A comparative study of wave 1 and 2 mortality factors among COVID-19 patients in a level 3 medical college hospital in Saharanpur India

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ABSTRACT

Background: In COVID-19, second wave death rate climbed in several states of India including Uttar Pradesh with relatively high number of casualties as compared to first wave. The literature lacks scientific reason behind this. **Aims and Objectives:** The present study aimed toward detection of mortality factors for COVID-19 patients from a Level 3 Medical College Hospital in both waves in Western UP District in India so as to find a better treatment strategies for COVID-19 patients for possible next 3rd COVID-19 wave. **Materials and Methods:** This study is aimed to find any difference in Wave 1 and 2 mortality factors among COVID-19 patients in a Level 3 Medical College Hospital in western up district Saharanpur in India from April 1, 2020 to Sep 30, 2021. **Results:** Although there were more number of deaths in Wave 2 (n = 537) as compared to Wave 1 (n = 172), deaths even after treatment of COVID-19 were more in wave 1 (72%) as compared to wave 2 (67.9%), but it was not statistically significant (P > 0.05). In COVID -19, Wave 1 most of the patients were elderly (aged >60 years) (40.3%) whereas in Wave 2 45–60 years age group were more affected (40.5%). Presence of more than 2 comorbidities was also seen more in wave 1 (37.1%) as compared to Wave 2 (23.8%). In COVID-19, both Waves (1 and 2) the most common co-morbidity was Type2DM (52% and 36.4%, respectively), but DM was found to be more in COVID + ve patients of Wave 1 as compared to wave 2 COVID + ve patients whereas any CARDIAC abnormality co-morbidity was found more in Wave 2 patients as compared to Wave 1 (14.2% vs. 12.1%). **Conclusion:** Possibly COVID-19 virus operated differently at Cardio-respiratory system leading to increased mortality in COVID-19 patients in Wave 2.

Key words: COVID-19; Hypertension; Level 3 hospital; Mortality; T2DM; Wave 1; Wave 2

INTRODUCTION

Till May 15 2021 after combining data of Waves 1 and 2, India reported nearly 25 million cases and 2.7 lakh deaths and estimated number of infections were in 36% of the population and an estimated (combined) infection fatality rate was 0.25%.[1] There could be few possible reasons for this such as:[1,2] a) Different age composition of the infected populations in the two waves; as the younger population got infected in larger numbers in wave 2 although they had lower risk of COVID-19 mortality, b) A fraction of the older population (aged 65 + years) also got vaccinated during wave 2. Despite the high number of COVID-19 fatalities in 2nd Wave, the death rate in the second COVID wave in India remained initially lower than the first. However, the second wave death rate climbed rapidly in a short span of time as several states reported a relatively high number of casualties as time progressed further.[3-5] In the 2nd wave the younger individuals got infected, in addition to older ones.[6] The symptoms of COVID-19 2nd wave

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are also variable, especially like gastrointestinal.[7] Later on, there was a significant percentage increase in the death rate in the second wave, but due to alarmingly high number of infections, the total death numbers were also disappointingly high.[8]

In this regard in one European Study,[9] by the European Research Network in Artificial Ventilation (REVA) which focused on Intensive care in European Union, found that 95% of these patients were in France, others in Belgium, and Switzerland. This study showed a high mortality for elderly patients, immunocompromised patients and also patients with extreme obesity or diabetes. The same study also showed that the faster the admission in intensive care after the first symptoms, the higher the mortality.

In another study[10] outside India, which also revealed that people who lived in areas flagged for extreme socioeconomic vulnerability had elevated mortality risk in our predominantly African-American cohort of COVID19 patients who were able to seek hospital care during the so-called "first wave" of the pandemic. By contrast, Black race was not associated with mortality in this study. Mortality factors revealed from many studies[9-13] may also have been operated in Indian Context cannot be said definitely. Moreover, according to Indian Media sources such as Newspaper (Hindustan times) approximately 70% of the admitted patients were above 40 years in both the waves of the pandemic and the proportion of males were slightly lower in second wave as compared to the first.[14]

Possibly the premature relaxation of safety measures, the mass gatherings, the insufficient vaccine roll-outs, and the spread of highly virulent COVID-19 variants have brought India's health system to its knees. This issue has attracted much scrutiny and international criticism over the failures of the administration also.[15]

Despite availability of above data from few studies,[9-15] the exact scenario of Wave 1 and Wave 2 mortality factors are lacking in Literature, due to this research gap, this study was carried out by researchers in this article.

Aims and objectives
The present study aimed toward detection of mortality factors for COVID-19 patients from a Level 3 Medical College Hospital in both waves in Western UP District in India so as to find a better treatment strategies for COVID-19 patients for possible next 3rd COVID-19 wave.

