Determinants of mortality in COVID-19 infection in western Uttar Pradesh, India: A Retrospective Study

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Abstract: A new disease SARS-COV -2 popularly known as COVID-19 had become global pandemic taking toll of many lives in short time. India is among the most severely affected countries with on-going COVID-19 pandemic. It is very crucial to determine the factors related to mortality in COVID-19 infected cases to reduce the further deaths. The aim of the study is to assess the determinants related with COVID-19 mortality.

Objectives: 1.To study the socio demographic profile of deceased from COVID-19 infection. 2. Assessment of factors related to mortality from COVID-19 infection.

Methodology: An observational retrospective study was conducted by telephonic interview of family members of all deceased provided in the line-list of deaths in the Meerut district, Uttar Pradesh, India on pre-designed pretested validated questionnaire during study period. The detailed information regarding progress of the disease and hospitalization was also obtained from the death summary of the hospital deaths and data collected was entered and analyzed in Epi info7.2.3.1 software.

Result: The case fatality ratio is around 2%.Increasing age, male gender ,urban population, delay in investigation and hospitalization ,poor health seeking behaviour are the determining factors in increasing mortality. Breathlessness followed by fever, cough are the most common presenting symptoms. Diabetics with Hypertension are at very high risk as compared to isolated non communicable diseases.

Conclusion: Though the COVID-19 disease is highly infectious but the mortality is not very high in first wave and vulnerable population needs more focus with proper planning and strategies. IEC needs to be promoted for early investigation and treatment.

Key words: COVID-19, mortality, determinants,

Introduction:

On 11th March, 2020, the WHO declared that COVID-19 was a global pandemic, indicating significant global spread of an infectious disease and reiterated the call for countries to take immediate step, speed up treatment response and measures to reduce transmission. Coronavirus disease (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and this novel coronavirus spreads primarily through droplets and aerosols of saliva or discharge from the nose when an infected person coughs or sneezes and may present with varying degrees of severity, namely mild, moderate or severe. COVID-19 has incubation period ranging from 1 to 14 days. The spectrum of the severest form of the disease includes acute respiratory distress syndrome (ARDS), severe pneumonia, sepsis and septic shock. COVID-19 has spread rapidly its roots to the different parts of the world, affecting billions of lives.[1],[2] The pandemic over more than a year is causing social and economic disruptions and overwhelming health-care systems. Multiple public health and social measures (PHSM) have been strategized and used to slow down community spread. Some of these PHSMs are restriction in domestic and international travel, social gatherings,

closing of schools, offices, religious places, etc.[3],[4] Various preventive measures have been proposed by the WHO and health ministries of different countries such as the use of masks, social distancing, hand hygiene, and respiratory etiquettes.[3] This has led to a lot of changes in our day-to-day lifestyle. Most of the countries have also imposed nationwide lockdowns of varying lengths and intensity, in an attempt to break the chain of transmission.[4] Numbers alone cannot possibly measure the impact of pandemic on world. With implemented lockdown again and again in several countries, it has not only imposed the restrictions on travel but also lead to shrinking economies, leaving people with starvation and degrading livelihood of many people across the world.

The first case of COVID-19 in India was reported from Kerala on 30th January , 2020 and soon sporadic cases were reported from all over the country within few months. Health Ministry has adopted various approaches like isolation, home quarantine, contact tracing and case management enhancing community participation at primary health care level. The WHO has been working closely with the Government of India to step-up preparedness and response measures for COVID-19, including surveillance and contact tracing, laboratory testing, risk communications and community participation, prevention and control and execution of these measures plan at district, state and national levels. Admirably, the Government of India countered with several proactive measures to prevent the emerging epidemic and demonstrated high level of political and administrative commitment. Health ministry constructed public health strategy to contain the infection in consultation with Indian Council of Medical Research (ICMR) and National Centre for Disease Control (NCDC) with support from other ministries of the government. According to health ministry COVID-19 positivity rate is 5.11%, 97% recovery rate and mortality rate is 3% as compared to 7% globally (2020).

