications it causes. Whether the disease could also be airborne, the complete virulence of the virus, a standard treatment protocol, the possibility of developing a vaccine, are among several other issues that don't have definite answers yet but are being researched on. However, based on the limited knowledge and information available, countries in the world are trying their best to combat the disease by devising their own treatment protocols to manage the patients who are affected with the virus. Some of the national systems that could successfully manage the disease and flatten the curve include European countries- Germany and Sweden, or Asian countries like China, South Korea, Vietnam, Singapore and Taiwan. In India, the state of Kerala has done a remarkable job in flattening the curve of the disease. This article aims to review the strategies that Kerala undertook (from its first case in late January until the third week of June 2020; till our enquiry ended) to manage the burden of Covid-19 disease, "The Kerala Story". It is imperative to learn from these successful strategies so that we can better control the spread of this disease, of which very little is known.

ORIGIN OF THE DISEASE

The Covid virus first emerged in Wuhan, the capital city of Hubei Province in China, reportedly in the last week of December 2020. On the 31st of December 2019, health officials of China reported to the WHO a cluster of pneumonia cases that was not responding to conventional treatment protocols. Later, Chinese scientists identified the infection to be caused by a novel virus similar to the SARS (Severe Acute Respiratory Syndrome virus) which they termed as Covid -19 virus. Based on experience with SARS, knowledge on possible modes of transmission for respiratory viruses/infections and associated prevention strategies, on the 10th of January, 2020 the WHO published a comprehensive package of technical guidelines to detect, test, and manage potential cases. On the 13th of January, officials confirmed a Covid-19 case in Thailand which was the first recorded case outside of China. After a brief field-visit to China, WHO issued a statement stating that, even though the full extent of transmission is unknown, there was evidence of human-to-human transmission in Wuhan. On the 30th of January, the director general of WHO Tedros Adhanom Ghebreyesus declared the novel coronavirus outbreak (2019-nCoV) a Public Health Emergency of International Concern

(PHEIC). WHO's situation report for 30 January reported a total of 7818 confirmed cases worldwide, with China having the major disease burden; 82 cases were reported in 18 countries outside China. On the risk assessment scale, WHO declared China to be at "very high risk" and other countries across the globe at "high risk" (WHO Coronavirus Disease COVID-19 Dashboard, 2019).

NATURE AND CHARACTERISTICS OF THE VIRUS:

The causative agent of this novel coronavirus infection is- SARS Cov2 (Severe Acute Respiratory Syndrome- Corona virus 2) of genus beta-coronavirus. It is characterized as a mild to severe respiratory droplet infection, transmitted chiefly by contact with infectious material (such as respiratory droplets, or with objects or surfaces contaminated by the causative virus). The droplets from the respiratory tract of an infected individual are transmitted onto a mucosal surface (e.g. mouth, nose) or conjunctiva of a susceptible person, or transmitted onto environmental surfaces. It took some time to determine if there was person to person transmission. A number of studies were undertaken in a short span of time to identify the mode of transmission. The means through which Covid-19 is spread are: primarily contact (direct or via a fomite), and droplet infection, airborne transmission (infectious agents in small airborne particles; which is very minimal because of the size of the droplets) and faeco-oral routes. Human-to-human transmission being the most common mode of transmission is why it has been difficult to curtail the spread of the disease. The median incubation period was estimated to be 5.1 days (95% CI, 4.5 to 5.8 days), and 97.5% of those who develop symptoms will do so within 11.5 days (CI, 8.2 to 15.6 days) of infection. The clinical symptoms include fever or chills, cough and shortness of breath, congestion or runny nose, sore throat, which may progress to pneumonia and respiratory failure, fatigue, muscle or body aches, headache, loss of taste or smell, and gastrointestinal symptoms like nausea/vomiting and diarrhoea (Cascella et al., 2020).

Globally, over 9 million people have been infected with coronavirus. The case fatality rate is 5.1 percent (473,797) i.e. around one in 20 (among the infected) in the world are dying due to this infection, though this varies across countries (WHO Coronavirus Disease- COVID-19 Dashboard, 2019). In India, 185,514 are the active cases, with 3.1 percent being its case fatality rate i.e. approximately one in 30 in the country are dying due to the infection. As of now, there are 14,894 deaths attributable to Covid-19 in India. In Kerala, there are 3603 confirmed Covid-19 cases with 22 casualties which makes their case fatality rate to be at 0.6 percent (mygov.in, 2020). The Kerala management model, thus becomes an important one that needs to be studied, so that similar measures can be undertaken to combat the deadly Covid disease (Statistics as of 25th June 2020).

MANAGEMENT STRATEGIES OF OTHER COUNTRIES

Japan has been successful in combating Covid-19 despite not implementing a lockdown or mass testing. The government released 'stay at home' policies. Each prefecture in the country was given the freedom to choose its own course of action in managing Covid-19. Public health strategies employed were social distancing, masking and contact tracing. Even with the

government's limited action, the management of the spread of Covid-19 is attributed to the quiet determination showed by the general public and their daily habits (Ariadne Labs, 2020).

South Korea has been hailed globally for its aggressive testing and contact tracing measures which have been successful in managing Covid-19 (Novotech, 2020). Location based technology was used in the response to this public health crisis (Lee and Lee, 2020). There was minimal physical contact between the medical staff and the patients. The governance characterized by high levels of transparency was effective during previous infectious disease outbreaks and in the present pandemic (Novotech, 2020).

Taiwan, a small island 150 kilometres away from China - the epicentre of the outbreak, has gained global recognition for its handling of the pandemic crisis. The country relied on its efficient and transparent health system that existed even before the pandemic started. Each citizen has a national health insurance card with a computerized chip containing their medical history and travel history which helped physicians identify probable cases ("Taiwan," 2020). Negative pressure rooms were created in hospitals and the healthcare staff working was reduced by two-thirds to reduce transmission of Covid-19 within the hospital environment (Shih-chung, 2020).

Vietnam, although one of the poorest South East Asian countries with a high population density has prudently fought with and is winning the battle against Covid-19. Vietnamese scientists have developed an indigenous test with 90% accuracy that provides results in 80 minutes. The government imposed a quasi-quarantine, had placed international travel bans in the country and meticulously traced contacts of infected people with a multi-tiered isolation system. The aggressive approach by the government even when number of cases were low was seen as heavy handed (Minh Le, 2020). According to the World Bank "*While many countries were debating their health and economic choices, Vietnam's government made an unequivocal decision to prioritise health over economic growth.*"

Countries	Income category*	Population (in million)#	Cases per million#	Case fatality rate#
Japan	High	126.5	142	5.3 %
South Korea	High	51.3	244	2.3%
Taiwan	High	23.8	19	1.6%
Vietnam	Lower-middle	97.3	4	No deaths

*Source: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

#Source: https://www.worldometers.info/coronavirus/

MANAGEMENT STRATEGY OF INDIA

India got its first Covid-19 positive case when three medical students from Wuhan arrived in Kerala in late January 2020. There was a gradual increase in the number of cases. India implemented its first lockdown on 25th March with a four hour notice when the number of cases was still below 700. The number of cases has grown exponentially since then, especially in

some states like Delhi, Maharashtra and Tamil Nadu (Rukmini S, 2020). These states have found it difficult to manage the sheer number of cases as it has placed a heavy burden on the health system. Four nation-wide lockdowns have been implemented so far with the fifth one initiating gradual unlocking, relieving restrictions and opening the economy back again. India was also one of the first countries to impose heavy travel restrictions (Salcedo and Cherelus, 2020). Despite many efforts, the incidence curve is yet to be flattened (Rukmini S, 2020).

