

## RESPONSE TO COVID-19 PANDEMIC OF A DISTRICT LOCATED IN WESTERN INDIA

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### ABSTRACT

**Background:** Amid uncertainty over the completion of the natural history of Covid-19 and the pandemic, it becomes imperative to review and adjust public health and social measures during the pandemic. An Intra-Action Review (IAR) was employed to allow district level stakeholders to reflect up on the on going outbreak response and to identify the current best practices, the achievements, and the challenges faced.

**Aim and objectives:** This study aims to reflect on the ongoing COVID-19 outbreak response at the district level to identify current best practices, gaps and lessons learnt. Also, to propose corrective measures and actions to improve and strengthen continued COVID-19 response.

**Material and Methods:** Four In-depth Interviews (IDI) were carried out with key stakeholders using a qualitative approach. Important areas were identified in form of pillars to trigger vital information.

**Results:** Gujarat has laid primary focus on hospital preparedness, capacity building, and ramped up surveillance efforts including door-to-door surveillance across the state. With the tagline 'Test is Best' the district Corporation established 11 Covid-19 testing booths for free antigen testing and 130 vehicles were giving round the clock services. More than 1800 coordinators assisted the corporation in serving the community. A "Psychological Intervention Center" provided psychological support to the people in need.

**Conclusion:** The lessons learned from challenges would help in improving the pandemic response if there were subsequent waves/surge of cases and best practices would provide some actionable insights to the district studied and other districts to help improve pandemic resilience towards safe and healthy living.

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## INTRODUCTION

The coronavirus pandemic is unprecedented. The first case of novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was reported from Hubei province of Wuhan, China in December, 2019.<sup>1</sup> Thereafter, it spread to most of the countries of the world and on March 11, 2020, the World Health Organization (WHO) declared the novel coronavirus SARS-CoV-2 outbreak a global pandemic.<sup>2</sup> As of 21<sup>st</sup> November, 57.9 Million cases and 1.37 million deaths have been reported worldwide.<sup>3</sup>

Countries have developed various strategies to deal with the COVID-19 pandemic like announcement of lockdown, mandating their citizens for wearing of face masks, checking all incoming airline passengers, quarantine of contacts, aggressive and early testing, closure of schools & colleges, tracing of contacts, etc.<sup>1</sup>

The WHO lauded "India's tough and timely actions" in form of six weeks lockdown in the beginning, against the corona spread by Prime Minister Narendra Modi, to ensure that the virus does not spread to new areas and to help flatten the

epidemic curve and to buy time to prepare for adequate medical facilities. The outbreak has been declared an epidemic in more than a dozen states and union territories, where provisions of the Epidemic Diseases Act, 1897 has been invoked, leading to the temporary closure of educational and commercial establishments. All tourist visas were suspended in March, as many of the earliest confirmed cases were individuals who had traveled from foreign countries.<sup>4</sup>

Gujarat was one of the first few states to have initial cases that were imported from European countries, where the disease had spread to some key cities including cities of Gujarat. Despite the national lockdown, in April 2020 Gujarat was one of the five states where a maximum number of cases and deaths were reported from India. The government of Gujarat took tough and timely action in form of lockdown under the leadership of the Chief Minister (CM) and Deputy CM. In order to adjust the effects of the pandemic, coordinated methods were used: pharmacological and non-pharmacological with intersectoral cooperation. State governments undertook various measures to contain the spread of the virus. Specific steps as advocated during lockdown and post lockdown to

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avoid corona infection were effective measures to curb the pandemic; Preventive measures enlisting Community engagement - Hand hygiene, Cough etiquettes, Environmental sanitation, Use of Personal Protective Equipment (PPE), Social distancing. Other measures to contain large outbreaks viz; Screening, Quarantine, Surveillance, Preparedness.

Amid uncertainty over the completion of the natural history of Coivid-19 and the pandemic it becomes imperative to review and adjust public health and social measures during the pandemic. An Intra-Action Review (IAR) was employed to allow district level stakeholders to reflect upon the ongoing outbreak response. *Implications;* The IAR findings and recommendations may contribute to improved management/actionable insights of the concurrent pandemic to the district and other districts of the country.

**MATERIALS AND METHODS**

**Study setting:** Adistrict of Gujarat- a state located in western part of India.

Intra-Action Review (IAR) is a qualitative review of actions taken to respond to an emergency to identify best practices, lessons learned, and gaps in a national public health response. IAR relies primarily on the personal experience and perceptions of individuals involved in the response - to assess what worked and what did not, why, and how to improve.<sup>5</sup>

*The objectives of the IAR were to*

1. Reflect on the ongoing COVID-19 outbreak response at the district level to identify current best practices, gaps and lessons learned
2. Propose corrective measures and actions to improve and strengthen the continued COVID-19 response.