Uttar Pradesh which is densely populated was also not untouched. Meerut district in Western Uttar Pradesh witnessed its first case in the month of mid -march and then as like all over country it too experienced widespread of COVID -19 cases putting all the health sector on its toes . Being in the vicinity of Delhi, capital of India and as a part of NCR, Meerut trend was quite similar to Delhi.

As per now it is clearly established that early detection and isolation of case and early initiation of drugs as well as quarantine of exposed plays a very crucial aspect to prevent the development of severity or complication. Knowledge of epidemiological characteristics and determinants of mortality in COVID infection is crucial in terms of planning interventions to reduce transmission risk to their contacts, geographical limitation and health logistics planning to treat COVID-19 patients. Thus, the current study was planned to explore the medical and non- medical factors which are directly or indirectly responsible or related with mortality of confirmed cases of COVID-19 patients presenting to a tertiary care health facility in Meerut, Uttar Pradesh, India.

Aim: Assess the determinants related with COVID-19 mortality.

Objectives: 1.To study the socio demographic profile of deceased from COVID-19 infection. 2. Assessment of factors related to mortality from COVID-19 infection.

Methodology: The line list of all the deaths occurred in the Meerut district, Uttar Pradesh, India among confirmed COVID -19illness during study period was obtained from the Chief Medical Office, Meerut. Telephonic interview of family members of all deceased was taken on pre-designed pretested validated questionnaire. The detailed information regarding onset

of symptoms, progress of the illness, treatment history, condition during hospitalization etc. and death summary of the all deaths occurring in hospitalized patients were obtained and analysis drawn from it. Data collected was entered and analyzed in Epi info7.2.3.1 software. Case fatality ratio (CFR) is defined as the proportion of individuals diagnosed with a disease who die from that disease and therefore CFR measures the severity among detected cases. The severity of COVID-19 has been widely reported to be influenced by increasing age, gender, locality, health seeking behaviour and underlying comorbidities. According to WHO a COVID-19 death is a death resulting from a clinically compatible illness in a probable or confirmed COVID-19 case unless there is a clear alternative cause of death that cannot be related to COVID-19 disease without any period of complete recovery between the illness and death.

Duration of study : September,2020 to November 2020 ie.3 months.Total number of deaths in confirmed COVID-19 cases during the study period in Meerut district is 259 (September-115,October-71 and November -73).

Result: In the Meerut district mortality among confirmed COVID-19 cases were 115, 71 and 73 in September, October and November month 2020 respectively. The case fatality ratio (CFR) was 2.2% in September, 2.1% in October and 1.4% in November. All 259 families of expired patients were contacted based on the provided contact number in the line list. We got response from 201 (77.6%) families and 58 (22.39%) turned out to be nonresponsive (16.98% had provided wrong contact number and 5.4% refused to cooperate).

   Of all maximum mortality 117 (45.17%)   had occurred in the age group 45 to 64 years followed by 91 (35.13%) in age group 65 and above,38 (14.6%) in age group 19-44 years,02 (0.78%) in 6-18 years and 01(0.39%) in less than 5 years.COVID-19 death was more in males 176(68%) compared to females 83(32.04%).Urban area was most commonly affected 247(95.36%) than rural area 11(4.64%).Death was reported highest in Hindu religion 230(88.8%) in comparison of Muslim 27(10.42% and others 02(0.77%).Majority of expiry 214(82.62%) occurred in designated COVID hospitals followed by 19 (7.33%) expiry in non-COVID hospital,13 (5%) at home and 15(5%) on the way to hospital. In all 233(89.96%) patients were hospitalized either in COVID or non COVID hospital for the management whereas rest expired suddenly at home or on the way to hospital. After hospitalization serious confirmed COVID-19 patients 85 (36.48%) died within 4-7 days,75 (32.18%) died within 24 hours of admission followed by 30 (12.87%) patients expired within 2-3 days , 29 (12.44%) after 8 days and 6 % were those whose duration of stay in hospital can't be determined. Difficulty in breathing alone was the most common symptom in nearly 55 (27.23%) patients followed by presence of all the three symptoms of fever, cough and shortness of breathing among 38(14.67%) patients, fever with breathing difficulty in 35(13.5%) ,only fever in 30 (11.58%),only cough in 25(9.6%),non -specific symptoms like generalized weakness, fatigue, body ache, malaise in 20 (7.72%),fever with cough in 16(6.17%), asymptomatic in 14(5.4%), vomiting in 8 (3%) other symptoms in 11(4.24%),07 (2.7%) had chest pain,07(2.7%) abdominal pain ,loose motion in 4(1.54%),swelling over limbs in 4(1.54%) and loss of appetite in 3 (1.15%).