India implemented a scenario based approach using early detection, surveillance and contact tracing for travel related cases. Active surveillance in containment zones to monitor local transmission of Covid-19 was done (Brar, 2020). To create awareness among the public to follow preventive measures risk communication was done by Ministry of Health and Family Welfare. The government of India has launched an app called *Aarogya Setu* to track the geographical location of Covid-19 positive cases although it has been criticised for its lack of privacy protections.

The state specific response has been different in individual states. Each state has the autonomy in deciding the specific course of action to be the best possible strategy, since health is constitutionally a State subject. The state governments work with the Central government through policy coordination and fiscal transfers (Harikrishnan and Chakraborty, 2020).

Many migrant workers faced a crisis when the lockdown was announced abruptly as they had lost their source of income, food, and shelter. This drove many of them to go back to their native villages and since public transport was stopped, many thousands of them decided to walk back. This arduous journey along with starvation, poverty, suicide, exhaustion, rail and road accidents led to many of them losing their lives as result (Pullanoor, 2020). The Central government then decided to organize special "*Shramik* Trains" to transport them back home.

As mentioned earlier, in India, health is a state subject with different states having the autonomy to design the functioning of their health systems, in conjunction with Centrally Sponsored Schemes. Since the 1970s, one Southern Indian state that has stood out and been internationally acclaimed for its health indicators is, Kerala. The 'Kerala Model for Development' is applauded by other countries and often cited as an ideal model for development (Arora and Nanada, 2011). In order to understand Kerala's success story in the management of a pandemic of this amplitude, it is imperative to understand the history of Kerala, which has shaped its health system architecture.

RELEVANCE OF KERALA'S HISTORY IN COVID-19 CONTEXT

The state of Kerala was formed on 1st, November, 1956 and is spread over 38,863 km^2 with 33,387,677 inhabitants as per the 2011 Census. Kerala, is the thirteenth-largest Indian state by population (Ministry of Home Affairs, 2011; MoHFW, 2017). It is divided into 14 districts, with the capital and largest city being Thiruvananthapuram. Kerala has a population growth rate of 4.91%, the highest Human Development Index (HDI 0.712), the highest literacy rate of 93.91% and the highest sex ratio of 1,084 women per 1,000 men (Ministry of Home Affairs, 2011; MoHFW, 2017). From the pre-independence era to now, Kerala has consistently maintained better and equitable health standards owing to its' political commitment, high

female literacy, social and economic reforms like the land reforms, the Narayana Guru movement, several social movements including the Kerala *Shastra Sahitya Parishad* (KSSP), access to better health care, and a good public distribution system (PDS).These movements have been across various religious and social groups, thus reducing inequity. Kerala has significant proportions of various minority religious groups, which not only coexist but also thrive together. It has been hailed for its religious plurality and communal harmony from historic times. (Meyer and Brysac, 2011).

In the late 1970's to the early 1990's, the state of Kerala experienced financial crisis owing to globalization and national economic reforms which restricted their expenditure in the social sector. The government could not cater to the increasing health needs of the population, which also had a negative impact on the quality of health care people received. This, along with unregulated privatization, led to the growth of private healthcare sector causing an exponential increase in out-of-pocket expenditure for health services & sub-optimal quality of healthcare, as a consequence. This growth also paved a way for an increased demand in "sophisticated" care (hotel-like facilities in hospitals) among the general public, which caused a wide gap among people in terms of access to care as well as affordability of good quality healthcare. In 1996, in line with the 73rd and 74th Constitutional Amendment Acts, which institutionalised the local government system in India, Kerala launched a "People's Campaign for Decentralisation Planning" to tackle the wild-fire like increased spread of the private sector. The campaign would also help achieve transparency in programme implementation, democratization of planning processes, and enhance people's participation in the welfare of the community. Thus, the primary health centres (PHCs), the community health centres (CHCs), and the district hospitals, were handed over to *gram panchayats*, block *panchayats* and district *panchayats* respectively, to maintain administrative, managerial and fiscal responsibilities (Elamon et al., 2004; Kutty, 2000; Ramakantan, 2009)

Decentralisation has done much for the improvement of public health infrastructure, accountability, and community participation, especially in places where local self-government institutions and staff of institutions were driven, motivated, and committed to achieve improvement. The state allocated 40 percent of the funds to local self-government institutions (LSGIs), of which the LSGIs allocate 25 percent funds to the service sector i.e. health & education. In 2016, the government sanctioned policies to provide quality healthcare to all citizens at affordable cost (following the Sustainable Development Goals of the United Nations) and the '*Ardram* mission' was conceived with aim of 'people friendly health care'. Under the *Ardram* mission the PHCs in the state would be converted to Family Healthcare Centres (FHCs) (Lamakaan, 2020).

From decentralization to the *Ardram* mission, Kerala, in the process, has shaped and developed its public health care infrastructure and health system in a dynamic evolving manner. The Nipah outbreak, in 2018, that hit Calicut in Kerala, was a learning experience for the state that helped create a robust public health care system, proficient to manage a pandemic like Covid-19. Lessons like awareness on public health tools such as tracing the epidemiological link to an index case, contact tracing, quarantine of suspect cases, trans-disciplinary approach in managing pandemics (not only the department of health, but other departments were involved

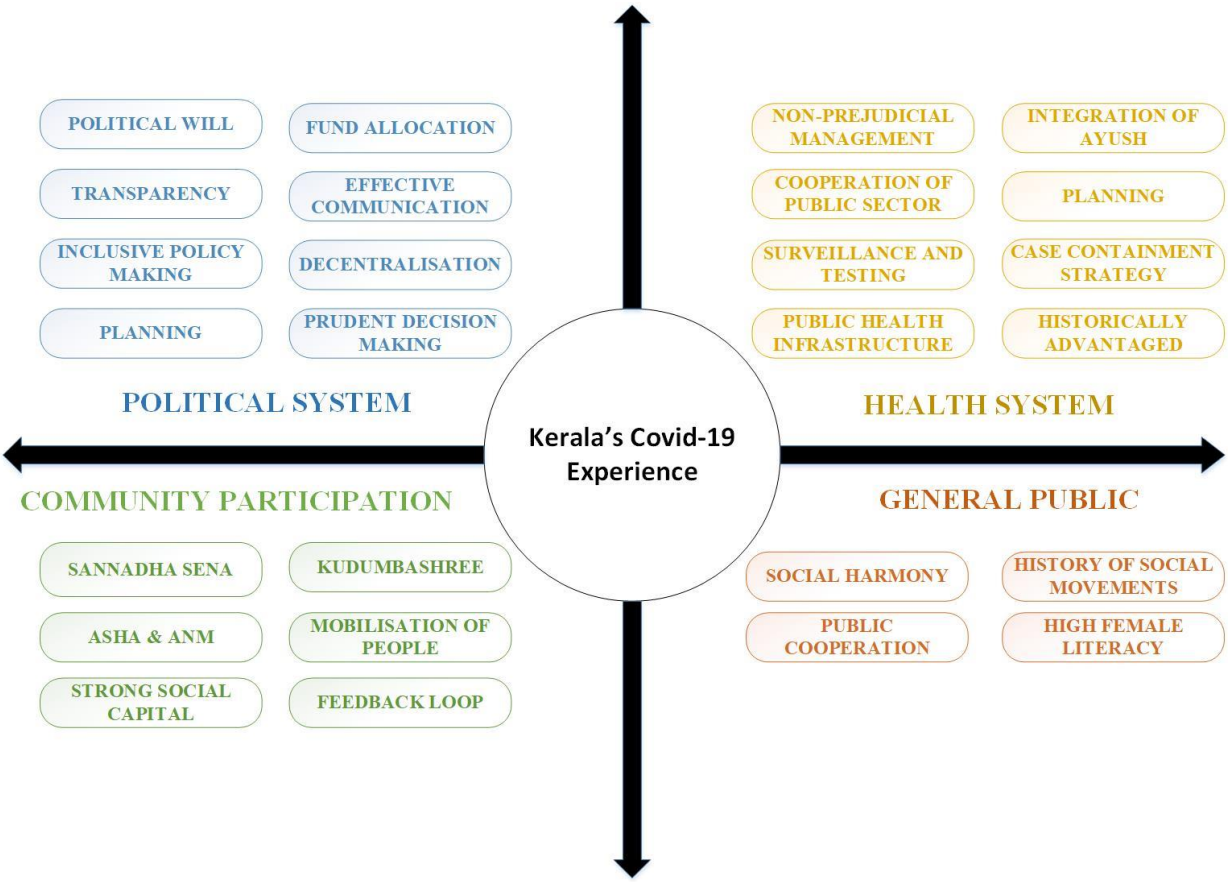
in the management process) came in handy at the time of the Covid-19 crisis. Due to all of these factors, the Kerala government could manage the Covid-19 pandemic better than the rest of the states in the country.