Four In-depth Interviews (IDI) were carried out with key stakeholders using a qualitative approach. In order to focus on the ongoing Covid -19 responses at district level, important areas were defined in the form of pillars to activate essential information as described below.

**Table 1** Pillars studied and stakeholders

S.No.	Pillars	Stakeholder
1	District-level coordination, planning and monitoring	Health Commissioner of the district
2	Public Health Response	Regional Deputy Director of the district
3	Case management and knowledge sharing in the latest innovation and research. Operational support and logistics in supply chain and workforce management	Superintendent of the Tertiary Care Hospital
4	Maintaining essential health service like Autopsy during the COVID-19 outbreak	Head of the Department of Forensic Medicine (FM)

The interviews were held at a place agreed upon by the participants after explaining the purpose of the interview. The participants were informed of IDI through emails and the same were recorded after prior informed consent. The IDIs were conducted by a trained researcher and two note-keepers. A semi-structured qualitative instrument/ interview guide was prepared to capture responses to a list of probing questions in English as all of the stakeholders were comfortable with this language. Each IDI lasted for about 40-45 minutes. The qualitative interview field notes were transcribed on the same day by the principal investigator and translated. The emerging

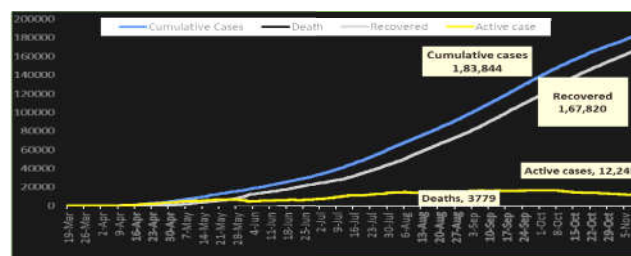
themes are presented in this paper. Non-verbal responses and communications were also noted.

**RESULTS AND DISCUSSION**

*Indicators and Trends of Covid-19 in the Country, State and the District studied*

**Table 2** Covid -19 Dashboard Indicators at a glance

	COVID-19 Dashboard Indicators <sup>6</sup> (Situation as on 18.11.2020)			
	World	India	Gujarat	Rajkot
Total Population (in Millions)	7776	1380	65.7	1.87
Total Cases	55943080	8912907	190361	14576
Case per million	7194.22	6457.6	2893.3	4513.6
Active cases	15636578	446805	12458	1126
Discharged	38963129	8335109	174088	13281
Discharged rate (%)	69.65	93.52	91.45	91.12
Deceased	1343376	130993	3815	169
CFR (%)	2.40	1.47	2.00	1.16
Death per million	172.76	94.91	57.98	52.33
Total Sample tested	925437598	127480186	6923993	471738
Test per million	119010.32	92362.6	105237.5	146078.5
Positivity rate (%)	6.05	6.99	2.75	3.1



**Figure 1** Trends in COVID-19 cases in the state of Gujarat (as on 11th November 2020)

Source: Epidemic Cell, Department of Health and Family Welfare, Gandhinagar, Government of Gujarat.<sup>7</sup>

Some highlights of the COVID-19 situation in Gujarat were as follows; As of November 18, 2020, there were around 66,25,876 cumulative tests conducted and 12,458 active cases in the state. The test positivity rate was remarkably reduced to 2.75% in November 2020 which was as high as 10.6% in June. 2020. The Case fatality rate (CFR) also drastically reduced to 2.0%, from 7.7% during the month of May 2020 (Table 2). The current compound daily growth rate is 0.57% which was as high as 14.65% in April 2020. Cases started increasing in May 2020 and a peak was observed in November 2020 (Figure 1)

There were around 14,576 cumulative cases in the district as of 18<sup>th</sup> November 2020. The test positivity rate remarkably reduced to 3.1 in November 2020 which was as high as 12% in July-August 2020. The Case fatality rate (CFR) was also drastically reduced to 1.16%, from 3.9% during the same month (Table 2). Cases started increasing in July 2020 and a peak was observed in November 2020 (Figure 2).

