

## ORIGINAL ARTICLE

## An analytical study about the operational effectiveness of the Covid Control Room in a Medical College of Northern India

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### Abstract

**Background:** Muzaffarnagar Medical College (MMC), Muzaffarnagar was declared a designated covid hospital by the Uttar Pradesh State Government. A Covid Control Room (CCR) was hence established to manage the disaster. **Aims & Objectives:** The CCR worked as the operational brain of MMC. **Study Setting:** Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh, India. **Study Design:** A hospital record based observational study. **Material Methods:** A total of 1132 admitted covid positive patients in three months constituted the study population. The CCTV cameras were installed inside the isolation wards, and the ICUs with 24/7 video coverage. The DGME (Uttar Pradesh) developed the Patient Information System (PIS) wherein information was uploaded in a database and WhatsApp messages were sent to the relatives twice daily. **Results:** The CCR received on an average 200 calls per day. A total of 12,622 calls were received in two months. With, PIS in function the no. of calls received in CCR reduced drastically. 100% coverage of the patients' information was achieved. **Conclusion:** The scope of the control room has expanded considerably to address various aspects of the covid-19 pandemic crisis. These findings will be helpful as a reference for future. It is one of the first studies and unique in nature.

### Keywords

COVID – 19; Pandemic; Health Seeking Behavior; Information System

### Introduction

As part of the government's initiative, many hospitals were converted to COVID Hospitals to deal effectively with the corona cases. Apart from government health care institutions, some private medical institutions were also considered to be declared as COVID Hospitals depending upon the high incidence rates in the affected areas and the facilities available. Local district-level health administration was entrusted with managing the operational services. Muzaffarnagar Medical College (MMC), which is one of the renowned private medical institutions within the NCR (National Capital Region) in Northern India, was also assisted & declared by the state

government as a designated COVID Hospital for the control & management of Covid cases in its vast catchment area.

MMC moved forward with full responsibility and accountability incorporating innovative ideas in the operational aspect of the covid management. It established an advanced Covid Control Room which was the first of its kind in any COVID Hospital in the state. The Covid Control Room worked as the operational brain of MMC enabling remote monitoring and managing escalations. It was the primary source of information and communication to the masses & attendants of the covid patients. The secured collaboration among different

departments and the digital workflow ensured optimal operation. (1,2,3)

## Aims & Objectives

1. To assess the effectiveness of functional integrity of covid control room after its establishment
2. To identify the future perspective of the integral role of the control room in combating the epidemics in India

## Material & Methods

**Study type:** A cross-sectional, analytical, observational study.

**Study population:** 1132 covid positive patients admitted at Muzzafarnagar Medical College Hospital.

**Study Area:** Muzzafarnagar Medical College, Muzzafarnagar, Uttar Pradesh, India.

**Study tool:** Digital record formats available at the Covid Control Room.

**Study duration:** 1<sup>st</sup> April 2021 to 2<sup>nd</sup> July 2021.

**Sample size calculation:** It is a hospital-based study depending on hospital records from 1<sup>st</sup> April 2021 to 2<sup>nd</sup> July 2021

**Inclusion Criterion:** All Covid patients admitted in MMC

**Exclusion Criterion:** Non-Covid patients

**Strategy for collection:** Covid Control Room was established in the administrative wing of the Muzzafarnagar Medical College. The high-quality resolution CCTV cameras were placed appropriately in the Covid isolation wards and ICUs fully occupied with the Covid-19 patients. There was live 24/7 video coverage of the patients admitted in these wards and ICUs. The workstation had a mike, walky-talky, five mobile phones, reference materials (including all standard Ministry of Health & Family Welfare guidelines), pen/pencil, register etc. All phone/computer banks were set up close to power, telephone, and data sockets/ports. Sufficient high-speed internet connectivity was also ensured.

To manage the admitted covid patients properly, eight hourly shifts of the clinical doctors in the isolation wards corresponded to the shifts of para clinical doctors, residents, and interns posted in the control room.

All the concerned doctors and staff were adequately sensitized prior to their posting to answer medical queries, logistics and administrative issues regarding health and health-related problems of the patients' attendants. Every call of the patients' attendants and their well-wishers was noted with the caller's details so that no patient data was missed. Five helpline numbers were provided to the patients' relatives for any help or query. The vitals of the patients were updated six times by the doctors. There was a daily compilation of data at the end of each shift. A team of police personnel/ officers was also deployed at the Covid Control Room to watch law-and-order issues closely.