WHY IS KERALA AT RISK?

Kerala has a population density of 859 per sq.km, which makes it the 8th most densely populated state in India (Census-2011). This makes it susceptible to human-to-human transmission of Covid-19. Kerala has a diaspora of 2.4 million in other countries out of which over 3 *lakh* have registered on Norka (Department of Non Resident Keralites Affairs) so far (Mathrubhumi, 2020). Many of the foreign returnees in the state have tested Covid-19 positive. Of all the Covid-19 cases in the state, 84.4% have a travel history. The state also has the highest proportion of elderly people (12.6%) in the country with a significant portion of the population suffering from comorbidities (74.6%) (Economic Review, 2017). This places a huge burden on the state to coordinate and effectively manage the isolation of the suspected cases and treatment of those who turn positive.

PARTICIPATORY AND TRANSDISCIPLINARY ASPECTS OF COVID – 19 MANAGEMENT

Kerala has followed an inter-sectoral approach in its effort against the Covid-19 pandemic. The experience can be broadly divided into four basic categories which are intricately interconnected. The political system comprises of a strong political will, combined with effective communication and decision making, leading to successful implementation of containment strategies. The political system is backed and advised by a well-functioning health system which is characterized by good public health infrastructure, efficient planning and non-prejudicial management of the Covid-19 response. The health system leads the surveillance and testing in the community with the help of a massive community participation and mobilization. All of the work is aided by the general public in the form of public cooperation. Taking the above points into consideration, the following conceptual framework was developed as part of this enquiry.



PUBLIC HEALTH MEASURES

As mentioned, Kerala's experience of having dealt with an infectious disease outbreak like Nipah, equipped it with the knowledge to deal with the novel coronavirus infection; the health system was well aware of the public health measures that needed to be taken during the Covid-19 pandemic. Concepts like tracking the epidemiological link, an index case, a contact case, a suspect case, quarantine, etc. were public health measures of utmost importance in dealing with a pandemic of such magnitude, which Kerala was familiar with. The following are the measures Kerala undertook.

1. Early diagnosis and contact tracing – According to CDC, contact tracing is *part of the process of supporting patients and warning contacts of exposure in order to stop chains of transmission* (CDC, 2020). Everyone coming from another country was asked to report to the nearest public health centre and stay under home quarantine. In-depth interviews were conducted with those that had positive Covid-19 results to find out contact/travel history. In case the patient was not in a condition to respond then the nearest relatives or primary contacts were interviewed. After identification of contacts, they were placed under home quarantine with regular phone calls to offer psychosocial support, to monitor the condition of the contact, assert guidelines and to verify if the contact was following the guidelines of home quarantine. A route map of patients

who tested positive for Covid-19 was created and published through social media and news agencies to find any missed out contacts (Gopika, 2020).

2. Social distancing, quarantine and self-isolation – According to CDC, social distancing also called as *physical distancing meaning to keep space between yourself and other people outside of your home (at least two metres)*. Quarantine is *used to keep someone who might have been exposed to Covid-19 away from others.* Isolation is *used to separate people infected with the virus from people who are not infected.* This can be done at home through self-isolation or in an institutional setting (CDC, 2020).

A campaign on social distancing called "Break the Chain" was initiated by the Kerala government to deliver the message of social distancing. Kerala implemented lockdown on March 23, two days before lockdown was announced for the whole of India. Public gatherings including religious and non-religious gatherings were banned. All schools and colleges except for medical colleges were closed. All festival gatherings were banned. Movie theatres and shopping malls were shut. All shops excluding those selling essential items were shut. All government functions were postponed. All inter-state, inter-district, international travel was stopped (Anilkumar, 2020). Masks were made compulsory for anyone stepping out into the street. Work from home was encouraged.

3. Judicious testing of all eligible persons and use of resources - On an average, around 500 tests were conducted every day. The number of testing kits were in short supply especially after the disease reached wealthier western countries. Hence, judicious use of testing was adopted in symptomatic individuals, suspected individuals, and primary contacts (Spinney, 2020). Also, all pneumonia cases reported in private and government hospitals were tested for Covid-19.

4. Strict border screening - Multiple teams were deployed at multiple border points identified along the Tamil Nadu and Karnataka border from mid-March onwards. Each team comprised of a senior police official, a paramedical staff and a local volunteer. Every vehicle was monitored, details of passengers were collected and their body temperatures were recorded. This was also done at railway stations and airports (Times of India, 2020).

5. Rigorous sentinel surveillance activities – According to WHO, a sentinel surveillance system is used when high quality data are needed about a particular disease that cannot be obtained through a passive system (WHO, 2020). Sentinel surveillance included random testing done in the community. It was done using RT-PCR (Reverse transcriptase polymerase chain reaction) test. Every week 900 samples are tested and until now more than 8000 samples have been tested (GoK Dashboard, 2020.). Testing was done in general population with acute respiratory infection but are not Covid-19 suspects, healthcare workers in non Covid-19 hospitals, people with high social exposure such as food delivery people, community volunteers, police or media, guest workers in the state. The Kerala government directed LSGs (Local Self Government) and police to intensify surveillance to ascertain people's compliance with the lockdown guidelines.

6. High quality care for confirmed cases - A guideline for treatment of Covid-19 patients was created early on. The guidelines had specifications for various categories of patients based on severity and co morbidities. These guidelines are available on the DHS (Directorate of Health Services) website.

7. Promoting respiratory and hand hygiene in the community – 'Break the chain' campaign was launched by the Kerala government on March 15, 2020 to promote hand hygiene in the community and sensitize the public about the importance of public and personal hygiene. As a part of this campaign, all public spaces were asked to keep hand sanitizers, soap and water at the entrances.

8. Proactive care to elderly and vulnerable individuals – *Kudumbashree*, a state-wide women's empowerment program, has initiated proactive measures to take care of the elderly through IEC and community kitchens. The community kitchens catered to anyone with no source of food or those who could not cook (Outlook, 2020). Post lifting of lockdown, measures were taken to ensure that the elderly, children and people with underlying conditions or compromised immunity did not need to come out of their houses. A helpline called the "*Prashanti Help Line*" was launched by the Kerala Police for the welfare of senior citizens during the pandemic (Official Website of Kerala Police, 2020.).

9. Management of guest workers – Workers belonging to other states and working in Kerala are called guest workers. Kerala has a large number of guest workers from various parts of the country. Initially guest workers agitated against the lack of care provided to them. Taking note of this, local police identified all dwellings of the guest labourers. Camps were set up by the Kerala government to accommodate more than 3.5 lakh guest workers. Every camp was provided with a home guard having knowledge of Hindi/Oriya/Bengali to communicate effectively with the labourers. Camp management committees were formed to address the grievances and make arrangements for food and essential items with the help of CSR (Corporate Social Responsibility) LSG (Local Self Government) and philanthropic organizations. These camps included basic facilities like cooking facilities and water supply. As the guest workers disliked the traditional Kerala food provided by *Kudumbashree*, the desired choice of food like chapathi, pickle, North Indian Dal curry and Khichdi was provided along with milk supply daily (Economic Times, 2020). Awareness regarding Covid-19 was provided to them in various languages including Assamese, Oriya, Hindi and Bengali. Some camps were provided with entertainment measures like TV, carrom and chess games. The guest workers were provided with a 24x7 helpline number to address their grievances. Medical screening and health check-ups were conducted with the help of labour department and health department. Tele counselling services were arranged for highly stressed workers by counsellors from TISS (Tata Institute of Social Sciences) ("Official Website of Kerala Police," 2020).

