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Combating Covid19 pandemic with effective surveillance: experience from Tamilnadu**Balaji Ramraj^{1*}, Aarth Marimuthu¹, Aamina Hussain¹, KR Sowmiya²**

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ABSTRACT

Covid-19 being a new disease, limited information was available on modes of transmission, incubation period, spectrum of clinical illness and period of communicability. Hence, surveillance plays a major role in monitoring disease trends, rapidly detecting new cases, providing epidemiological information and to conduct risk assessments at various levels to guide preparedness and response. This study was done to analyse the surveillance measures taken by Tamilnadu state government to detect disease trend for initiating the control measures in order to handle the pandemic situation. Tamilnadu intensified its surveillance measures after reporting of its first case on March 7, 2020 and declared COVID-19 a notifiable disease under integrated disease surveillance programme (IDSP). The state government employed various surveillance methods in order to monitor the spread and intensity of COVID-19 disease. The surveillance data was analysed in terms of time, person and place to estimate the magnitude of the problem, also in-depth analyses on age, sex-gender, comorbidities, were also analysed to measure the disease trend and to assess the effectiveness of the control measures initiated. Though Tamilnadu has an established public health cadre, Covid-19 surveillance is challenging because mild and subclinical cases were not seeking health services. For flattening the epicurve, the focus of the surveillance system should be to find every case and isolate. Strengthening the existing surveillance system, addressing vulnerable population, expanding the source of reporting and increasing the testing capabilities are essential to enhance surveillance.

Key word: Covid-19, Pandemic, Surveillance, Tamilnadu

Introduction

COVID-19 caused by SARS-coV-2, a novel corona virus was first identified in the Wuhan city province, China on December 2019. World health organization declared COVID -19 as pandemic on March 11, 2020 as it crossed the international borders.^{1,2} Covid-19 being a new disease limited information was available on modes of transmission, incubation period, spectrum of clinical illness and period of communicability. Hence, surveillance plays a major role in monitoring disease trends, rapidly detecting new cases, providing epidemiological information and to conduct risk assessments at various levels to guide preparedness and response.³ Surveillance is essential for timely decision making to prevent the spread and to promote rapid recovery during any public health emergency. Tamilnadu intensified its surveillance measures after reporting of its first case on March 7, 2020 and declared COVID-19 a notifiable disease under integrated disease surveillance

programme (IDSP). Surveillance provides the basis for identifying the people who needs treatment, contact tracing, quarantine and to take preventive measures in this rapidly evolving situation.⁴ The data collected should be integrated, analysed, interpreted and finally disseminated to the health practitioners, health agencies and the public. This study was done to analyse the surveillance measures taken by Tamilnadu state government to handle the pandemic situation and to detect disease trends for initiating the control measures. Authors verified for the authenticity of the data from various sources such as government's health website notifications, official daily bulletins and press releases.

Public health surveillance

In order to enable a coordinated approach, standardized case definitions and diagnostic criteria are essential. Tamilnadu state government released a set of case definitions of COVID-19 and standard operating procedures in a timely manner to be applied at different

levels for the purpose of public health surveillance. (Table.1) These recommendations aided in contact tracing, laboratory testing, case-reporting, data aggregation, and specimen collection.

Table.1. Definitions adopted by the state government for surveillance^{5,6,7}

Suspect Case	- A patient with acute respiratory illness [fever and at least one sign/symptom of respiratory disease (e.g., cough, shortness of breath)], and a history of travel to or residence in a country/area or territory reporting local transmission of COVID-19 disease during the 14 days prior to symptom onset - A patient/Health care worker with any acute respiratory illness and having been in contact with a confirmed COVID-19 case in the last 14 days prior to onset of symptoms; - A patient with severe acute respiratory infection [fever and at least one sign/symptom of respiratory disease (e.g., cough, shortness of breath)] and requiring hospitalization and with no other aetiology that fully explains the clinical presentation; - A case for whom testing for COVID-19 is inconclusive.
Laboratory Confirmed case	A person with laboratory confirmation of COVID-19 infection, irrespective of clinical signs and symptoms.
Contact	A contact is a person that is involved in any of the following: - Providing direct care without proper personal protective equipment (PPE) for COVID-19 patients - Staying in the same close environment of a COVID-19 patient (including workplace, classroom, household, gatherings). - Traveling together in close proximity (1 m) with a symptomatic person who later tested positive for COVID-19.
High Risk Contact	- Touched body fluids of the patient (Respiratory tract secretions, blood, vomit, saliva, urine, faeces) - Had direct physical contact with the body of the patient including physical examination without PPE. - Touched or cleaned the linens, clothes, or dishes of the patient. - Lives in the same household as the patient. - Anyone in close proximity (within 3 ft) of the confirmed case without precautions. - Passenger in close proximity (within 3 ft) of a conveyance with a symptomatic person who later tested positive for COVID-19 for more than 6 hours.
Low Risk Contact	- Shared the same space (Same class for school/worked in same room/similar and not having a high-risk exposure to confirmed or suspect case of COVID-19). - Travelled in same environment (bus/train/flight/any mode of transit) but not