To smoothen the inflow of the information, the Director-General of Medical Education - DGME (Uttar Pradesh)

developed the Patient Information System (PIS) wherein patient's information was uploaded in a database daily and WhatsApp messages were sent to the relatives/ attendants of the patients twice daily at 6 am and 6 pm regularly. This Patient Information System (PIS) was also adopted at Muzzafarnagar Medical College as an essential component of the functioning of the Covid Control Room. The PIS include patient information update under these headings – Name, Age/Sex, Ward/Bed No, Date of admission, Vitals: Blood Pressure, Pulse Rate, Respiratory Rate, Temperature, SPO<sub>2</sub>, Mode, General Condition and Remarks.

This Covid Control Room (CCR) was monitored closely by a designated CCR –in- charge from the Department of Community Medicine, accountable for liaising, reporting and overall management. Interview with the CCR In charge was done to gain the perspective of 'All-in-one' integrated control room.

**Data Analysis:** These collected data was checked twice by the researchers to ensure its authenticity and appropriateness. The data was analyzed after being coded, and a suitable statistical test was applied using Microsoft Excel and SPSS version 25.

**Ethical considerations & Consent:** The Institutional Ethical Committee of Muzzafarnagar Medical College has given the approval for the conduction of this study. Informed consent from the concerned has also been taken before data collection. Confidentiality of the collected data has been strictly adhered.

Flow diagram depicts that CCR is well connected to the isolation ward, L2 ICU & L3 ICU with the help of 24 hours x 7 days CCTV cameras. Total five helplines were provided in CCR for the callers and were connected to the nine different but unique integrated units inside the hospital. According to the CCR in charge -The helplines kept buzzing with patients' relatives, and attendants calls and the well-trained staff at the Covid Control Room found themselves inundated with queries. The Covid Control Room received in a range of at least 250 - 300 calls per day. The telephone helpline lines in the control room were operated by 30 personnel from different departments. They first received the calls made by the relatives & or attendants of the admitted covid patients. According to their type of query, they forwarded the calls to any one of the nine different special units established in the Muzzafarnagar Medical College. These nine units had 125 officials and workers comprised of a triage, holding area, admission desk, diagnostic team, drugs and consumables team, food supplies, oxygen supplies, and dead body disposal team. (Figure-1)

## Results

**Table 1** shows that the difference between recovered and death cases according to their age group is statistically significant ( $p < 0.05$ ), but the difference between

recovered and death cases according to their sex is found to be statistically insignificant ( $p > 0.05$ ).

[Table 2](#) revealed the age-group & sex-wise distribution of Covid-19 death cases at Muzzafarnagar Medical College. The majority of the deaths in both sexes occurred among  $\geq 40$  years cases and least in  $< 40$  years covid patients. There is no significant difference among the deceased regarding their age group and sex ( $p > 0.05$ ).

[Table 3](#) shows the shift-wise weekly call distribution of the patients' relatives/ attendants received at CCR (Covid Control Room) of Muzzafarnagar Medical College starting from 1<sup>st</sup> May to 2<sup>nd</sup> July 2021. A total of 12,622 calls were received in 9 weeks from the relatives/ attendants of 1132 admitted covid patients. Morning shift calls were more (36.5%) followed by evening (32.1%) and night shift calls (31.3%), respectively. An increasing trend of calls received at CCR was noted during the first three weeks, and then it started declining gradually in the rest of the six weeks in all the shifts till the end.

[Figure 2](#) depicts that initially, the PIS data sent to patients' relatives/ attendants were not satisfactory, not all the patients were covered. But from the 10<sup>th</sup> day of the start of PIS on 22<sup>nd</sup> May 2021, a drastic significant change was noted, and within fifteen days, 100 % coverage of the patients was achieved, and PIS ran very smooth till the end.

[Table 4](#) revealed that PIS data sent was only 29/94 patients (30.85% messages) on the first day, followed by 60/61 patients (98.36% messages) on the 10th day and then from the 15<sup>th</sup> day onwards it rose gradually near to 100% till the end. This is attributable to the successful operation of PIS through CCR.