10. Care of Healthcare workers- Caregiving in a pandemic situation entails the risks of transmission of the disease to health care workers. Front-line workers by virtue of their occupation are invariably at a higher risk of contracting COVID-19. Healthcare workers (HCWs) are exposed to a higher quantum of risks. Hence, they are at an elevated risk of contracting COVID-19 as compared to the general population. Occupational exposures that

include aerosol generation from the respiratory tract, e.g., procedures like naso-pharyngeal swab collections, endotracheal intubations or respiratory suctioning that are performed on suspected COVID-19 patients, make the HCWs highly prone to contracting the disease. Also, the high-transmission efficiency of the causative agent SARS Cov2 lead to infections even beyond hospital settings.

Some countries like US, UK, Spain, Brazil, Denmark have documented the disproportionately higher number of infection rates among healthcare workers and have taken necessary remedial steps. India unfortunately does not have national data on the infection rates among healthcare workers. The disproportionate risk in healthcare workers and their protection has been taken into policy consideration in UK and USA, but not yet in India. As on 15th June, 3.2% of the total number of cases in Kerala were among health workers compared to 4.11% in Delhi as on 28th April (IANS, 2020).

Additional protective interventions needed to be taken for the protection of HCWs, which included provision of high quality PPEs- aprons, gowns, gloves, masks, face shields and goggles. The Kerala government prepared ahead to ensure adequate availability of PPE kits for frontline workers. Other than doctors and nurses, Kerala also has ASHA workers, *Kudumbashree* health volunteers, *Anganwadi* workers, hospital development committee members, palliative volunteers and other health activists. They also ensured safe waste disposal and counselling for health workers. Kiosks were setup for healthcare workers following South Korea model to collect nasopharyngeal swabs without using PPE (Babu, 2020). Even though Kerala is equipped with superior mechanisms for healthcare, the government still faced the challenge of limited resources and labs for testing. The Kerala Government Medical Officers Association (KGMOA) initially (in the first week of May) had reported an acute shortage of PPEs including masks and gloves for healthcare personals. Healthcare personnel working in the district and *taluk* hospitals had insufficient PPEs, and N95 masks. However, the chief minister and the health minister managed to handle the situation and provide adequate PPEs. The administration also roped in the small-scale industries in to address this shortage.

11. District specific activities -Decentralization of power & planning is one of the key factors in Kerala's success story of Covid-19 management. Even though, the state had a standard protocol issued for Covid-19 management, it was used as a framework which the district used to build their own containment activities. Each district council had the autonomy to come up with an effective case containment strategy based on the context of their district. This helped in solving a lot of issues that kept arising at the ground level which the state could not foresee. A district control room was set up for each district which co-ordinated the functioning of all management activities. Excellent strategies like conducting a survey to identify and assess the most likely reasons that people would choose to break quarantine were undertaken by some districts. One inevitable reason, why people were breaking quarantine was, because they had to buy essentials. With the help of community volunteers, ASHAs, *Kudumbashree* and active involvement of the *panchayats*, the non-medical needs of people, which essentially involved provisions for home, baby food, even cattle feed were met (The Quint, 2020). Every person who had entered a district was screened and a database was

created so that they could be reached at short notice. Graphical representations of the travel route of positive cases were created and publicised. This led to self-reporting. As people realised from the route maps and the travel times that they had come in contact with someone positive for Covid-19, many walked up to be screened or treated. Even though, measures to maintain confidentiality was taken seriously at each step by the district officials, it was difficult at the ground level, as news always spread by word of mouth in the community.

These measures at district level helped the state overall in implementing the containment strategies to flatten the curve of the infectious Covid-19. Notable work from some of the districts are mentioned below:

Pathanamthitta: The first few cases of Covid-19 in India were recorded in Pathanamthitta and soon it came to be known as a hotspot for the virus. A rapid response team which consisted of community medicine experts and medical doctors from various public health centres was set up. The district administration prepared to bear the influx of Covid-19 patients, with nearly 1,000 beds per taluk, which meant 6,000 beds in the whole district. The General Hospital Pathanamthitta and the district hospital in Kozhencherry were identified as Covid-19 special hospitals, and equipped with Intensive care units, ventilators and C-pap machines. Geo-spatial mapping of cases to identify clusters of the infection was also done. (The Quint, 2020).

Kasaragod: The "Kasaragod Model" of Covid-19 management has been showcased by the Union health ministry as one of the success stories of the fight against the pandemic in the country. Kasaragod reported the third case of COVID-19 in the country — a student airlifted from Wuhan on February 3, 2020. The district administration mounted a massive exercise to trace the 150-odd contacts of that one student. Section 144 was imposed in the entire district, with seven drones employed for surveillance. Under the "Care for Kasaragod" initiative, a detailed action plan —which included tracking quarantined people using GPS, home-delivering essentials to the containment/cluster zones etc. were undertaken. Core teams were formed with incident commanders to rush to various areas and take quick action (The Indian Express, 2020).

Thiruvananthapuram: Round the clock surveillance done in 3 shifts at the international airport. Special awareness sessions were conducted for taxi drivers at the airport. Ambulances were kept ready at the airport to shift passengers with symptoms. The Thiruvananthapuram Corporation has an action plan which consists of converting 10% of the wards in PHCs, CHCs and *Taluk* hospitals with in-patient facilities into isolation wards (The Hindu, 2020). A triple lockdown was also established to contain the spread of the disease especially those with an unknown source.

Alappuzha: House boats are being converted into isolation wards with almost 2000 beds added (Sajimon, 2020).

Ernakulam: Each *Panchayat* is to have an ambulance. A Field Response Home care team was deployed in *panchayats* to take decision on the line of treatment for those who are sick. Online medicine delivery was started (The Hindu, 2020).

Thrissur: Provided "*Aparachitha Choornam*" an *ayuvedic* medicine to migrant labourers that can be used to purify the atmosphere in the rooms. Action was taken to avoid price hike of vegetables and fish during lockdown (Varrier, 2020).

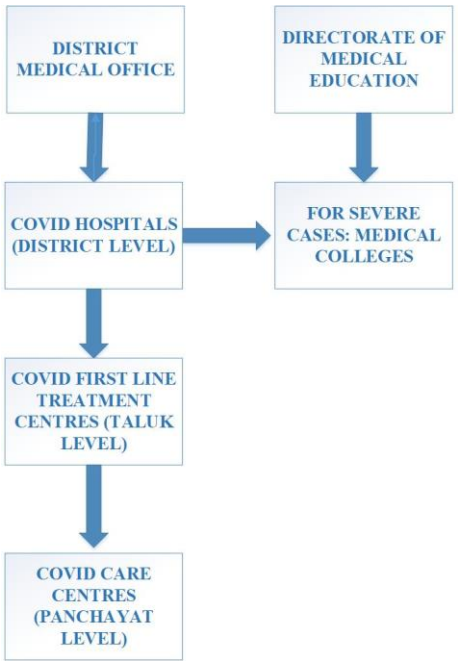
IMPLEMENTATION OF PUBLIC HEALTH MEASURES

Kerala has established a system of communication that works through both top-down and bottom-up channels. This system of communication has helped in building an implementation system that works at the grassroots level. For the state to have managed the pandemic exceedingly well, strategies needed to be evolved keeping the local context and the needs of the people as priority. The flexibility of the strategies is a testament to the fundamental importance given to the mass. Although some states in India have reported instances of discrimination based on religious and other grounds, no such incidents have been reported in Kerala to its credit (Sarkar, 2020).