**Highlights of In-depth Interviews of stakeholders from the District studied**

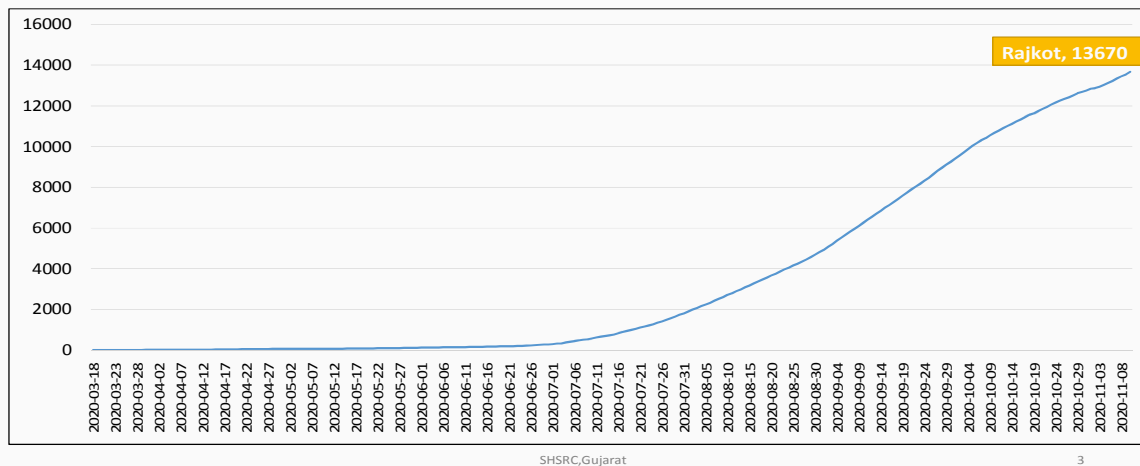
**Public Health Response to Covid-19 Pandemic**

**Evolution:** First positive case of Covid in Gujarat was found on 18<sup>th</sup> March from the Jangleshwar area of the district. He was considered a suspect case but treated as positive even before the test results. He was isolated and his entire family members were quarantined at Pathikashram (govt. guest house). Jangleshwar area caters to around 50,000 populations, was

then immediately declared as Hotspot, and the entire area was quarantined.

**Logistics and supply management:** From the beginning, most of the logistics were supplied without much interruption. Initially, there was a delay in the supply of Personal Protection

### Trend of Cumulative Cases



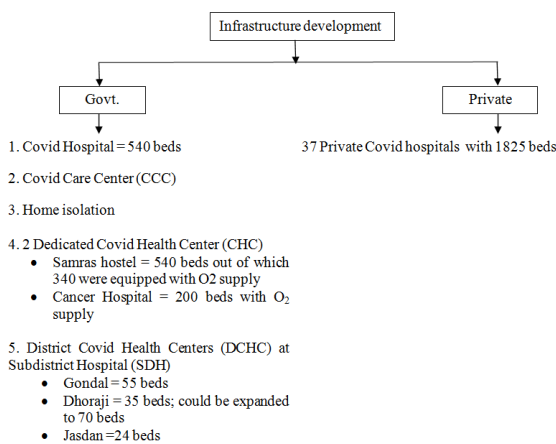
**Figure 2** Trends in COVID-19 cases in the District studied (as on 8<sup>th</sup> November 2020)

Source: State Health System Resource Centre (SHSRC), Department of Health and Family Welfare (DHFV), Gandhinagar, Government of Gujarat.<sup>8</sup>

The area had certain peculiarities like overcrowding, resistance in the community for testing, and isolation/quarantine which were overcome by the help of religious leaders and medical staff. Scrupulous contact tracing was done as per the Indian Council of Medical Research (ICMR) guidelines by enthusiastic team of Health Care Workers (HCW) with the support of Govt. officials.

Specialized Out Patient Department/Clinic (OPD) was started within the Jangleshwar area at an Urban Health Center (UHC) to prevent further spread of infection, where screening of all asymptomatic close contacts was initiated. Initially, 160 isolation beds were prepared in Pradhan Mantri Swasthya Suraksha Yojana (PMSSY) Covid Hospital attached to Medical College (Tertiary Care Hospital) of the district. Gradually more beds were added to strengthen bed capacity to 540.

#### Health system strengthening in the district



**Human resource recruitment/mobilization/deployment AND Capacity building:** Medical officers (MO) and staff nurses were deputed from the DHFW of the state. Medical officers, Dentists, Nurses, and others were trained in Ventilatory Care & Infection Control Measures through webinars; they were given incentives when recruited for surveillance activities.

Equipment Kits (PPE) which was overcome by supplies from various companies. There has been a shortage of drugs like Tocilizumab & Remdesivir in Private Setup at times.