## Discussion

In India, the second wave of Covid-19 that started in March 2021 was more dangerous than the first wave. During the second wave, there were shortages of vaccines, hospital beds, necessary medicines, and oxygen cylinders up to a great extent in some parts of the country. (4) By the last week of April, India started leading the globe in terms of new and active cases of covid-19. At the end of April 2021, India reached the top and reported over 400,000 new cases in a single day. (5, 6) Despite all these, health experts also believe that there is underreporting of cases in India due to multiple reasons. (6 – 9) Delayed reporting at designated health facilities, the health-seeking behavior, overburdened health system due to the sudden increase in covid-19 cases, all these could be the possible reason for that. (2)

The current study is the first one of its kind in the region, and that is why no such data is available to compare the findings of this study. The State Government declared Muzzafarnagar Medical College as the designated Covid hospital in March 2020. In order to control the alarming and threatening situation, it was decided to establish an ultra-modern CCR under the same roof and one platform

in designated covid hospitals for resolving all problems related to the coronavirus pandemic. In Muzzafarnagar Medical College, before the establishment of the CCR on 25<sup>th</sup> April 2021, calls of the patients' relatives/ attendants were coming at the hospital/ college reception only to enquire about the whereabouts of the admitted patients but that system was not appreciable one to deal with the increasing number of concerns and enquiries about the admitted covid-19 patients due to the sudden rise in covid-19 cases after 3<sup>rd</sup> week of April 2021. So, to tackle the situation as well as in order to smoothen the management of covid-19 patients, CCR was planned to establish at Muzzafarnagar Medical College also. During the first three weeks of the functional CCR, the number of calls was chronologically high, but since the CCR was incorporated by PIS, which is a robust computer-based patient record system exclusively made to support users by providing access to complete and accurate data, reminders, alerts, clinical decision support systems links to medical knowledge, and other aids. The number of daily calls declined drastically in a chronological manner in all the shifts till the closure of CCR in July. The morning shift was from 8 am to 4 pm, the evening shift from 4 pm to 12 midnight and the night shift from 12 am to 8 am. In this study, it has been noted that the morning calls were more followed by evening and night calls, and the same was the case before CCR establishment also. ([Table 3](#))

The PIS (which is a type of patient/ clinical information system which is dedicated to collect, store and make available clinical information essential to the delivery of patient care) was started on 22<sup>nd</sup> May. After that, the number of calls received in CCR reduced tremendously because the patients' attendants used to get updated information about their patients twice daily (morning and evening) regularly. This is due to the successful implementation of the PIS in the remaining six weeks and the resultant decrease in the CCR load, thereby improved CCR functioning and better patient management. The meticulous planning and implementation of CCR helped to solve the problems. The coordination between the different teams assisted in the distinction among the multiple patients with the same name, age, sex, timely management of the patients and systemic monitoring made anarchy into satisfied client satisfaction.

However, all these were not so easy, to begin with as there were many teething problems. The provided mobile numbers of the patients were either not correct most of the time, some were out of coverage area, and some received no response at all. All these were attributed to the low performance of PIS during the initial days of its introduction in CCR. The CCR made calls to the attendants regarding their patient's well-being, sent text messages, and updated their information. Then gradually, the problems were resolved, and within ten days, the messages start flowing to the patients' relatives/ attendants appreciably. By the 15<sup>th</sup> day, 100 % coverage

of the patients was achieved, and PIS ran very smooth till the end. (Table - 4) This resulted in reducing the workload of CCR, and there was optimal utilization of the resources. The proper functioning of CCR contributed in reasonable recovery rates of 87.72% as a whole. The timely diagnosis and interventions helped in quicker treatment regimens and regular monitoring facilitated in treatment outcomes. In our study, the total patients in the three-month study period were 1132, out of which 993 (87.72%) were recovered, and 139, unfortunately, died (12.28%) because of varied reasons. (Table 1) The maximum death occurred in higher age group patients (> 40 years and above) and was found to be statistically significant, and the same was consistent with the findings of E. S. Asirvatham et al. (2) Further, in our study, no statistically significant difference was found among the deceased as far as their age group, and sex is concerned ( $p > 0.05$ ). (Table 2)