    In the study 19 (7.33%) patients had COVID positive members in their families which were the source of contact for them. Most of the patients 92(35.52%) expired within 4-7 days of the onset of symptoms followed by 43(16.6%) within 8-10 days, 41(15.8%) within 11 to

20 days,09(3.47%) within 2-3days, more than 20 days in 08(3.08%) , 03(1.1%) within 24 hours of onset of symptoms and 44(17%) were can't be determined due to incomplete or lack of death summary. Reporting of positive COVID-19 sample is an essential aspect in initiation of its management. It is observed in the study that 103(39.76%) patients expired within 4-7 days of confirmation of positivity for COVID compared to 66(25.48%) within 24 hours,38(14.67%) within 48-72 hours ,17(6.56%) in 8-10 days,05(2%) within 8-10 days ,2(0.7%) after 20 days and 21(8.1%) cannot be determined. Duration between onset of symptoms and hospitalization of patient is also essential. In the study 233 patients in all were hospitalized prior their demise. 53(22.74%) patients admitted within 4-5 days of onset of symptoms followed by 50(21.45%) within 2-3 days, 22(14%) within 24 hours, 25(10.72%) within 6-7 days,13(5.5%) more than 12 days. Among all the deaths under study 165(63.7%) had one or two chronic illness. Most common co-morbidity is diabetes with hypertension in 39(23.63%) patients followed by isolated diabetes mellitus among 29(17.57%), hypertension in 28(16.96%), chronic kidney disease in 20(12.12%), heart disease among 17(10.3%),chronic obstructive pulmonary disease in 10(6%),liver disease in 07(4.24%) and other conditions like cancer, brain hemorrhage, pregnancy etc. compromise of 17(10%).

 The study have identified some non- medical factors which might indirectly influenced the initiation of the management of COVID-19 patients and their outcome. From the response of 201 families it is observed that 57(28.35%) patients investigation was delayed and therefore the diagnosis. Poor health seeking behavior was the most common reason among 28(14%) followed by 21(10.4%) ,07(3.4%) where the private practioner prescribed the medicine for symptoms and private non –COVID-19 hospitals without advising COVID test at very first point of contact respectively and 0.4% due to own negligence. Hesitancy and lack of information regarding admission in COVID-19 hospital resulted in wandering of patients from one private hospital to another in 07(3.48%) patients, delay in arrival of government ambulance in 05(2.48%) and 03(1.5%) due to insufficient communication by visiting health team are the other non-medical factors which might indirectly led to loss of crucial time in initiation of management of patients.

Discussions: This study was observational retrospective, record-based which aimed to explore epidemiological characteristics and determinants of mortality in COVID-19 patients .In this study, we found case fatality ratio (CFR) ranging between 1.4 to 2.2 % among the positive cases which was similar in Tamil Nadu, Andhra Pradesh (2.06%) [1]and Uttar Pradesh (1.3to2.0%)[2] .In India, the case fatality ratio for COVID-19 is lower than that observed in high-income countries. This difference might be due to the age structure of the Indian population, which is comprised of larger proportion of younger population. In our study expiry was highest (45.17%) in the age group of 45-64 years followed by 65 years and above (35.13%) compared to least in under five population same as found in studies done in Bihar and Tamil Nadu by Agrawal et.al[3] and Edwin Asirvatham[4] et. al respectively. The study analysed that COVID -19 deaths was more in male (68%) than females and urban (95%) than rural areas. Similar findings were observed in study conducted by Agrawal et.al[3] in Bihar and by Dehingia N[5] et.al. The novel corona virus knows no caste and religion but to surprise positive cases as well as deaths were reported high in Hindu religion compared to Muslims and the reason attributed to this can be stigma and current political scenario among Muslim religion resulting in hiding reporting of symptoms and testing. Nearly 82.62% patients