MATERIALS AND METHODS

This study aimed to answer the following Research Question: There is a difference in Wave 1 and 2 mortality factors among COVID-19 patients in a Level 3 Medical College Hospital in Western up District Saharanpur in India.

The study aimed toward detection of mortality factors for COVID-19 patients from a Level 3 Medical College Hospital in a Western UP District in India so as to find, better treatment strategies for COVID-19 patients for the next COVID-19 3rd wave.

This research was carried out in India on Patients admitted in a Level 3 Medical College Hospital of India, for which the ICMR's Ethical guidelines for biomedical and health research on human participants (2017) were strictly adhered.

The study was carried out in COVID-19 Control Room in Collaboration with Department of Medicine and Anaesthesia. The study was started after approval from IEC Committee In charge and Principal of Medical College. The confidentiality in study was ensured by not disclosing the identity of patients. The authorization letter was obtained from principal and study was approved by IEC Committee (IEC no: IEC-19-18-2-2022).

The working definition of UP Govt. of COVID-19 guidelines as per ICMR recommendations for both Waves (1 and 2) was followed. According to which patient was considered COVID-19 disease if Pt had fever, cough, and breathlessness suggestive of COVID-19 with Confirmation from RTPCR test from BSL-2 Lab in Medical College.

The present study was undertaken on all patients secondary data admitted in various wards of Level 3 Hospital from from April 1, 2020 to Aug 31, 2021.

All patients admitted in Wave 1 and 2 were enrolled.

The secondary data from Control Room were taken from data entry operator of control room after obtaining permission from IEC Committee of Institution from April 1, 2020 to Sep 30, 2021 (1 year and 6 Months), till the last patient of COVID-19 was admitted in this Medical College Hospital.

The following study criteria was taken:
All patients of any age, sex, religion, and caste who were admitted in various wards of a Level 3 Medical College Hospital in a Western UP District Saharanpur India were included in this study.

The data from COVID Control Room from a Level 3 Medical College Hospital in a Western UP District in India were undertaken and analyzed.

Study was done from April 2020 to till 30th Sep 2021.

This study was done as per the following Gantt Chart Method.

Date of completion of IEC approval completion from IEC committee	25th Sep 2021
Date of completion of data analysis	30th Sep 2021
Statistical analysis completion	7th Oct 2021
Journal article writing work	October 15–Dec 15, 2021

This was done by statistical software Epi-Info ver 7.2.2.2. The Proportions were calculated and Chi-square test of Significance was applied to know P values.

RESULTS

The data from Wave 1 and 2 (till June 2021) in Level 3 Hospital Facility revealed the following findings:

Total 3182 COVID-19 patients were admitted in this health facility from April 1, 2020 to September 30, 2021, out of which 1815 were discharged (35 Refereed, 572 DOPR), LAMA were 40. The Total COVID deaths (combined in Wave 1 and 2) were 489. Although total mortality rate was 709 (22.2%), COVID mortality even after treatment was higher in Wave 1 (72%) as compared to Wave 2 (67.9%). However, this difference was not statistically significant (P>0.05) (Table 1).

Although there were more no of deaths in Wave 2 (n=537) as compared to Wave 1 (n=172), COVID-19 Deaths were more in Wave 1 (72%) as compared to Wave 2 (67.9%) but less no of deaths occurred after patient COVID status turned negative from positive in Wave 2 (22.7%) as compared to Wave 1 (28%).This finding was not statistically significant.(P>0.0.5) (Table 1).

In COVID-19, Wave 1 Elderly above 60 years were maximum affected (40.3%) whereas in Wave 2, 45–60 Years age group was more affected (40.5%). Younger age group (31–45 years) was affected in Wave 2 (19.7%) as compared to Wave 1 (13.7%) (Table 2).

In COVID -19, Wave-1 patients at least 1 co-morbidity was found in 42.7% whereas in Wave 2 no co-morbidity was found in 48.5% patients. More than 2 comorbidities were more in wave 1 (37.1%) as compared to Wave 1 (23.8%) (Table 3).

In COVID-19, both Wave 1 and 2 the most common co-morbidity was DM (52% and 36.4%, respectively), but DM was more in Wave 1 as compared to Wave 2 CARDIAC abnormality as co-morbidity was found more in Wave 2 as compared to Wave 1 (14.2% vs. 12.1%), whereas respiratory illness co-morbidity was similar in Wave 1 (11.3%) and Wave 2 (11%) (Table 4).

The common co-morbidities in both Wave 1 (2020) and Wave 2 (2021) associated with mortality were obesity (2.4% and 100%), respiratory illnesses (11% each), cardiac abnormalities (12.1% and 14.2%) including DM (41.9% and 36.5%), and hypertension (38.7% and 31%) least were mental illnesses (4%). Factors which were statistically significantly different and were associated with mortality in Wave 1 and Wave 2 were DM, Hypertension, obesity (P<0.05) but respiratory and cardiac illnesses differences between COVID-19 Wave 1 and Wave 2 were not statistically significant (P>0.05) (Table 5).