The sudden hike in covid-19 cases has put tremendous pressure on the health system, as the high-risk people viz, senior citizens, immunocompromised people, and those with chronic diseases also develop severe COVID-19 and are at an increased risk for adverse outcomes. (10) Alarming evidence is coming up for the young and adult general population as they are also at risk for critical illness and adverse outcomes. (11)

As the number of cases were not coming down, public health efforts focused on reducing mortalities. When a health system is overburdened, and the morale of health care workers is affected significantly, the standard of health care services would be compromised, leading to adverse health outcomes. Current therapeutic strategies to deal with COVID-19 are only supportive, and prevention efforts to reduce transmission in the community are considered the most effective methods. (12) In our study, there was no doubt havoc situation in those three months (April, May & June). Still, things were under control as the covid-19 warriors' morale was high till the end despite various odds apart from the successful implementation of PIS through the CCR.

It has also been pointed out in a study that the COVID-19 deaths could be reduced provided there is accurate early diagnosis, identification of clinical features of severe risks, prediction of disease progression and appropriate clinical exposure, especially among the vulnerable ones, may reduce the spread and severity of infection as well as covid mortality and produce a better clinical outcome. (13)

It has been reported that there are 12 times more deaths among patients with chronic illnesses than those with no underlying conditions (19.5% versus 1.6%). (14) "The risk of dying from coronavirus disease is also linked to underlying health conditions such as cardiovascular disease, diabetes mellitus, kidney disease and hypertension, and the health-care system capacity. The test, track and treat strategy of India has targeted diagnosis, treatment, surveillance, supply chains, and strengthening health systems. All these, along with the

appreciable efforts of covid warriors, has resulted in lowering the case fatality rate."

Globally, age is always a significant predictor for the risk of death due to Covid-19, which preferably affects people in their mid-fifties, the sixties and seventies the hardest. In a study, the findings indicated a disproportionate death rate among the categories of age, gender and geography. They also demonstrated that age is the most significant risk factor for death due to COVID-19. The current study also confirms almost the same existing evidence except for geography as being not included in the study. 2 The high death rate with advanced age is expected. It could be due to chronic diseases, the reduced and less responsive innate and adaptive immune system among the elderly. (15, 16) However, in our study, comorbidity data collection is one of the limitations.

Many studies have revealed less mortality among women, which could be due to the protection of the X chromosome and sex hormones, which play an essential role in providing innate and adaptive immunity and are consistent with our findings. (17) The higher mortality among men could be due to behavioral risk factors such as smoking, and alcohol consumption, which are relatively higher among men in India. (18)

E. S. Asirvatham et al. reported the prevalence of any one or more comorbidities among the deceased was found to be around 85%, and a significant proportion of deceased having other comorbidities such as diabetes, hypertension, and CAD, respectively, with a strong association with age. Many researchers confirmed that the disease severity increased the admission rate in intensive care units (ICU). Increased risk of mortality of COVID-19 are strongly associated with comorbidities. (10, 19, 20) Studies in China reported around 70% of deaths with anyone comorbidity, (10,21) South Korea and Brazil reported 83% and 90.7%. These studies have reported hypertension, CAD, and diabetes as the main comorbidities among deaths. (22, 23)

It has been recognized that the patient's ability to control the viral load determine the severity of the Covid-19 symptoms, and it is this ability that gradually decreases as the age advances and, apart from other attributable factors, may result in immune-senescence and inflammation contributing to high mortality rate among the aged covid-19 patients. (24, 25)

Finally, in our study, after managing 1132 patients in three months as per the standard guidelines and with the help of dedicated and committed members of the CCR team and incorporation of an effective PIS as well as resultant handling of 12,622 calls, the cases in Muzzafarnagar Medical College and nearby areas showed significant improvement. The closure of CCR was on 2<sup>nd</sup> July 2021 after a successful contribution in combating the fight against Covid-19 pandemic in Northern India.

The success story of the Covid Control Room, which was the backbone of combating the covid cases, may be

attributed to the dedication of all the covid warriors involved and no doubt the strict commitment of the management & administration of the institute itself.

### Conclusion

COVID-19 deaths, spread and severity of infection could be reduced with accurate early diagnosis, identification of clinical features of severe risks, prediction of disease progression and appropriate clinical exposure, especially among the vulnerable ones, which produced a better clinical outcome.