The state coordinates various strategies through the district control rooms. The district control room in turn communicates with each panchayat who are in touch with the frontline workers and the community at large. The district control unit has a digital system that contains data of all those under home quarantine. The doctors in each district conduct trainings for various other frontline workers.

PUBLIC HEALTH INFRASTRUCTURE

1. Covid-19 Management facilities



a. Covid Hospitals- These are dedicated hospitals that cater to severe or critical Covid patients. There are 28 Covid hospitals in the state, with two for each district. All measures were taken to postpone elective surgeries and reduce General OP. Care was taken at these hospitals to

make sure there was no contact between Covid-19 and non-Covid-19 patients. Infection controls in hospitals were rigorously enforced (Health & Family Welfare Dept., 2020).

b. Covid First Line Treatment Centres - These centres were set up to manage any sudden outbreak of Covid in any local area without affecting the business continuity of the state's healthcare network. All mild and moderate cases are treated in these centres and severe cases are referred to Covid hospitals (Health & Family Welfare Dept., 2020).

c. Covid Care Centres - This was established with the aim of taking care of those who have no residence in Kerala like tourists, those in-transit etc. These centres provide independent single rooms with attached toilets, electricity, water and internet connectivity. Food and drinking water were also provided. They were also provided with adequate security (Health & Family Welfare Dept., 2020).

d. Covid cell - Covid cell are set up in transport, tourism, higher education, general education, LSGs, civil supplies, food safety, power and water sources, women and child development, information technology with health department as the nodal institution. Covid cell is the hub of all the activities in the institution and led by persons with decision making and implementing capacities (Health & Family Welfare Dept., 2020)

2. DISHA Help Line

District Intervention System for Health Awareness or DISHA is a 24/7 helpline number launched in 2013 under the National Health Mission and Government of Kerala. The 16-member team is called in during crisis situations. They had been actively involved in the outreach work of the recent floods in Kerala, the Nipah outbreak, the Ockhi cyclone and so on ("DISHA," 2013). The permanent team at DISHA consists of 15 counsellors and a manager. For the Covid-19 outbreak, 55 more volunteers have been recruited to attend the calls with 12 health workers and 2 doctors available during every shift. With the outbreak of Covid-19, they are engaged in attending distress calls, answering queries and counselling Keralites from around the world (M Athira, 2020)

3. NORKA

Department of Non Resident Keralites Affairs is a division of the Government of Kerala. This department was officially established on December 6th 1996, to address and resolve the issues of non-resident Keralites. Norka Roots is a venture of the same department, which is accountable for the implementation of all governmental schemes (Superb-Attestation, 2018). Norka also renders additional assistance to Keralites during emergency situations. During the Covid-19 outbreak, Norka has been in the process of bringing expatriates back with priority given to pregnant women, people who need medical assistance, elderly and people with an expired visa. Over 3 lakh non-resident Keralites have registered on Norka so far (Mathrubhumi, 2020).

4. Psychosocial Support

Spending time in quarantine can be mentally taxing and isolating. To provide psychosocial support for such individuals a helpline number was launched. To this end, 1143 personnel were recruited and have given psychosocial support calls to 4,11,324 people in quarantine/isolation. In addition to this, psychosocial support calls are given to mentally ill patients, children with special needs, guest labourers, and elderly people living alone. Counselling service is also given to alleviate stress of personnel working in Covid-19 outbreak control activities. A total of 10,55,306 psychosocial support calls have been given to all such categories so far (DHS daily bulletin).

5. Use of Ayurveda during Covid-19

The Kerala government has decided to integrate Ayurveda into the management of Covid-19. It is one of the components that make up the health system quadrant of the conceptual framework mentioned above. To that effect, the Kerala government has set up Ayurveda bodies at the state, regional and district levels for a COVID-19 prevention programme and started *'Ayur Raksha'* clinics at government hospitals at district and taluk levels. "*Ayur Raksha'* clinics provide preventive medicines and other health support (Bureau, 2020). The use of Ayurveda and local health traditions is quite widespread among the public.

FRONT-LINE WORKERS

1. Kudumbashree

Sociologists of all times have highlighted the role of women in bringing social changes and its effectiveness. As mentioned in the conceptual framework, The *Kudumbashree* make up a huge part of the community mobilisation. *Kudumbashree* is the poverty eradication and women empowerment programme implemented by the State Poverty Eradication Mission (SPEM) of the Government of Kerala. It was officially launched in 1997 by the then Prime Minister Atal Bihari Vajpey. It is essentially a community network that covers the entire State of Kerala. It consists of a three-tier structure with Neighbourhood Groups (NHGs) as primary level units, Area Development Societies (ADS) at the ward level, and Community Development Societies (CDS) at the local government level. It is arguably one of the largest women's networks in the world. In 2011, the Ministry of Rural Development (MoRD), Government of India recognised *Kudumbashree* as the State Rural Livelihoods Mission (SRLM) under the National Rural Livelihoods Mission (NRLM). The *Kudumbashree* network by 31st March, 2019, had 291,507 NHGs affiliated to 19,489 ADSs and 1064 CDSs with a total membership of 4,393,579 women. They created protection equipments, cultivated and supplied food materials free of cost, cooked food and served with loyalty, nursed and cared the elders and vulnerable communities, provided professional help in the form of counselling, ensured better distribution of food supplies from the public distribution system and served their duty as a lower level staff in Covid Care Centres. They also assisted the police force through its *nirbhaya* volunteers, provided food to health care workers and officials at check posts, collected information about quarantined persons to ensure strict quarantining. This list of activities performed by the powerful women army of cannot be ignored, when we acclaim the success story of Kerala in

Covid-19 management. *Kudumbashree* Women of Kerala teach a new lesson to other parts of the nation and even to the world during this pandemic which is "*empower your women, then they will act as a protecting shield to you, your family and to your nation*" (DrBiju, 2020).

2. ASHA (Accredited Social Health Activists)

An ASHA worker and a neighbour was put in charge of every home where a person is supposed to be in quarantine. As referred to in the conceptual framework, ASHA workers also make up a part of the community participation. These persons informed the police if anyone defied the quarantine rule. ASHAs and health inspectors carried out household surveys. Additional incentives were provided for the ASHA workers for their help in Covid-19 management activities.

3. Sannadha Sena

It a social volunteering force of volunteers within and outside Kerala. These volunteers have expertise in relief operations and are active during emergency situations. There are 3,46,306 volunteers as on 23rd June. They are provided with training videos and instructions through a registered app ("GoK Dashboard," 2020).

Activities:

- Identification of those who need assistance
- Delivery of food or essential items
- Procurement of locally produced goods
- Emergency assistance at homes
- Call centre operations

4. Police

The Kerala police have played a huge role in ensuring lockdown regulations were being enforced while also attending to the needs of the people. To monitor lockdown enforcement, drones and exclusive women police bullet patrol teams have been deployed. Kerala police initiated active surveillance at airports and railway stations. To restrict the movement of the general public, a geo-fencing app was launched and checkpoints were arranged along with mobile and foot patrolling. Interstate and inter-district borders were sealed. Police were responsible for issuing essential travel pass through an online pass system. To monitor the movement of vehicles during lockdown, a road vigil app was launched ("Official Website of Kerala Police," 2020).

"*Oru Vayar Oottam*" was an initiative started by the Kerala police to provide food packets to the needy and destitute people through their open kitchen. Essential or emergency medicines were delivered to citizens through ERSS (Emergency Response Support System) and highway patrol teams. Essential commodities were supplied to various tribal colonies and SC/ST colonies. *Prashanti* helpline was also launched for the welfare of senior citizens. Blood donation campaigns arranged for those in need.