expired in COVID-19 hospitals (62.6% in public and 31.34% in private) established by health system in the study similar to higher mortality (71%) found in Tamil Nadu.[4] In the current study fever (64.34%) and breathing difficulty (55.40%) were the most common symptoms reported followed by dry cough among 30.44% and 14.54% had fever, breathing difficulty and dry cough together at the time of admission which are in line with the existing literature that fever, dry cough, shortness of breath and fatigue were the common symptoms on admission among the deceased patients.[6,7] Another study that reviewed 24,410 cases across the world showed 78% of the cases with fever and 58% with cough.[8] Secondary infection was linked to 7.33% of deceased patients which is similar to study done in western UP by Gargi et al.[9] In our study, the prevalence of any one or more comorbidities among the deceased was found to be around 63.7% %.Studies in China reported around 70% of deaths with any one comorbidity[10,7]South Korea and Brazil reported 83% and 90.7%; and these studies have reported diabetes, hypertension and CAD as the main comorbidities among deaths.[11,12] Considering co-morbidity in the present study diabetes ,hypertension emerged as a significant risk factor for COVID-19 mortality among 41% deceased (presence of both conditions in 23.63% and single condition in 17% each) . This was similar to the findings of a New Delhi and Tamil Nadu study by Aggarwal *et al*. and Laxminarayan et al.[13,1] The median time interval between starting of symptoms and hospital admission was found to be 4 days, which is within the range mentioned in studies from Southern India ,China and Italy (3–10 days) .[4,6,14] The duration might change during the different phases of the epidemic due to rapid changes in the level of knowledge and awareness, stigma, fear of the disease, health-seeking behaviour and availability of health services. According to our study, time interval between hospital admission and expiry was maximum in the range of 3-7 days (37%) and within 24 hours among32% patients. Other countries reported a slightly higher, but a wide range of 5–16 days of time interval between hospital admission and death.[6] The shorter period of hospital stay with negative outcome could be due to the delayed seeking of care due to lack of awareness about the disease, shortage of COVID facilities with ICU beds and ventilators. Study found that the time interval between the onset of symptom and death is in the range of 3-7 days for majority of deceased followed by 8-10 days similar in Southern part of India.[4] Nearly 40% cases ascertained before death in current study succumbed within 3-7 days of testing and 26% were identified ≤24 hours before death. Our estimates of time to death after confirmation by testing are same as in other parts of the country[1,4] . Findings in our study indicates that large proportions of the patients were diagnosed late in their disease course, although other factors like patient's health status, capacity of health care institution and approach to end-of- life care can also be contributing factors in time to death.

Conclusion: The study concludes that the increasing age ,male, people living in densely populated areas and with underlying comorbidities expired disproportionately due to COVID-19 infection .The study estimated a time interval of 8-14 days between onset of symptoms and death, with 4-7 days each for symptoms onset to hospital admission and admission to death. Among the vulnerable and elderly population the shorter interval between onsets of symptoms to admission in hospital is very critical as it would lead to early diagnosis and treatment resulting in better outcome and markedly reduced mortality. As the number of mortality from COVID-19 continues to increase, early diagnosis and timely treatment for moderate and severe cases are of crucial importance. The increasing awareness

of the impact of these factors may help decision makers, the public health officials, and the general public better control the risk of pandemic, particularly in the reduction in the deaths of COVID-19.

Recommendation: It is essential to focus on awareness though IEC (i.e. information, education and communication) in all individual of society with special emphasis on vulnerable population in order to reduce gaps from onset of symptoms to testing and hospitalization. A good quality training of all the health professionals from doctors to ward attendant is required. Government also needs to provide better infrastructure for speedy testing, early diagnosis and treatment after hospitalization to reduce mortality from COVID infection.

Limitations: The analysis is based on data available for deaths that were reported in the district through hospital admission. The data have limitations in terms of completeness such as the presence of symptoms that were not reported in all the deaths.

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Ethical approval: The study was approved by the Institutional Ethics Committee.