**Surveillance activities (containment, tracing, testing, isolation, quarantine):** Rapid Antigen testing, Surveillance & required treatment was being provided by Dhanvatari Raths (Mobile Medical Units/Van/Clinic) with the help of IT-enabled Integrated Hotspot Analysis system (ITIHAS portal) under UHCs. A separate OPD for Rapid Antigen Testing was setup by the Municipal Corporation (MC) to reduce the workload of Flu OPD staff of the Hospital.

**Community-Based Interventions and Response:** Extensive Information Education & Communication (IEC) activities for public awareness regarding Cough etiquette, Physical distancing, Hand washing, etc took place via Television, Radio, Hoardings, Pamphlets. Counseling sessions to reduce the resistance of the community for testing and not to hide their symptoms were conducted. A reverse quarantine strategy was implemented for the screening of vulnerable populations & home isolation.

**Leadership and Governance:** Support and guidance from Principal Secretary (PS) Health, Collector, and Commissioner of the district were commendable to overcome the impact of the pandemic.

**Monitoring/Data Management:** District level administrative team, the District Corporation, Community Medicine department of the attached Medical College collaborated in managing data, analysis, and monitoring.

**Role of media:** Many times media was in for finding faults. Health awareness video clips and success stories prepared by Information Dept. at district level changed the lens of media who later published them to aid public response to hospital care.

**Infection in Health Care Providers:** It was not merely due to work in covid, but actually because of overconfidence of the staff who perceived that they were immune to Covid infection,

hence not following infection control measures especially doffing technique at times.

### **District Level Co-ordination, Planning and Monitoring**

**Purpose of the interview:** To review operational, tactical & strategic coordination of Covid-19 response of the district.

### **Operational coordination mechanisms in place for health emergency**

A list of foreign travelers was prepared since the starting of February 2020, who was sent to govt. quarantine facility established at Pathikashram. The first case – Adim (name changed) had visited Aji GIDC area, thereafter 13000 people residing in this area were screened. Vigorous contact tracing, containment zone, and quarantine facilities were established immediately to prevent the spread of infection. The modes of communication used were telephones, short-lived Whats App groups for quick sharing of information and better decision making.

**Systems adopted for better coordination:** For the corporation, it was very important to ensure the lockdown in a city with no home delivery systems, so Swiggy & Zomato which employed delivery guys were roped in. There was good coordination with local shopkeepers, grocers, milk shops, and chemists to start home delivery. There was a tie-up of auto-rickshaw drivers with shop keepers who would deliver at home and their phone numbers were displayed on the website.

**Important decision-makers:** They were Collector, Commissioner, District Development Officer (DDO), and Police.

**Resources:** Funds & human resources utilized, NGOs came forward to feed daily wage workers. Trusts (Bolbala trust, Sadbhavna trust, Ramkrushna mission, Sargam club & Annapurna trust) joined hands in feeding around 1 lac people every day in form of cooked food, milk, and grocery. Prime minister's Swanidhi Yojna, (govt. scheme) provided free ration, but this led to a chaotic situation wherein people were beating & stealing the ration. So Mr. X at the RUDA building was given the charge of feeding people in need. A system was strengthened wherein people who wanted to donate food were registered and locations of people in need were identified and supplied with food.

**Experience with the city and its people regarding following rules:** By and large the city had responded well to calls and followed rules. 980 cameras in the city were utilized to penalize people found spitting, not wearing masks, and not maintaining physical distancing.

### **Maintaining essential services, Autopsy**

**Purpose of the interview:** To review availability, accessibility & feasibility of essential services during Covid-19, autopsy in particular at the hospital.

**The process established for autopsies:** After Principal Secretary Health, a recommended autopsy for Covid-19 in a meeting, guidelines & criteria for research autopsy for Covid-19 were explored. Permission from Institutional Ethical Committee (IEC) was obtained and Microbiology & Pathology Departments collaborated. Within two days all formalities were completed and first consent for autopsy was received. To start with inclusion criteria were; young age (<70 years) and

the absence of co-morbidities. Initially, little consent was obtained, so the criteria were redefined to consent given by relatives of deceased.

**Resources required:** As per ICMR guidelines, the negative pressure room system was established in the autopsy room incurring an expenditure of around 2.5 lacs (0.25 million). PPE kits and other resources viz; types of equipment & human resources to perform autopsy was in adequate amount. Autopsy findings were shared with the department of Medicine. A team of three persons did the work of photography, dissection, sample collection & disinfection and it was observed that none of them developed symptoms though a backup was kept ready. Routine autopsies were not disturbed. The time required to perform Covid research autopsy was comparatively more than routine autopsy as extra precautions were required. The average time required to perform Covid research autopsy was 1.5 to 2.5 hours.