	having a high-risk exposure.
Quarantine	Separation and restriction of movement of people who were exposed to Covid-19 and to see if they develop symptoms.
Isolation	Separation of patient with Covid-19 from people who are not sick.
Influenza like illness (ILI)	one with acute respiratory infection with fever $\geq 38^{\circ}\text{C}$ AND cough.
Severe acute respiratory infection (SARI)	one with acute respiratory infection with fever $\geq 38^{\circ}\text{C}$ AND cough AND requiring hospitalization.

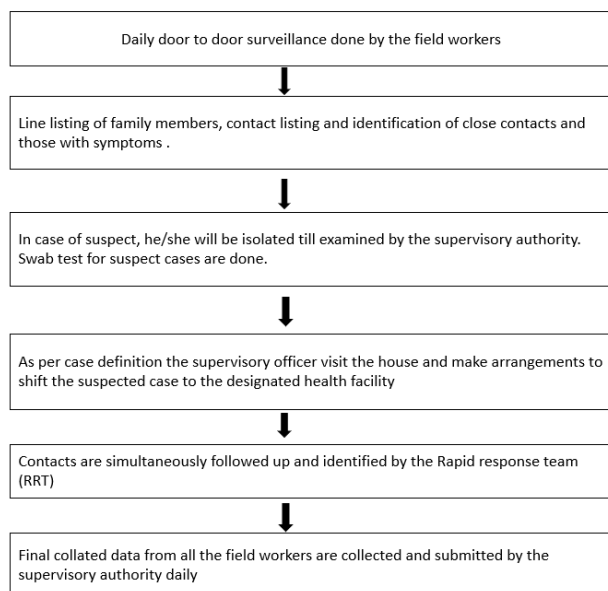
The period of surveillance to prevent further transmission such as isolation of the cases and quarantine of the contacts was determined based on the incubation period of the disease ranging from 2 to 14 days. Initially, thermal screening of passengers from all international flights was done to identify the imported cases. Laboratory testing was done for suspected cases and they were kept under hospital isolation whereas others were monitored under home quarantine. People were advised to avoid nonessential travel to COVID-19 affected countries. Later when cases surged, the borders were closed for all modes of transport to avoid both entry and exit. At the end of march, the cluster containment strategy was followed once local transmission was proved. The initial surge in the cases happened during early April following a religious congregation in Delhi and next cluster of cases were from local Koyembedu market which contributed to the 35% of cases in the state. District level disaster management 24*7 control room was also activated with contact numbers. The state established dedicated Covid hospitals (DCH) in tertiary care centres, dedicated Covid health centres (DCHC) in selected hospitals and nursing homes and dedicated Covid care centre (DCCC) in colleges and hotels. Dedicated Covid care centre (DCCC) will keep only asymptomatic or Covid suspects but not confirmed cases. Dedicated Covid hospitals (DCH) and Dedicated Covid health centres (DCHC) will have separate ear marked areas for suspect and confirmed cases and not to be mixed under any circumstances. Any suspect case with co-morbidity was admitted only at dedicated covid hospital with intensive care unit (ICU) facility. All three facilities will be linked to the surveillance team at the state and district emergency operations centre (EOC).⁸

Active surveillance

Active surveillance was done by daily house to house visit by village health nurse or Anganwadi workers to search clinically suspect cases with influenza like illness (ILI), to identify the contacts of the confirmed cases and to monitor them. They helped counselling the household members to take basic precautions to avoid direct contact with the suspect case and use of mask. Each health worker was given 50 households (30 household in

difficult areas) and collected data was collated and the cumulative data reported to the 24 hours fully functional control room for Covid-19 surveillance. The swabs taken daily were recorded by the lab technician in a RT-PCR mobile app. Every confirmed case was considered as the Epicentre. An area of 3 km radius around the epicentre will be the containment zone. An additional area of 5 Km radius (7 Km in rural areas) was considered the buffer zone. (Figure.2)

Figure.2 Flow chart describing the steps in Active Surveillance



Passive surveillance

In addition to the active surveillance, all the health care facilities both government and private listed in the containment and the buffer zone were informed to passively report the suspected case details.⁹ Every hospital shall collect samples for Covid-19 as per the guidelines and send them to designated laboratory via district nodal officer. Every hospital was advised to inform all cases of Covid-19 with influenza like illness (ILI) or severe acute respiratory infection (SARI) to city health officer in case of Chennai district and to deputy directors of health services in other districts.¹⁰

Participatory surveillance

Arogya Setu application, an innovative approach of participatory surveillance was encouraged to be used by the public for self-reporting their symptoms.¹¹ This app provides information about the location of laboratory confirmed cases using Bluetooth and mobile location data and also provides information about the necessary measures to be taken according to the risk status.