DISCUSSION

In our present study, although there were more No of deaths in Wave 2 (n=537) as compared to Wave 1 (n=172), but COVID-19 Deaths were more in Wave 1 (72%) as compared to Wave 2 (67.9%) but less no of deaths occurred after patient COVID status turned negative from positive in Wave 2 (22.7%) as compared to Wave 1 (28%). There could be two explanations about this decrease. The first and main explanation is a better knowledge of the disease and its treatments, mainly by the use of corticosteroid and oxygenation. The second explanation is the reduction in pressure on the hospital system since April. Hence, less affected patients could be welcomed in hospitalization and intensive care units, and possibly they were less affected and their chances of survival are higher as found in a study[15]

In our present study, in COVID-19 Wave 1 elderly above 60 years were maximum affected (40.3%), whereas in Wave 2 45–60 years age group was more affected (40.5%). Younger age group (31–45 Years) was affected in Wave

Table 1: Profile of COVID-19 death status of patients as per treatment given

COVID treatment given	Wave-1 (2020) (n=172)		Wave-2 (2021) (n=537)	
	Frequency	Percentage	Frequency	Percentage
COVID+ve Deaths	124	72.0	365	67.9
COVID−ve Deaths post treatment	48	28	172	22.7

Chi-square values: Corrected χ²=0.8, df=1, P=0.36, OR=1.2, RR=1.1, P>0.05

Table 2: Personal profile of COVID-19 patients death

Personal Profile	Wave-1 (2020) (n=124)		Wave-2 (2021) (n=365)	
	Frequency	Percentage	Frequency	Percentage
Age				
≤30.00	6	4.8	21	5.8
31.00–45.00	17	13.7	72	19.7
46.00–60.00	45	36.3	148	40.5
61.00–75.00	50	40.3	97	26.6
76.00+	6	4.8	27	7.4
Chi-square values: χ^2=7.8, df=1, P=0.05				
Gender				
F	35	28.2	157	43.0
M	89	71.8	208	57.0

Table 3: Number of co-morbidity in COVID-19 patients death

Number of co-morbidities	Wave-1 (2020) (n=124)		Wave-2 (2021) (n=365)	
	Frequency	Percentage	Frequency	Percentage
0	25	20.2	177	48.5
1	53	42.7	101	27.7
2	33	26.6	42	11.5
3	10	8.1	16	4.4
4	3	2.4	29	7.9
Chi-square values				

Table 4: Types of co-morbidity in COVID-19 patients

Types of co-morbidities	Wave-1 (2020) (n=124)		Wave-2 (2021) (n=365)	
	Frequency	Percentage	Frequency	Percentage
DM	52	41.9	133	36.4
HTN	48	38.7	113	31.0
RA	2	1.6	0	0.0
OBESITY	3	2.4	0	0.0
RESPIRATORY	14	11.3	40	11.0
MENTAL ILLNESS	5	4.0	0	0.0
CA	2	1.6	1	0.3
CARDIAC	15	12.1	52	14.2
Other illnesses	13	10.5	8	2.2

2 (19.7%) as compared to Wave 1(13.7%). These findings in our study were in Unison with few related studies[6-8,14-15]

The second COVID-19 wave in India was slightly different than the first one, with higher mortality being reported in all age groups except those below 20 years, and more people developing acute shortness of breath and requiring supplemental oxygen and mechanical ventilation, a new study revealed.[14] This study – Clinical profile of hospitalized COVID-19 patients in first and second wave of the pandemic: Insights from an Indian registry-based observational study found that – the mean age of the patients was significantly lower in the second wave with higher proportion of patients in the younger age group intervals of less than 20 years, and 20–39 years, the study said.[14] The second wave of COVID-19 in India was slightly different in presentation than the first wave, with a younger demography, lesser comorbidities, and presentation with

breathlessness in greater frequency," the study stated.[14] These findings in our study were also in Unison with few related studies.[6-8,14-15]

In our present study, in COVID -19 wave at least 1 co-morbidity was found in 42.7% whereas in Wave 2 no co-morbidity was found in 48.5% and presence of > than 2 comorbidities were however more in wave 1 (37.1%) as compared to Wave 2 (23.8%). One study[12] in UK revealed that a propensity-score-matched analysis revealed an increased risk of mortality in patients with advanced cirrhosis (CTP-B and CTP-C) compared with a UK cohort of 620 patients with SARS-CoV-2 infection but not chronic liver disease.