**Communication strategies and platforms established to support the services:** Dead Body Management Committee would give information of death from hospital via WhatsApp to Covid Autopsy group of Forensic Medicine (FM) department. A person from the FM department would counsel the three contacts (relatives) mentioned on the indoor sheet of the deceased for giving consent for autopsy. Informed written consent was obtained and the body was sent to the mortuary. After autopsy, an information sheet was given to the relatives.

**Preparation of an autopsy report:** Before the procedure disinfection was done and after an autopsy, organs were being preserved in 10% formalin solution for 72 hours. Samples were sent to Histopathology Laboratory and Microbiology Department for RTPCR.

**National guidelines for Covid-19 autopsy and places where autopsies were performed:** ICMR autopsy guidelines were strictly followed. Worldwide Covid-19 research autopsies were being performed in Germany, Switzerland, Italy, few states of the USA, Netherland & India. In India, AIIMS Bhopal performed the 1<sup>st</sup> autopsy and they had performed 22 autopsies, while at the hospital studied 24 were performed till the date of interview.

**Enabling factors that helped to overcome the challenges encountered in autopsy initiation and obtaining Informed Consent:** With support from Public Works (Civil) department, required infrastructure was promptly established. Initially, little consent was obtained; eight of them were received from Sadbhavna's old age home itself. But after media sensitization, more consent was received. Out of every 20 deaths, eight consent were given by relatives.

### **Hospital Care during Covid-19 Pandemic**

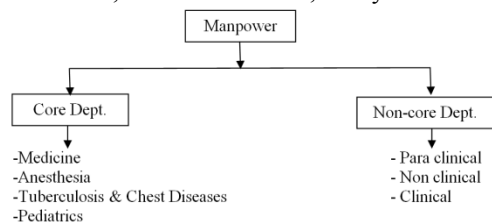
**Covid-19 and hospital preparedness:** In March the hospital had advance preparedness even before the 1<sup>st</sup> positive case of Gujarat was detected on 18/03/20. There were 240-250 beds out of which 40 were ICU beds. The bed strength was expanded to 590 beds out of which 142 were ICU and 192 were equipped with ventilators.

**Leadership and Governance:** PS Health visited the district and hospital and provided her invaluable guidance and support. Additional Director & Addl Chief Sec (ACS) interacted with patients and staff personally. There was an increasing demand for Oxygen supply; hence the requirement of 20,000L of oxygen tank was made available to the hospital.



Integration with Municipal Corporation (MC), Jilla Panchayat & Fire Dept. was effectively established.

**Human resource recruitment/mobilization/deployment and capacity building:** Staff involved were; Faculty, Residents, Interns, Undergraduate students, Nursing, ECG technicians, Attendants, Lab. Technicians, X-ray technicians, Nutritionists.



Continuous efforts were made to build the capacity of staff in form of IGOT & Infection control training before joining their Covid duty. Refresher training was also given on the spot by consultants inwards.

**Logistics and supply management:** 291 ventilators were commissioned and in use at peak of the pandemic. 150 multipara monitors to start with could be expanded to 250. 90 ventilators were given to private hospitals on loan. Adequate quantities of drugs like Tocilizumab, Enoxaparin & Remdesivir were made available. Picture of indent book was sent through WhatsApp directly to pharmacist from each ward for easy availability of drugs. In-house lab service of IL-6, D-Dimer, S. Calcitonin, S. ferritin, etc. was available for quick lab reports and to prevent the spread of infection. Portable X-ray & USG machines were adequately available and a buffer stock was kept in the medical store. Supply chain management could be rated as 3.5 out of 5 on a scale of 1-5.

**Management of Cases/Clinical Care; Testing strategies:** RTPCR tests were conducted by the Microbiology Dept in three batches per day and testing kits were adequate in amount. Separate OPD was held for Rapid Antigen Testing. 20 to 22 SOPs (Standard Operational Procedure) for clinical management were in place. Two teams consisting of a Physician, Anesthetist, and an Intensivist from a private hospital visited the patients regularly. A Discharge Committee was constituted for counseling the discharged patients for home isolation, DCHC, or CCC.

**The flow of patients:** The patient attending Flu OPD was managed by a senior resident. The suspect patient was shifted to the suspect wing till his test result. If he/she was Covid negative, he/she was counseled for home isolation. The unstable patient was treated in a triage area, after stabilization the patient was shifted to an isolation ward. Treatment was given as per the Ministry of Health & Family Welfare (MOHFW) and ICMR guidelines by consultants and residents.