CCR did not just answer queries but also showed the callers the road to recovery, clarify nagging doubts and offer psycho-social support. Many people call the control room just for a bit of reassurance. A sense of being in the war was palpable in the CCR, and on what makes it all meaningful: - "We were not just answering calls but saving lives."

### Recommendation

These findings will serve as a ready reference to preparedness for the upcoming third wave in India. This is more effective by the wealth of insights gleaned from situations experienced from the second wave of the pandemic in India.

### Limitation of the study

Cases have been considered from 1<sup>st</sup> April, though CCR started from 25<sup>th</sup> April 2021. There are not many reviews of the literature to compare as it is one of its kind of a study. The collected data also have limitations in terms of completeness, such as the presence/ absence of chronic diseases that were not recorded in all the deaths.

### Relevance of the study

The covid control room and its scope have expanded considerably to address the various aspects of the health crisis. It can be replicated in any epidemic situation, Covid or non-Covid.

### Authors Contribution

SS - Instrumental in the concept, study design & initial manuscript drafting. GSM - Overall supervision, reviewed & approved the final manuscript. KM – Critically reviewed the manuscript thoroughly and prepared the final draft. SKR- Systematize the collection of data and subsequent analysis and review. SS - Assisted in analysis and also in initial script drafting and editing.

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**Tables**

**TABLE 1 AGE-GROUP & SEX-WISE PROFILE OF ADMITTED COVID PATIENTS WITH THEIR MANAGEMENT OUTCOME. (N= 1132)**

Variables	Categories	Management Outcome						Total (N=1132)		χ <sup>2</sup> test p - value	
		Recovered (n=993)		Death (n=139)		No.	%	No.	%		
		No.	%	No.	%						
Age group (years)	< 40	263	Col % Row %	26.48 91.96	23	Col % Row %	16.55 08.04	286	Col % Row %	25.26 100.0	χ <sup>2</sup> <sub>2, 0.05</sub> = 6.63 df = 2 <b>p &lt; 0.05</b> Significant
	40 - 60	445	Col % Row %	44.81 86.74	68	Col % Row %	48.92 13.25	513	Col % Row %	45.32 100.0	
	> 60	285	Col % Row %	28.70 85.58	48	Col % Row %	34.53 14.41	333	Col % Row %	29.42 100.0	
	Total	993	Col % Row %	100.0 <b>87.72</b>	139	Col % Row %	100.0 <b>12.28</b>	1132	Col % Row %	100.0 100.0	
Sex	Male	634	Col % Row %	63.85 88.79	80	Col % Row %	57.55 11.20	714	Col % Row %	63.07 100.0	χ <sup>2</sup> <sub>1, 0.05</sub> = 2.07 df = 1 <b>p &gt; 0.05</b> Insignificant
	Female	359	Col % Row %	36.15 85.88	59	Col % Row %	42.45 14.11	418	Col % Row %	36.93 100.0	
	Total	993	Col % Row %	100.0 <b>87.72</b>	139	Col % Row %	100.0 <b>12.28</b>	1132	Col % Row %	100.0 100.0	

**TABLE 2 ASSOCIATION BETWEEN AGE & SEX OF COVID – 19 PATIENT DEATHS. (N = 139)**

Age (Years)	Sex-wise patient death				Total (n=139)		χ <sup>2</sup> test p - value
	Male (n <sub>1</sub> = 80)		Female (n <sub>2</sub> = 59)		No.	%	
	No.	%	No.	%			
< 40	13	16.25	10	16.95	23	16.55	χ <sup>2</sup> <sub>2, 0.05</sub> = 0.765 df = 2 <b>p &gt; 0.05</b> (Insignificant)
40 – 60	37	46.25	31	52.54	68	48.92	
> 60	30	37.50	18	30.51	48	34.53	
Total	80	100.0	59	100.0	139	100.0	

**TABLE 3: WEEKLY CALL DISTRIBUTION OF THE PATIENTS’ RELATIVES/ ATTENDANTS AND THEIR PERCENTAGES RECEIVED AT COVID CONTROL ROOM. (N = 12662)**