The Kerala police took initiative to take care of approximately 4 lakh guest labourers who were stranded in the state. Linguistic liaison officers rendered their services to attend to the grievances of guest labourers. Awareness videos in Hindi and Bengali were made for guest labourers. Frequent visits to guest labourers camps were made to ensure their welfare.

They also maintained direct communication with the public regarding the regulations and created awareness through press meetings and social media handles. Covid safety apps were installed in the mobile phones of quarantined persons to detect violations. Cases were registered against individuals for not wearing mask, creating fake news and rumour mongering. To ensure the health needs of the police personnel were taken care of, a telemedicine app was launched.

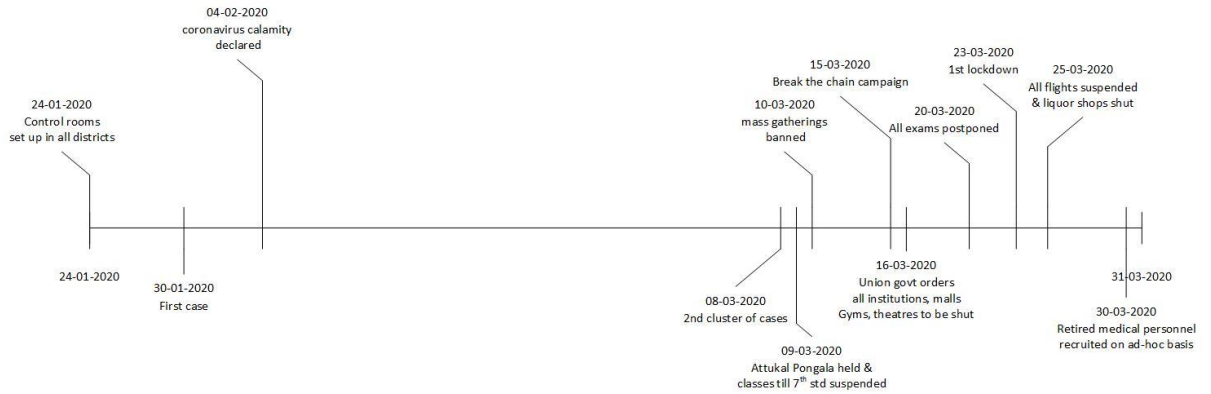
5. Role of Media

The media has played a vital role in sharing relevant information regarding Covid-19, increasing awareness and busting false myths and messages. The Kerala government released 88 videos on YouTube to train health workers and to promote awareness in the public about hand washing techniques, social distancing norms, home quarantine etc. The Kerala police created and released over 400 awareness videos to propagate the message to stay home via "Break the chain" campaign. Videos in Hindi and Bengali were also made for guest labourers. The news media was instrumental in giving pertinent instructions to the public while also releasing route maps of Covid-19 cases. They have also released WhatsApp chat bots to counteract the spread of false information.

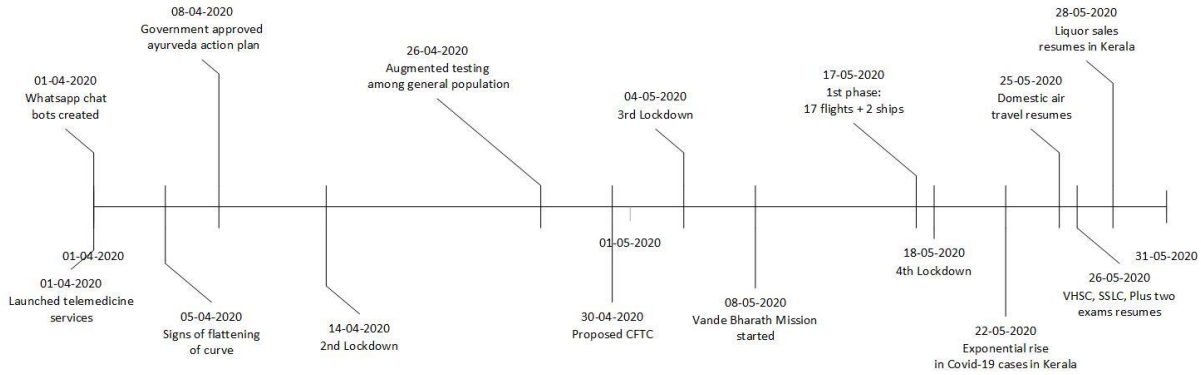
EPIDEMIOLOGY OF COVID IN KERALA

1. Timeline of key events

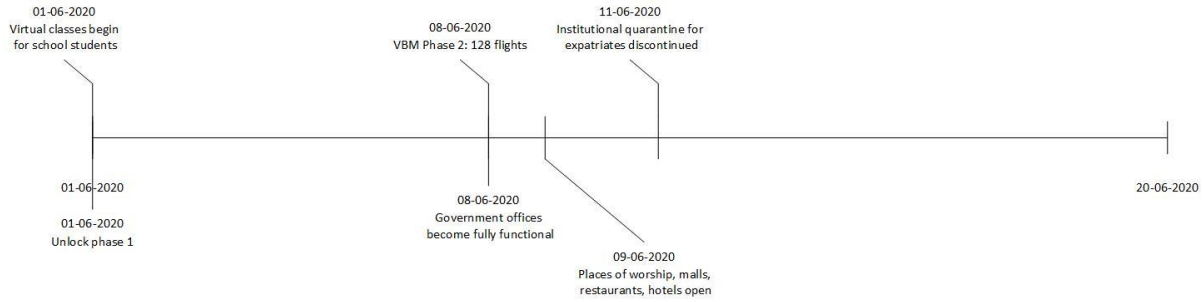
A. January – February - March



B. April – May



C. June



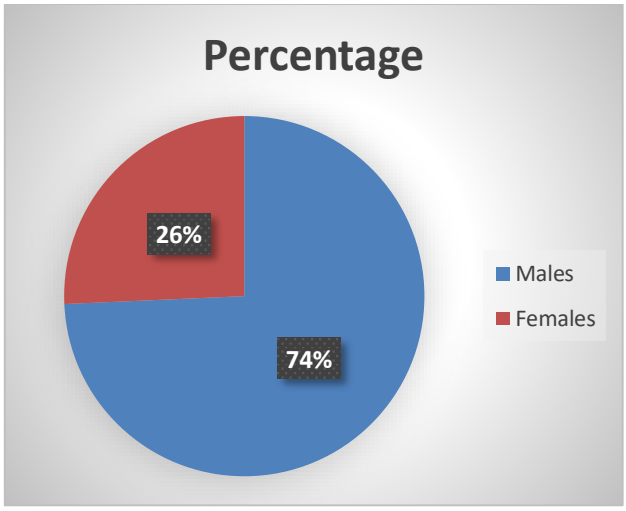
Source: DHS daily Bulletin, https://english.manoramaonline.com/news/kerala/2020/05/06/covid-19-timeline-kerala-india-coronavirus-chronology-important-dates.html

2. Descriptive Statistics (data as on 15th June, 2020)

a. Age of the patient – in years: (N = 2275)

Mean	37.78
Median	36.00
Mode	30
Standard Deviation	15.4
Range	0- 93

b. Gender proportion: (N=2453)