**Biomedical Waste and Dead body handling:** Around 17000 kg/month of BMW was generated. The facility of color-coded drums (Yellow, Red, and Black) was created and waste was collected twice a day. Plastic waste was microwaved. Wet mopping was done 2-3 times a day by sodium hypochlorite solution. 108 Ambulances were disinfected regularly. Round the clock, Infection Control Nurse and Sanitary Inspector were made available. SOPs were made for dead body disposal & all MOHFW guidelines were followed. A team of 7-8 members including Forensic Medicine Dept. & Resident Medical Officer was formed. All precautions were taken using no-touch technique. The body was covered in a plastic bag;

face could be seen under the transparent plastic cover. There was a special crematorium where MC and Fire Brigade Dept. cremated the body. Relatives of the deceased were well informed by the designated floor managers.

**Measures were taken for the prevention of Infection in Health Care Providers:** Separate ward for treatment of infected health care providers was created. Consultants were in touch with them for treatment & counseling on a daily basis.

**Food and Nutritional care of the patients:** Seven-Course healthy meals were provided to the patients.

- Morning – Tea/Coffee with breakfast
- Afternoon – Lunch (Diabetic / Non-diabetic diet)
- Evening – Fruit dish, lemon juice, non-sugar biscuits
- Night – Dinner with golden (Haladi/Turmeric) milk
- Kettles were provided at required places for making ready-to-eat food
- 3 L of water was provided along with an admission kit

**Data management:** Softwares used were Gujarat Health Management Information System (GHMIS) software and Covid Daman Software. Support from Dept. of Community Medicine was crucial in real-time update of data and analysis which was helpful in taking timely action.

**Media:** Additional Superintendent dealt with media to provide correct facts, patient interviews, publicity of infrastructure, and clarifying doubts in order to prevent the spread of wrong information to the public.

**Communication Strategies:** A Control Room was setup to give information regarding the health status of patients to relatives. Others were; Video calling facility for relatives, Counselor for real-time update of patients. The floor manager played a vital role in communication. After completion of Covid duty, floor managers would suggest the scope of improvement in post doffing register.

**Floor Managers in improving quality of care:** Middle to senior-level faculty was assigned duties as Floor Managers in rotation in various wards of Covid hospital. They were the backbone of the Hospital, working as administrative heads of the assigned wards. From managing stationary issues to a declaration of death was done by them. To facilitate their working there was a WhatsApp group to communicate and resolve problems/troubles effectively.

*Some good practices related to the care of covid patients as observed by these managers were documented in a post-doffing register maintained for them.* To quote a few in their own words were; staff being cooperative, quick response by the staff, paramedical staff, and medical students were doing a good job, support from senior faculty was appreciable, final MBBS students were enthusiastic and learning with interest, attendants were doing a good job (caring, feeding patients), coordination with radiology department was very good.

*Related to logistics, supply, and repair-* Arterial Blood Gas (ABG) machine repaired in time, quick response to low oxygen pressure, supply chain improved, Injection vasopressin procured timely.

**Important Verbatim;** “Have shifted 14 patients to DCHC and patients have given good reviews about treatment received and other facilities availed. In charge sisters are doing work nicely” One another wrote “Extensive communication and counseling with patients on Bipap who were on verge of leaving hope and

willingness to live gave satisfaction, well-organized system for good working atmosphere, good cleanliness and hygiene maintained”

**Some practices observed by Floor Managers for improvement-**Too many phone calls from relatives hampered working, more PPE kits needed, donning and doffing room location need to be changed.

**Related to repair-** More ECG technicians required, pulse oxymeters not working at places, ABG not working at ICU, installation of washbasins for patients needed at few places, shortage of ventilators and ICU beds for critical patients, water leakage problem at FLU OPD entrance.

**Related to patient Care-**Tiffin service parcel delayed, personal belongings of a patient lost, less number of attendants during morning hours, need of a staff toilet in doctor's room, patient call, and management by same phone being difficult, power cut for few minutes at night, declaration of patient condition to be done by treating physicians. The majority of the suggestions for improvement were discussed by the core-committee and resolved efficiently.