Suspect cases detected on surveillance were isolated in a room in their house temporarily until examined by the concerned medical officer or shifted by the ambulance to the designated health facility. Home isolation was suggested for pre-symptomatic or mild cases and moderate to severe symptomatic cases were treated in the healthcare facilities according to the treatment guidelines.

Separate line list was prepared for Indian nationals and foreign nationals.¹²

Contact tracing

Quarantine and Isolation are important for breaking the chain of transmission in Covid-19. Contact tracing was done to identify, monitor and support those who have been exposed to the infection by obtaining information from the patient about his/her family members, persons at patient's workplace or school associates, or others with knowledge about the patient's recent activities and travel.^{13,14} All households and close contacts of a confirmed and suspect cases were home quarantined. The contacts were line listed and a symptom diary was provided to each close contact to record the presence or absence of various symptoms or signs for a minimum of 28 days from last day of exposure.¹⁵ Direct and high-risk contacts of a confirmed case were tested once between day 5 and day 14 from exposure even if asymptomatic. Those being home quarantined were followed up till the test results of suspect case comes negative. Stickers were pasted in their houses alerting others and to ensure social distancing. Around 22.57 crores were sanctioned by the government for establishing quarantine centres for those where home quarantine not possible.¹⁶

Testing capacity

King institute of preventive medicine and research, Chennai and Theni medical college were involved in testing initially. In mid-April it was expanded to 27 laboratories to handle the rise in cases and currently about 71 laboratories [43 government and 28 private] in Tamilnadu were involved in Covid-19 RT-PCR sampling. The government stated in the press release on 6th may that 12000 samples were tested per day approximately and the results were made available in 12 hours.

Sero-surveillance

Sero-surveillance have also been planned to monitor the trend in prevalence of SARS-COV2 infection at district level by Indian council of medical research (ICMR) along with surveillance staff from state health departments and WHO. This might help in determining the percentage of asymptomatic as well as susceptible individuals.¹⁷

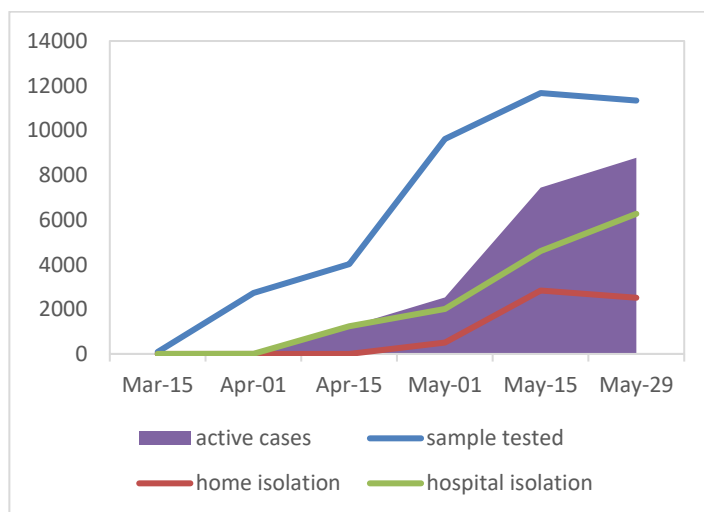
Other methods to support the surveillance activities

Community disinfection was carried out in the containment zones by the local authorities.¹⁸ Strict local curfew was followed in line up with the central government. Various risk communication strategies were followed to make people aware of the crisis situation and to adopt protective behaviours like hand hygiene, cough etiquette and physical distancing to protect themselves.

Stakeholders were engaged to support public health surveillance and investigation. Infection prevention and control was monitored as per the guideline of ministry of health and family welfare.

The surveillance data was analyzed in terms of time, person and place to estimate the magnitude of the problem, also in-depth analyses on age, sex-gender, comorbidities, were also analysed to measure the disease trend and to assess the effectiveness of the control measures initiated. Aggregate data was made available publicly via release of bulletins by the authorities in website and media.(figure.1) The areas were classified as red, orange and green zones and accordingly control measures were intensified in the affected zone (red zone) and restriction was relaxed in areas where no new cases have been reported(green zone). The nodal officer of Chennai engaged a team of volunteers with total of 166 supervisors, 100 programme managers and 100 data managers leading each team to pay real attention to slum pockets. The teams have been tasked with monitoring households, collecting data and counselling people and ensuring availability of masks and distributing herbal drinks and multivitamin tablets.¹⁹

Figure.1 Tracking Covid-19 in Tamilnadu: total number of active cases, samples tested and patients isolated.