Week No.	Shift-wise call distribution						Total (n = 12622)	
	Morning (n <sub>1</sub> =4612)		Evening (n <sub>1</sub> =4056)		Night (n <sub>1</sub> =3954)		No.	%
	No.	%	No.	%	No.	%		
1	541	11.73	590	14.55	590	14.92	1721	13.63
2	1185	25.70	1137	28.03	1122	28.40	3444	27.30
3	1323	28.70	1115	27.50	1125	28.45	3563	28.22
4	718	15.56	533	13.14	646	16.33	1897	15.03
5	415	09.00	338	08.33	304	07.70	1057	08.37
6	214	04.64	170	04.20	85	02.14	469	03.72
7	123	02.66	92	02.26	40	01.01	255	02.02
8	79	01.71	63	01.55	27	00.68	169	01.34
9	14	00.30	18	00.44	15	00.37	47	00.37
Total	4612	100.00	4056	100.00	3954	100.00	12622	100.00
Column %	4612	36.539	4056	32.134	3954	31.326	12622	100.00
Row %	4612	36.539	4056	32.134	3954	31.326	12622	100.00

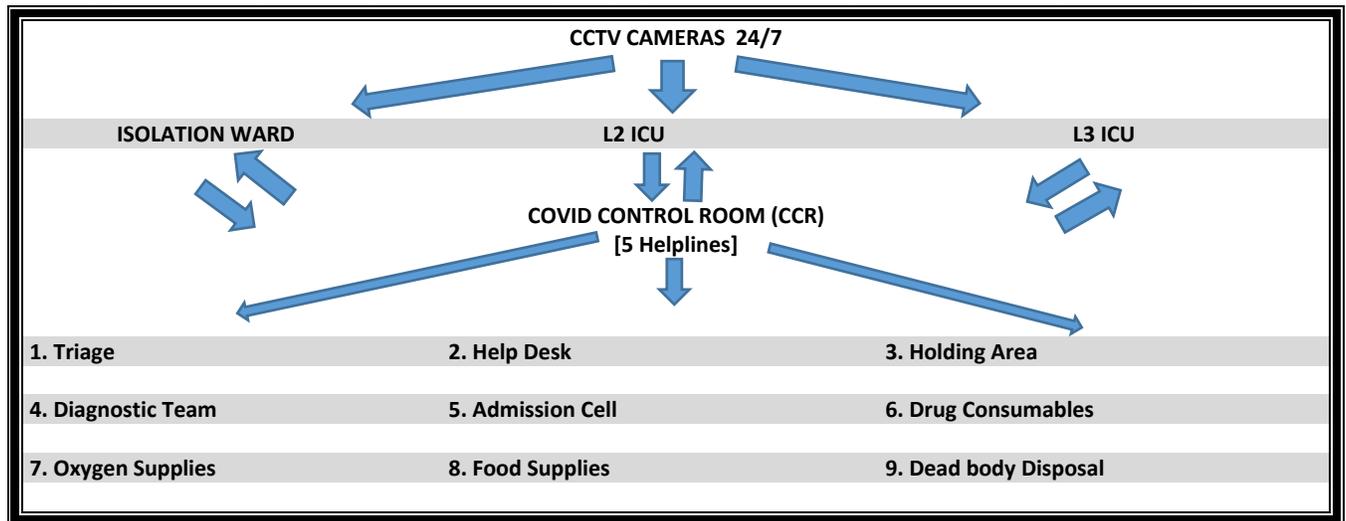
χ<sup>2</sup><sub>16, 0.05</sub> = 136.897; df = 16; p < 0.0001; Highly Significant

**TABLE 4 TREND WISE DISTRIBUTION OF PIS DATA SHARED TO PATIENTS’ RELATIVES/ ATTENDANTS BY CCR**

Event Days	Total No. of Patients	Total No. of PIS data sent (Morning)	
		No.	%
On day - 01	94	29	30.85
On day - 10	61	60	98.36
On day - 15	38	38	100.0
On day - 42	02	02	100.0

**Figures**

**FIGURE 1 PICTORIAL REPRESENTATION OF DIFFERENT FUNCTIONAL UNITS OF COVID CONTROL ROOM**



**FIGURE 2 DAY- WISE DISTRIBUTION OF PIS DATA SENT TO THE PATIENTS’ RELATIVES/ ATTENDANTS**