**Facilitating factors/Enablers linked to the Hospital Patient Care Response:** Under constant support and guidance of Principal Secretary Health, Collector, and Commissioner of the district the institute is considered as a mentoring institute in Gujarat. Others being; continuous monitoring by CCTV up to Chief Minister's level (Chief Minister's Dashboard and CCTV monitoring), entire system working on autopilot mode, no dearth in logistics, five Ambulance vehicles running with the support of governance, the daily meeting of nodal officers for local-level monitoring, centralized separate donning doffing areas for male & female, hot snacks served to all Health Care Workers before donning, 18 Normal deliveries & 16 LSCS conducted and not a single newborn was affected, specialized OPD in hot zone area, plan for post covid physiotherapy and spirometry to increase lung capacity of recovered patients for which 500 portable spirometers made were available, empowering the recovered covid patients for plasma donation.

**Table 3** District Response to Covid-19 Pandemic; “Innovations/Best Practices”

Pillars	Innovations/Best Practices
Public Health Response	1. Setting up of Specialized OPDs in the hotspot (Jangleshwar); Care by specialists viz; Pediatrics, Psychiatry, Skin, Medicine, Obs & Gynaec for fulfilling the needs of non-covid patients in form of treatment of Non-Communicable Diseases (NCDs), Reproductive Health, Ante Natal Care (ANC), Immunization, etc. All ANC women were screened on a priority basis for detection of covid infection. Swabs were collected by Ear-Nose-Throat specialists in the community from all close contacts of patients.
	2. Involvement of Private Hospitals with the prior permission of Collector since June 2020. Christ hospital was given 50 Govt. beds for Covid & all bills were paid by the Chief District Medical officer (CDMO) and Collector's office, so that patients were treated free of cost in private hospitals also. A Committee was formed under the guidance of the Regional Deputy Director to keep a watch on the expenditure by patients in private hospitals. There was an initial resistance seen from private hospitals that then joined hands in providing quality care to the patients. A Grievance Committee was also formed, which gave notices and recovered the money of patients from private hospitals. 60 ventilators from govt. were given to private hospitals on a loan basis.
	3. Rapid Response Teams from the department of Community Medicine of the hospital visited Private hospitals, Field & UHCs to check the quality of care provided by them.
	4. Counseling, Meditation & Yoga for quarantined persons by experts; viz Psychiatrist, Psychologist, Women & Child

		Development through the establishment of a counseling Center.
District-level coordination, planning and monitoring	1	A home delivery system for delivering goods and services.
	2	980 cameras utilized for monitoring.
	3	The technique of Testing, Treating and Tracing for breaking chain of transmission with the tagline “Test is Best”.
	4	Appointment of UHC Prabhari, Ward officers & Engineers for early detection of Acute Respiratory Tract Infection (ARI) cases by surveying all houses within 3 days. Rapid Antigen Testing was helpful for quick detection.
	5	Appointment of 1800 Covid coordinators in various residential areas for ensuring that all Standard Operating Procedures (SOPs) were followed and ARI cases were detected. Their activities were monitored by UHC Prabhari via Zoom meetings.
Maintaining essential services; Autopsy	1	<i>Preliminary findings:</i> Main organs involved are lungs, kidney, liver, and heart. A very prominent finding seen was hyper coagulopathy of vessels and microscopic findings seen were micro thrombus formation. <i>Suggestions based on preliminary findings:</i> Anticoagulants can be considered in the early management of patients. The patient area was differentiated into two zones: Red & Green.
	1	Green zone patients (Stable Pts.) benefitted from rag-based music therapy, recreational activities like drawing, chess, carom, ludo, antakshari, and others. Signages in Gujarati and English were mounted in the hospital.
	2	Psychiatric counseling and consultation via video call.
Hospital Care	3	Three Physiotherapists were deputed for promoting prone position for patients in isolation wards of the hospital. They used portable mikes to promote mass proning position to increase the blood oxygen level.
	4	Round the clock fireman was available for fire safety.
	5	Partnership with private setup.
	6	Convalescent Plasma Donation by recovered Covid Patients; 200 donations were done till the date of interview. District studied stood 2 <sup>nd</sup> in plasma donation in Gujarat.
	7	A separate control room was established in a nearby school compound which provided facilities like snacks, luggage, sanitary services, Ukala, and others to the relatives.
	8	Separate entry for 108 ambulances in the hospital.
	9	A strong network of faculty on all floors/wards of the hospital designated as Floor Managers.
	10	Staff was provided with refreshments, Adult diapers, Sanitary pads, etc.
	11	Research was undertaken; FM Dept. played a pioneering role in research autopsy. Randomized Control Drug Trial was being conducted by departments of Medicine, Community Medicine, and Pharmacology.