The common co-morbidities in both Wave 1 (2020) and Wave 2 (2021) associated with mortality were obesity (97.6% and 100%), respiratory illnesses (89% each), cardiac abnormalities (88% and 86%) including DM (58%), and

Table 5: Details of comparison of individual co-morbidity of COVID-19 died patients in Wave 1 (2020) (n=124) and Wave-2 (2021) (n=365)

Type 2DM				
	Wave 1		Wave 2	
	Frequency	Percent	Frequency	Percent
NO	72	58.1	232	63.5
YES	52	41.9	133	36.5
Total	124	100.0	365	100

Corrected Chi-square values : χ^2=16.9, df=1, P=0.00, RR=0.5, OR=0.4, 95% CI:=0.2–0.6
Significant statistical difference

Hypertension				
	Wave 1		Wave 2	
	Frequency	Percent	Frequency	Percent
No	76	61.3	252	69.0
Yes	48	38.7	113	31.0
Total	124	100.0	365	100.0

Corrected Chi-square values: χ^2=34.6, df=1, P=0.00, RR=0.4, OR=0.29, 95% CI:=0.1–0.4
Significant statistical difference

Obesity				
	Wave 1		Wave 2	
	Frequency	Percent	Frequency	Percent
No	121	97.6	0	0
Yes	3	2.4	365	100
Total	124	100.0	365	100

Corrected Chi-square Values: χ^2=5.3, df=1, P=0.00, RR=4.0
Significant statistical difference

Respiratory illness				
	Wave 1		Wave 2	
	Frequency	Percent	Frequency	Percent
No	110	88.7	325	89.0
Yes	14	11.3	40	11.0
Total	124	100.0	365	100.0

Corrected Chi-square Values : χ^2=0.0, df=1, *P*=1.00, RR=1.0, OR=1.0
No statistical difference

MENTAL ILLNESS				
	Wave 1		Wave 2	
	Frequency	Percent	Frequency	Percent
No	119	96.0	0	0
Yes	5	4.0	365	100
Total	124	100.0	365	100

Corrected Chi-square Values : χ^2=457, df=1, *P*=0.00, RR=0.0, RR=0.01
Significant statistical difference

Cardiac				
	Wave 1		Wave 2	
	Frequency	Percent	Frequency	Percent
No	109	87.9	313	85.8
Yes	15	12.1	52	14.2
Total	124	100.0	365	100.0

Corrected Chi-square Values : χ^2=0.2, df=1, *P*=0.6, RR=0.0, RR=0.01
No Significant statistical difference

hypertension (61.3% and 69%) least were mental illnesses (4%). These findings in our study were in Unison with few related studies.[9,10]

In our present study, in COVID -19 both Wave 1 and 2 the most common co-morbidity was DM (52% and 36.4%, respectively) but DM was more in Wave 1 as compared to wave 2 whereas in Wave 2 cardiac abnormality co-morbidity was found more in Wave 2 as compared to Wave 1 (14.2% vs. 12.1%) whereas respiratory co-morbidity was similar in Wave 1 (11.3%) and Wave 2 (11%). These findings in our study were in Unison with few related studies.[10,11] The uncontrolled hypertension during COVID-19 is the main culprit and is hidden terrorist responsible for premature heart attack, brain attack, leg attack, lung attack, eye attack, and nose attack.[13]

In our present study, the common co-morbidities in both Wave 1 (2020) and Wave 2(2021) associated with mortality were obesity (97.6% and 100%), respiratory illnesses (89% each), cardiac abnormalities (88% and 86%) including DM (58%), and hypertension (61.3% and 69%) least were mental illnesses (4%). Study,[9] by the REVA focused on 4244 patients in intensive care, from February 25 to May 4 showed a high mortality for elderly patients, immunocompromised patients and also patients with extreme obesity or diabetes.

A few factors were statistically significantly different in Wave 1 and Wave 2 such as DM, hypertension, obesity (P<0.05) but respiratory and cardiac illnesses differences between COVID-19 Wave 1 and Wave2 were not significant (P>0.05) this suggests that possibly COVID-19 virus operated differently at cardio-respiratory system for causing increased mortality in COVID-19 wave 2.

Limitations of the study
This article is based on hospital-based secondary data, so representativeness to population can be an Issue. Few constraints such as lack of investigations such as HRCT scan, D-Dimer which were not available to define exact COVID-19 cases severity, is also a limiting factor of this study.

CONCLUSION

In COVID-19, Wave 1 in our set up the respiratory and cardiac abnormalities were main associated factors with COVID-19 deaths, but in Wave 2 these factors were less associated, pointing toward the possibility that in Wave 2 virus mutation such as delta variant may have been more responsible for more damage to cardio-respiratory system in COVID-19 deaths in our Level 3 Medical College facility in Saharanpur, India. However, authors further detailed studies from higher centers in future on mortality factors of COVID-19 in Wave 2 in Indian context.

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