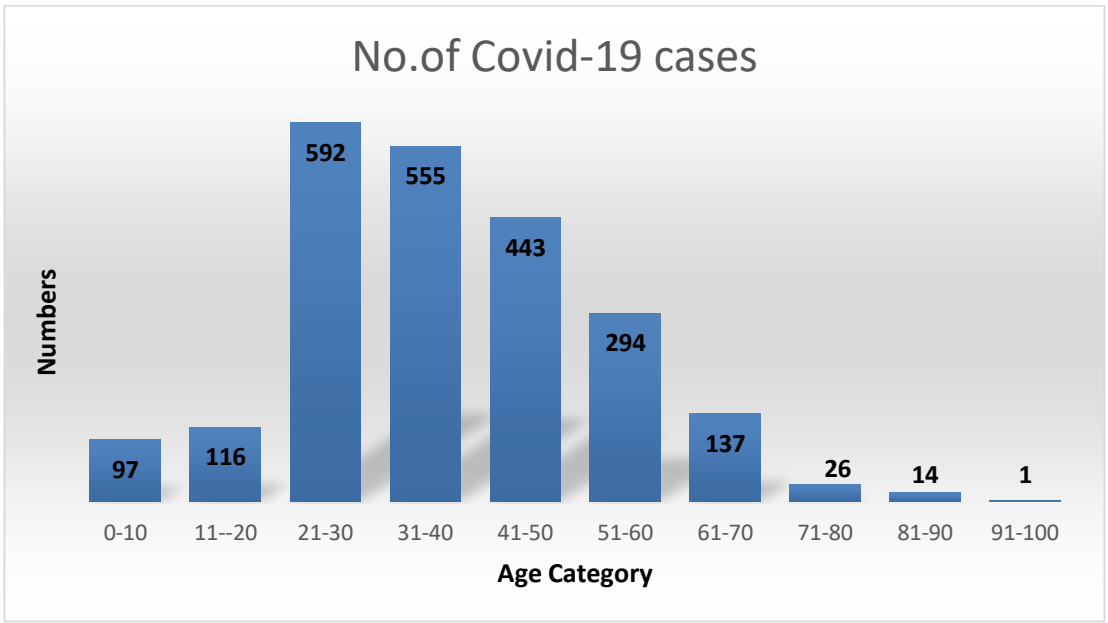


c. Total Case fatality rate: 0.78% (Deaths=20)

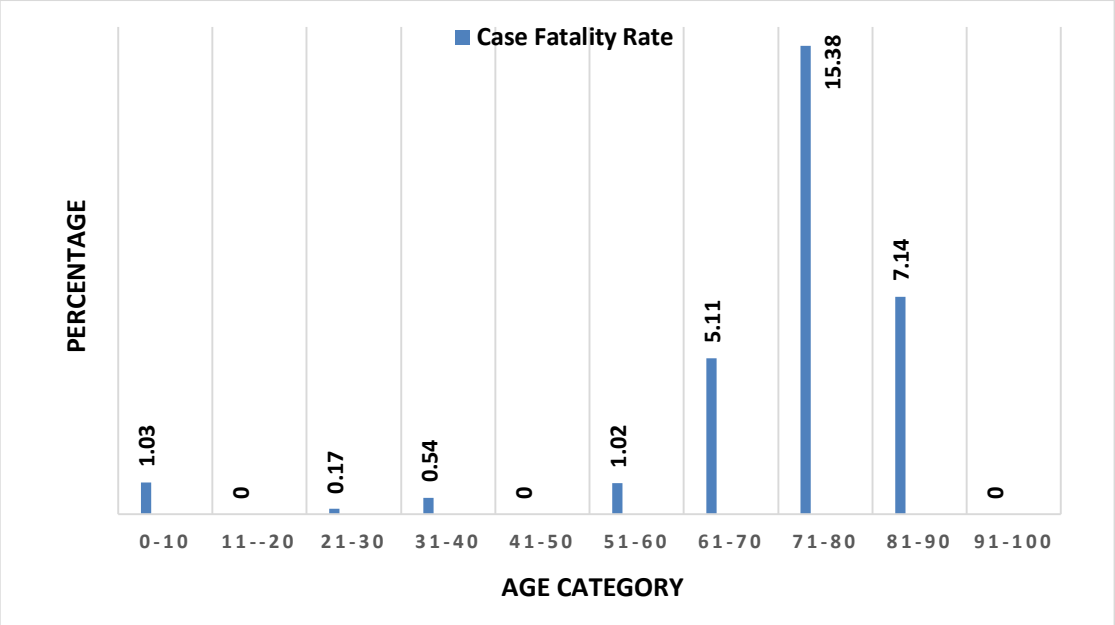
d. Gender wise Case fatality rate:

Gender	Frequency	Deaths	Case Fatality Rate (%)
Female	640	7	1.09
Male	1813	13	0.71

e. Age-specific number of confirmed cases



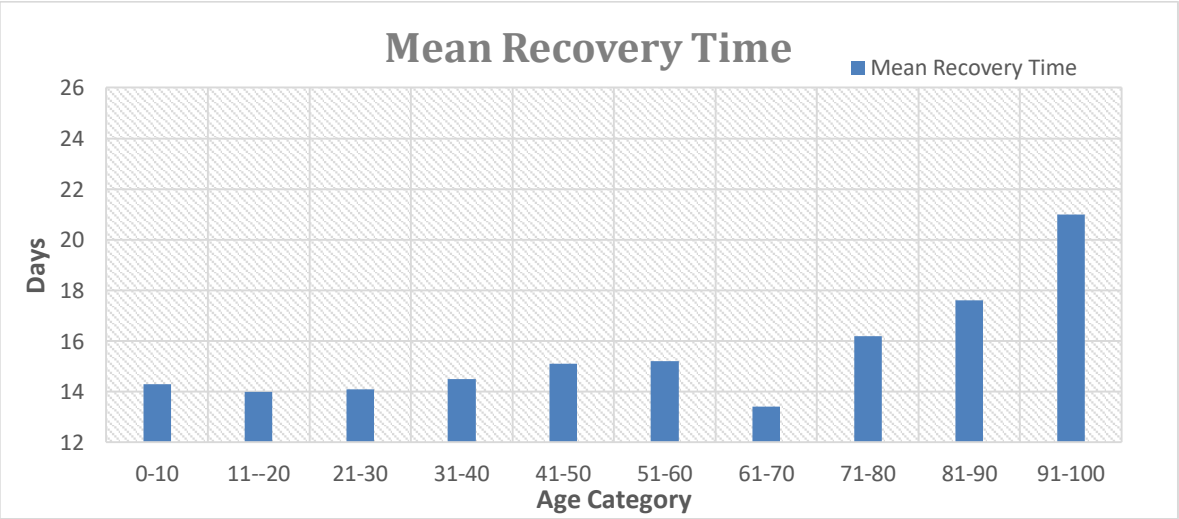
f. Age specific case fatality rate



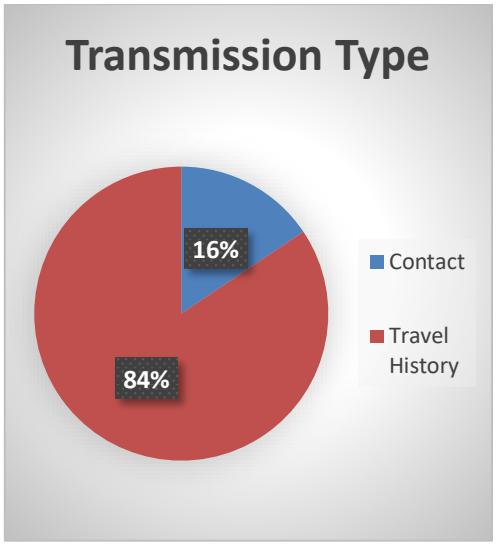
g. Gender wise Mean Recovery time (in days):

Gender	Frequency	Mean	SD
Female	147	15.4	7.2
Male	425	14.6	7.2

h. Age-wise mean recovery time



i. Transmission type



j. Gender wise transmission Type:

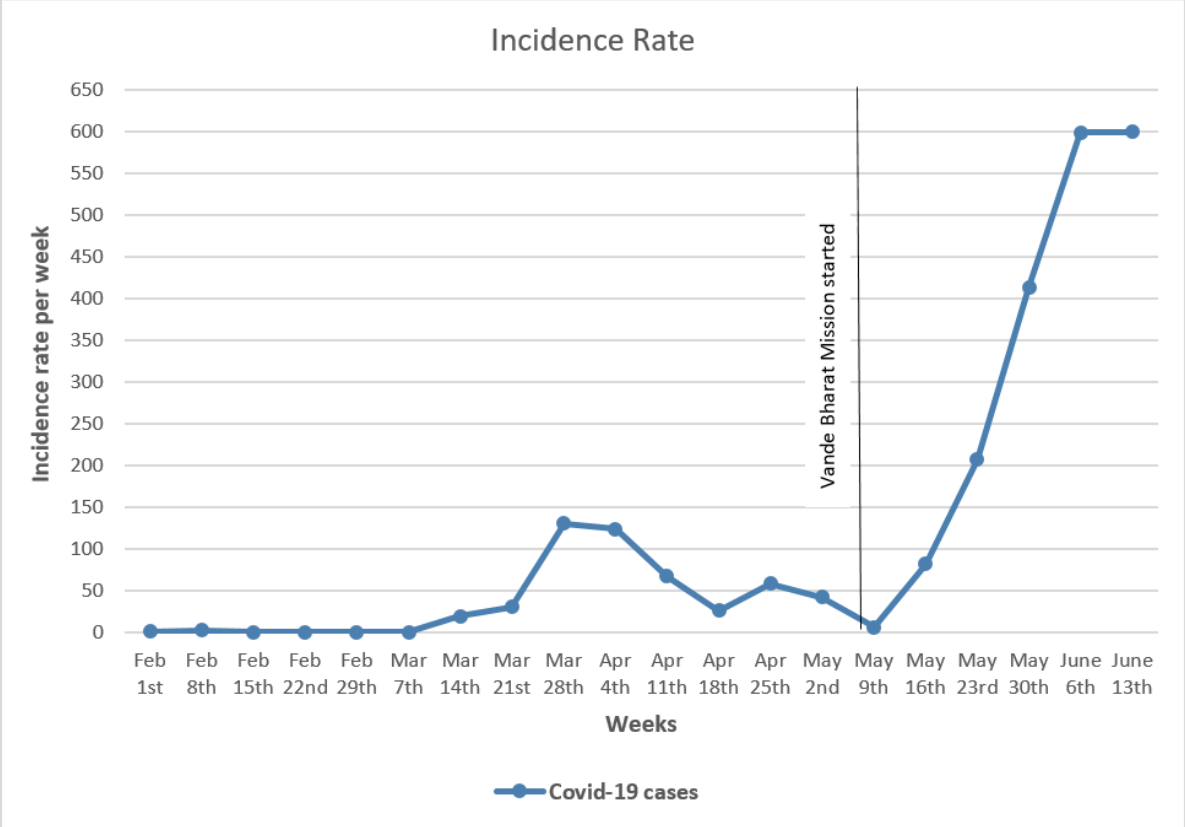
Gender	Contact	Travel
Female (%)	176 (27.5)	464(72.5)
Male (%)	210 (11.6)	1602 (88.4)

k. Health workers and Covid-19:

Number of health workers tested positive in the state: 70

Out of all the contact transmissions, **18.04%** are health workers

l. Incidence rate curve



Source for descriptive statistics: ("GoK Dashboard," 2020)**,** https://docs.google.com/spreadsheets/d/e/2PACX-1vQU9eLCMT0XwWnoxV_LkyCkxMcPYO7z7ULdODoUFgcdzp48pgGpGrVZFXvraXYvUioVRsQgQDU_pQyI/pubhtml#

m. Countries with similar population

Country	Income Category*	Population-2020 (in crores)#	Prevalence of Covid-19#	Cases per Million#	Case Fatality Rate#
Afghanistan	Low	3.89	0.036 %	637	1.9%
Poland	High	3.78	0.078%	777	4.2%
Canada	High	3.77	0.262%	2,618	8.2%
Morocco	Lower-Middle	3.69	0.024%	238	2.4%
Saudi Arabia	High	3.48	0.366%	3666	0.7%
Kerala~	**Lower-Middle**	**3.47**	**0.007%**	**70**	**0.7%**
Uzbekistan	Lower-Middle	3.34	0.015%	152	0.3%
Peru	Upper-Middle	3.30	0.697%	6972	2.9%
Malaysia	Upper Middle	3.24	0.026%	261	1.4%
Ghana	Lower-Middle	3.11	0.039%	385	0.4%
Australia	High	2.54	0.029%	288	1.3%
Srilanka	Upper-Middle	2.14	0.009%	88	0.5%
India	Lower-Middle	138	0.025%	264	2.9%
World	--	780	0.104%	1040	5.4%

*Source: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

#Source: https://www.worldometers.info/coronavirus/

~source: ("GoK Dashboard," 2020)

NON COVID PATIENTS- OTHER COMMUNICABLE DISEASE BURDEN

Rise in other communicable diseases – Dengue, Chikungunya and Leptospirosis cases are on the rise. Chikungunya cases could be spiking now because the threshold of herd immunity is beginning to wane. A change in the predominant type of dengue virus circulation was seen in the community this year. As of 15th June, the number of infectious diseases this year are as follows ("DHS daily reporting," 2020):

- 1418 cases of Dengue, 3 deaths
- 233 cases of Chikungunya
- 291 Leptospirosis cases, 7 deaths
- 61 H1N1 cases, 2 deaths
- 75 Malaria case
- 236 cases of Scrub-typhus, 3 deaths
- 12,623 cases of Chickenpox, 2 deaths
- 1782 cases of mumps
- 48 cases of measles, 1 death

CURRENT CHALLENGES in COVID-19 MANAGEMENT

The Kerala government has mandated that from June 20th, all gulf returnees must obtain a Covid -19 negative certificate within 48 hours of boarding the chartered flight. This has led many expatriates to be put under a tedious and costly process that they voice to be unethical and discriminatory. Many expatriates face discrimination on returning back to their home state, as they are avoided by their neighbours and sometimes even reported to the police for stepping out of their homes. The same discrimination is faced by many healthcare workers throughout the state. There has also been a rise in the patients who have been diagnosed with Covid-19 of an unknown source. This has made it difficult for the Kerala government to trace and quarantine the possible sources of contact. Community spread thus seems to be one of the greatest challenges that Kerala is facing currently.

CONCLUSION

Kerala has time and again faced multiple public health challenges, and has competently dealt with all of them. The Covid-19 pandemic is no different. Kerala has been able to bank on its historical experience, political will, large social capital, community participation and communal harmony to combat this global pandemic of unprecedented proportions.

Kerala was the first state in India to have a Covid-19 positive case. The state had formed a response team even before this occurred and was prepared. This preparedness has helped Kerala in flattening the curve. Even though the number of cases have spiked recently with the influx of expatriates, Kerala has effectively managed to trace, quarantine, test, isolate, and treat as was necessary. The Alma-Ata declaration of 1978 emphasized community participation as being a key component to achieve "Health for All"; the management strategies of Kerala reiterates this fact. Although the health system faced a huge burden in sheer numbers of the cases to be managed, the frontline workers which included *Kudumbashree, Sannadha Sena*, the media, Kerala police, all of them formed a connective mesh, which is inclusive of all individuals in a community. This inter-sectoral collaboration is definitely one of the fundamental components that other states should adopt onto to their management strategies.

The success of the Kerala experience so far has been context specific. The investment into public healthcare, education and a mobilized social capital had begun a long time ago. Although all of the measures taken may not be replicable in other parts of the world, the lessons gained from the Kerala experience show the importance of transparency, prudent judgement and local autonomy in effective governance and placing long term goals over short term interests.

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