**Table 4** Challenges encountered, their Impact and Limitations

Sr.No.	Pillars	Challenges	Impact	Limiting factors	
1.	Public Health Response	1. Surveillance deficits	Delay in hospitalization; Led to worsening of symptoms which required oxygen support; as a result death rate increased	Lack of manpower	
		2. Fear of testing and isolation/quarantine in community			
		<b>Challenges</b>		<b>Impact</b>	<b>Limiting factor</b>
		1. People not revealing the truth about their travel history and symptoms	The spread of infection increased and led to failure in breaking the chain of transmission	Low awareness and accountability / participation of people to realize their responsibilities	
2.	District-level coordination, planning and monitoring	2. Enforcing the lockdown	Helped to reduce the spread of infection in the community	-	
		3. Establishment of Containment zone	The resistance of community for testing	Taboos and myths in the community	
		4. Working continuously for 7 months in Covid along with the continuation of core responsibilities	Mental stress and anxieties	Working without leaves was a challenge	
		<b>Challenges</b>		<b>Impact</b>	<b>Limiting factors</b>
3.	Maintaining essential services; Autopsy	1. Infrastructure to perform Covid 19 research autopsy was not there to start with			
		2. Consent was a major challenge. Obtaining consent from relatives of young age patients, females, Muslim	As consents were mainly given at night, the work-load of staff increased at night and they had to perform	As the relatives were in grief, it was difficult to get consent immediately after	

	families & highly educated people	their non-Covid duties as well. Due to these only 25 autopsies could be performed; otherwise, 100 autopsies could have been done. (out of 25, 80% to 90% were performed during night time)	the death of a patient
	<b>Challenges</b> Working continuously since March 2020 in Covid along with the continuation of core responsibilities	<b>Impact</b> Burn out / Mental stress and anxieties	<b>Limiting factors</b> Working without leaves was a challenge
<b>4. Hospital Care</b>	1. Working in covid hospital/red zone	Infection in health care workers, though efforts were made by interventions viz; counseling by the psychiatrist, motivational speakers were invited every week, rotational duty in non-covid work	

**Table 5 Recommendations for future Preparedness and Solutions**

Pillars	Recommendations for future preparedness and solutions
Public Health Response	1 Strengthening of human resources.
	2 Strengthening of Infrastructure; Capacity building at periphery level including all CHCs, SDH, Taluka level hospitals.
	3 Improving the quality of surveillance activities.
	4 Improving Partnership with Indian Medical Association (IMA) to establish an integrated approach for future emergency situation.
District-level coordination, planning and monitoring	1 Enhancement of Education of community regarding; hand washing, social distancing and coughs etiquette by including it in the school curriculum. Involvement of community leaders in IEC and Yojanas (govt. schemes).
	2 Building hand washing infrastructure. Making hand sanitizers economic so that it can be used widely.
	3 With the involvement of the IT and the Telecom industry, devices like mobile phones, watches, etc. can be designed to measure SpO <sub>2</sub> .
Maintaining essential services; Autopsy	1 If there was a second spike, with permission of higher "authorities" consent could be obtained to perform all autopsies under the Epidemic Disease Act. This would help in getting autopsies of all ages. (e.g. Young age patients too).
	1 The hospital is prepared in advance in case a future spike of infection occurred in terms of oxygen supply, ICU beds, Ventilators, etc. Out of 1000 beds available in the hospital, 50% were being occupied for Covid admissions, so there was a need to increase bed strength to manage any future emergency situation.
Hospital Care	1 Another area of concern is to have a sound strategy to boost the morale of health care providers although some systems were in place in terms of psychiatric counseling and consultation via video call.
	2

Gujarat has laid primary focus on hospital preparedness, capacity building, and ramped up surveillance efforts including door-to-door surveillance across the state. With the tagline 'Test is Best' the district Corporation established 11 Covid-19 testing booths for free antigen testing and 130 vehicles were giving round the clock services. More than 1800 coordinators assisted the corporation in serving the community. A "Psychological Intervention Center" provided psychological support to the people in need.

The lessons learned from challenges would help in improving the pandemic response if there were subsequent waves/surge of cases and best practices would provide some actionable insights to the district studied and other districts to help improve pandemic resilience towards safe and healthy living. The process of response review is knowledge enriching and may help interested stakeholders in improved handling of public health emergencies that enable long-term health and economic security. To conclude, the three key features of effective leadership which were identified by the review are; communication, decision making, and mental health and wellbeing.

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**CONCLUSION**

The case study was undertaken: to review the patient care/public health actions already undertaken by the district; to identify the current best practices, the achievements, and the challenges faced.

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