 Conflict of interest: Nil

Authors Contribution: All the authors have equally contributed.

References:

1. Laxminarayan R Wahl, B Dudala SR et al. Epidemiology and transmission dynamics of COVID-19 in two Indian states. Science 370,691-697(2020) *medRxiv*. 2020; (published online July 17.) (preprint) https://doi.org/10.1101/2020.07.14.20153643

2. Upadhyay Ashwini ,Research Square ,BHU, Analysis of COVID-19 case falality ratio in the states and UT of India https:/orcid.org/0000-0001-5610-3912

3.Neeraj Agrawal, Bijit Biswas, Pallavi Lohani Epidemiological determinants of COVID-19 infection and mortality: A study among patients presenting with severe acute respiratory illness during the pandemic in Bihar, India, Niger Postgrad Med J. Oct-Dec 2020 Year : 2020,Volume : 27, Issue : 4 ,Page : 293-301

4. Edwin Sam Asirvatham , Charishma Sarman et al, Who is dying from COVID-19 and when? An Analysis of fatalities in Tamil Nadu, India, Clinical Epidemiology and Global Health ,Volume9,January-march 2021,pages 275-279.

5. Nabamallika Dehingia, Anita Raj, Sex Difference in COVID-19 case fatality, Do we know enough? The Lancet Global Health, Volume 9,issueE14-15,January 01,2021

6. T. Chen, D. Wu, H. Chen, *et al.* T. Chen, D. Wu, H. Chen, *et al.* Clinical characteristics of 113 deceased patients with coronavirus disease 2019: retrospective study BMJ, 368 (2020), p. m1091.

7. Y. Du, L. Tu, P. Zhu, *et al.*Clinical features of 85 fatal cases of COVID-19 from wuhan. A retrospective observational study Am J Respiratory Critical Care Med, 201 (11) (2020), pp. 1372-1379

8. M.C. Grant, L. Geoghegan, M. Arbyn, *et al.* The prevalence of symptoms in 24,410 adults infected by the novel coronavirus (SARS-CoV-2; COVID-19): a systematic review and meta-analysis of 148 studies from 9 countries PloS One, 15 (6) (2020), Article e0234765.

9. Pandey et.al. Household secondary attack rate of COVID -19 and its associated risk factors in western Uttar Pradesh: A cross sectional study, International Journal of Scientific Research,Volume9,issue 12,dec-2020,page:74-75.

10. W.-J. Guan, W.-H. Liang, Y. Zhao, *et al.* Comorbidity and its impact on 1590 patients with COVID-19 in China: a nationwide analysis Eur Respir J, 55 (5) (2020), p. 2000547

11. J. Pachiega, AJdS. Afonso, G.T. Sinhorin, *et al.* Chronic Heart Diseases as the Most Prevalent Comorbidities Among Deaths by COVID-19 in Brazil Revista do Instituto de Medicina Tropical de São Paulo (2020), p. 62

12. Korean Society of Infectious D, Korea Centers for Disease C, Prevention Analysis on 54 mortality cases of coronavirus disease 2019 in the Republic of Korea from january 19 to march 10, 2020 J Kor Med Sci, 35 (12) (2020), pp. e132-e

13. Aggarwal A, Shrivastava A, Kumar A, Ali A. Clinical and epidemiological features of SARS-CoV-2 patients in SARI ward of a tertiary care centre in New Delhi. J Association of Physicians India 2020;68:19-26.

14. Giacomelli A, Ridolfo AL, Milazzo L, et al. 30-day mortality in patients hospitalized with COVID-19 during the first wave of the Italian epidemic: a prospective cohort study. *Pharmacol Res.* 2020;158:104931.

15. Rees EM, Nightingale ES, Jafari Y, et al. COVID-19 length of hospital stay: a systematic review and data synthesis. *Med Rxiv.* 2020.04. 30.20084780.