Discussion

The state government employed various surveillance methods in order to monitor the spread and intensity of COVID-19 disease. They provided aggregate data on daily basis on the total number of suspect cases, total number of confirmed cases, total number of deaths, total number of contacts under surveillance and number of discharges.²⁰ Although they provide data on age, sex-gender and comorbidities, in-depth analysis on testing patterns, risk factors, symptomatology and severity should also be analyzed on a periodic basis. Mapping of hot spots were done to concentrate focused intervention. The major focus apart from contact tracing, was on door to door surveillance for symptomatic individuals by the local authorities and communicating with the households,

enquiring about the pre-existing diseases and sensitizing them on preventive measures related to the coronavirus. Whereas additional measures targeting asymptomatic patients and focusing on vulnerable groups and those with co-morbidities, would have resulted in further case reductions.²¹ Behavioral surveillance is also essential to track the knowledge, attitude and practice of the people at risk as the control of Covid-19 relies on hand hygiene, cough etiquette and physical distancing.

Surveillance is difficult when the disease present in with high proportion of asymptomatic, mild or subclinical cases. This could be addressed via syndromic surveillance and home isolation of cases, wherever possible. Northern Italy indicated the importance of sentinel surveillance to check for community transmission.²² To include a wider group in the surveillance, pooling method was adopted in Kerala by pooling blood samples of high risk groups such as travelers on plane, ships and road, health workers in non-Covid Centre, volunteers and police men.²³ Kerala was the first state in the country which began a pilot project of rapid tests. The test was used to detect the prevalence and positive cases were reconfirmed with swab samples. This helped in isolating possible carriers quickly.²⁴ States like Gujarat, Telangana, Andhra Pradesh, Srinagar, and Punjab have launched GIS-based mobile application for disease surveillance and monitoring by integrating data such as the area of outbreak, available infrastructure to identify the population at risk and even to ensure home delivery of groceries and for monitoring movement of those home-quarantined.²⁵ The Kerala State Disaster Management Authority had begun collating disease surveillance data separately, with primary and secondary contacts of confirmed patients, traced and identified on a live geo-map, This allowed officials to identify high-risk zones to activate containment measures. Further, the state was also adding layers such as the availability of laboratory facilities and isolation wards in these areas. Coordination between the inter district and inter state officials and evaluation of surveillance systems are essential to improve the performance.

Like other states, Tamilnadu government also deployed technology for tracking the movements of home quarantine people through a GPS based mobile app called Covid19 quarantine monitor.²⁶ It worked as a geo fence and alerted the authorities If the quarantined person goes out beyond a certain perimeter. Other digital technology like Arogya Setu was also utilised for contact tracing in community. The use of surveillance technologies, although necessary during the ongoing pandemic, it also raises privacy and security concerns.

The state expanded testing capabilities as the number of new novel coronavirus cases continued to increase. Experts have suggested increasing the testing rates further in order to contain the situation.²⁷ Although testing more

samples might be the reason for case surge, it's also possible that the surveillance systems might have missed a cluster of infections in the earlier phase of the outbreak. For flattening the epicurve, the focus of the surveillance system should be to find every case and isolate.

Along with the existing health resources community leaders, local non-governmental organization (NGO), religious leaders at the community level and private institutions might be involved for surveillance activities, to lessen the burden and to address the manpower shortage. Proper communication addressing the fear and stigma and timely action on the rumours and misinformation must be done. Various challenges faced during surveillance was listed out in box.1.

Box 1. Various challenges faced during COVID-19 surveillance

Poor cooperation from the public

Disease stigma

Underreporting of cases

Avoid seeking help fearing quarantine

Manpower shortage for surveillance activities

Collection and testing of large number of samples

Testing cost in private labs

Training health professional for surveillance and treatment

Not all can handle digital technology and has risk of security and privacy issues.

Arranging Quarantine and isolation facilities when home quarantine and isolation not possible

Lack of motivation among health workers and fear of getting infected

Conclusion

Though Tamilnadu has an established public health cadre, Covid-19 surveillance is challenging because mild and subclinical cases were not seeking health services. As asymptomatic cases also transmit infection in COVID-19, a robust surveillance system is essential in addressing and estimating under-reporting and under-ascertained cases in order to initiate public health measures. Strengthening the existing surveillance system, addressing vulnerable population, expanding the source of reporting and increasing the testing capabilities are essential to enhance surveillance. Better quarantine measures combined with identification and isolation of all cases can only aid us in controlling the disease along with evaluation of surveillance system for improving the existing approaches.

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