Table no. 01 Distribution of case fatality ratio

Months -2020	Total positive cases	Total number of deaths	Case fatality ratio (%)
September	5,228	115	2.2
October	3,397	071	2.1
November	5,219	073	1.4
Total	13,844	259	1.87

Table no: 02   Distribution of respondents

Deceased due to COVID -19	Frequency (N)	Percentage (%)
Contacted	201	77.68
*Unable to contact	044	16.98
**Non-cooperative	014	5.40
Total	259	100

*unable to contact : either phone was not picked up after repeated calls, provided number was incorrect , out of service or unreachable. ** non –cooperative means relative refused to give details. Table no: 03 Socio-demographic factors of study subjects

Factors	No. of COVID-19 death	Percentage (%)
1.Age (year)		
less than 5 years	01	0.39
6-18	02	0.78
19-44	38	14.6
45-64	117	45.17
65 and above	91	35.13
Total	259	
2.Gender		
Male	176	68
Female	083	32.04
3.Residence		
Urban	247	95.36
Rural	011	4.64
4.Religion		
Hindu	230	88.80
Muslim	027	10.42
Others	02	0.77

Table no: 04 Factors associated with COVID-19 mortality

1.Place of death	**Number of deaths (N)**	**Percentage (%)**
COVID hospital	214	82.62
Non –COVID hospital	019	7.33
Brought dead to hospital	013	5.02
Home	013	5.02
2.Duration of stay in hospital before death		
Within 24 hours	75	32.18
1-2 days	30	12.87
3-7 days	85	36.48
8 days and more	29	12.44
Not known	14	06
Total	233	89.96
Dead prior to admission	26	10.03
3.Duration between onset of symptoms and death		
Within 24 hours	03	1.1
24-48 hours	09	3.47
3-7 days	92	35.52
8-10 days	43	16.60
11-20 days	41	15.8
More than 20 days	08	3.08
Can't be determined	44	16.98

Total		
4.Duration between reported positive and death		
Within 24 hours	66	25.48
24 hours to 48 hours	38	14.67
3-7 days	103	39.76
8-10 days	17	6.56
11-20 days	05	1.93
More than 20 days	02	0.77
Can't be determined	21	8.10
5. Duration between onset of symptoms and hospitalization		
Within 1 day	33	14.1
2-3 days	50	21.45
4-5 days	53	22.74
6-7 days	25	10.72
8-10 days	11	4.7
More than 11days	13	5.5
*Can't be determined	48	20.6
Total	233	100

* reason : due to unavailability of death summary from private COVID and non -COVID hospitals.

Table no: 05 Symptoms in COVID-19 infection

Presentation of the disease	Number of deaths	Percentage (%)
a. Asymptomatic	14	5.4
b. fever	30	11.58
b. dry cough	25	9.6
c. shortness of breath	55	21.23
d. fever with dry cough	16	6.17
e. fever with breathlessness	35	13.5
f. fever, dry cough, breathlessness	38	14.67
g. loss of appetite	03	1.15
h*.non specific symptoms	20	7.72
i. chest pain	07	2.7
j. swelling on limbs	04	1.54
k. vomiting	08	3.0
l. pain in abdomen	07	2.7
m. Loose motion	04	1.54
n. others	11	4.24

COVID Positive family members	19	7.33

*Non-specific symptoms include headache, body ache, malaise, weakness.

Table no: 6 Among all the deaths under study 165 deceased were having chronic illness.

Co-morbidities	No. of deaths	Percentage (%)
Diabetes	29	17.57
Hypertension	28	16.96
Diabetes with Hypertension	39	23.63
Heart disease	17	10.30
Chronic renal disease	20	12.12
Liver disease	07	4.24
Chronic obstructive pulmonary disease	10	6.06
Pregnancy	01	0.6
*others	16	9.7
Total	165	100

*others include cancer, brain hemorrhage, immune compromised diseases etc.

Table no: 07 Non-medical factors influencing the outcome of the disease

Indirect factors related with death		No. of deaths (N)	Percentage (%)
1.Delay in Investigation	a. Poor health seeking behaviour	28	14
	b.at the level of Private Practioner	21	10.4
	c.at the level of non-COVID Hospital	07	3.4
	d. At the level of patient	01	0.4
Total		57	28.35
2.Delay in treatment (Due to wandering in private hospitals)		07	3.48
3.Delay in transportation		05	2.48
4. Due to improper communication of visiting Health team		03	1.5