Sociodemographic and clinical characteristics associated with COVID mortality among hospitalized patients in Rajasthan: A retrospective observational study

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ABSTRACT

Background: It has been over a year since the declaration of novel coronavirus disease (COVID-19) as pandemic by World Health Organization on March 11, 2020. Although mortality in India is low, as compared to western countries, the steady increase in the number of cases is still a worrying sign. The objectives of this study were to identify and quantify the association between sociodemographic and clinical characteristics with mortality among patients, suffering from COVID-19 at a tertiary care hospital in Udaipur, Rajasthan. Material and Methods: This retrospective observational study involved 824 patients hospitalized for COVID 19 at a tertiary hospital in Udaipur, who were discharged or had died. Electronic health records of the patients were accessed to retrieve the sociodemographic information (age, gender, residence, religion, socioeconomic status), history of exposure, clinical characteristics on admission, comorbidities, and outcomes (recovery or death). The Cox regression model was used to calculate associations between mortality and baseline characteristics in the form of hazard ratios (HRs). Results: Mortality in this study was found to be 5.82%. The mean age of the patients was 48.14 ± 16.2 years. The median time from time of admission to discharge was 8 days (interquartile range (IQR) 5–11), whereas the median time to death was 5 days (IQR 4–10). The variables found to be associated with higher mortality were age (HR 1.17; 95% confidence interval (CI) 1.15–1.24), residing in urban area (HR 1.29; 95% CI 1.17–2.15), diabetes mellitus (HR 1.3; CI 1.02–5.57), and patients having both diabetes and hypertension (HR 2.4; CI 1.69–3.14). Conclusion: Sociodemographic variables and comorbidities impact the mortality among COVID 19 patients. The variables most clearly associated with a greater hazard of death were older age, urban area, diabetes, and having both diabetes and hypertension.

Keywords: Clinical, COVID 19, India, mortality, socio demographic

Introduction

It has been more than a year since the declaration of novel coronavirus disease (COVID-19) as pandemic by World Health Organization on March 11, 2020. With over 180 million cases and 3.8 million deaths worldwide, pandemic has not halted yet.[³] As of July 6, 2021, India had over 30 million cases and 397,637 deaths.[²] Being the second-most populous country in the world, with inflated population density and poor socioeconomic conditions, tackling a pandemic becomes even more challenging. Also, providing the specialist or intensive care to a relatively large number of patients can be an arduous task for the health authorities, and that too at an affordable price to the poor people is an extra burden on public health department. Resource deficit health sector in India is at the
verge of saturation and health care professionals are at the risk of physical and mental exhaustion.\textsuperscript{[8]}

With the emergence of new, more transmissible variant of COVID 19, the path to halt this pandemic seems worrisome.\textsuperscript{[6]}

In India, there is an additional challenge of supply huddles and hesitancy associated with COVID vaccination, implying the control of subsequent wave of COVID 19 to be more difficult. As part of the pandemic response to first and second COVID wave, Indian government formed multidisciplinary taskforces and advisory panels. One of the strategies was allocation of geographical areas as red (hotspots), yellow, and green zones in descending order of case load and implementing the control practices accordingly.\textsuperscript{[8]} However, for the prevention of subsequent waves, investing in primary care physicians and community health workers is required, to address the social determinants of COVID 19-associated morbidity and mortality.\textsuperscript{[4]}

Primary health care sector can help address the misinformation, fear, and stigma surrounding Covid-19 and facilitate timely access to health care systems. Some countries (like Taiwan and New Zealand) have successfully been able to flatten the curve and have one of the lowest mortality burdens.\textsuperscript{[3]} Although mortality in India is low, as compared to western countries, the steady increase in the number of cases is still a worrying sign. Hence, there is a need to study the factors associated with COVID 19 infection and its outcomes.

Moreover, the clinical presentation of COVID 19 patients and their outcomes have been variable in different countries.\textsuperscript{[8-10]} In India, various studies determined the clinical profile and outcomes of COVID 19 patients.\textsuperscript{[11,12]} Jain et al.\textsuperscript{[13]} also explored factors associated with mortality in different countries. Evidence suggests that sociodemographic characteristics of a country play a crucial role in its fight against Covid-19, which might be the reason for lower case fatality rate in South Asian subcontinent as compared to developed countries. In this study, we are estimating the association of various sociodemographic and clinical characteristics with the mortality among COVID 19 patients.

### Materials and Methods

This retrospective observational study was conducted among 824 patients admitted for COVID 19 treatment in a 1200 bedded tertiary care hospital in Udaipur, Rajasthan and who died or were discharged between July 10 and October 26, 2020. Only positive reverse transcription polymerase chain reaction test was considered as diagnostic criteria for the patients included in this study. The information about the patients was collected from electronic medical records of the hospital. The following variables were analyzed:

1. Age (as a continuous variable and stratified into groups, i.e., $<20$, $20-29$, $30-39$, $40-49$, $50-59$, $60-69$, $70-79$, and $\geq 80$ years);
2. gender;
3. residence (urban or rural);
4. religion;
5. socioeconomic status: Determined by using modified BG Prasad socioeconomic status scale (used for both urban and rural area);\textsuperscript{[14]}
6. history of exposure to COVID patient;
7. clinical characteristics on admission (cough; fever; breathlessness; anosmia, headache, diarrhea, or other gastrointestinal symptoms; myalgia);
8. co-morbidities (hypertension; diabetes mellitus; tuberculosis; chronic kidney disease; heart disease); and
9. outcome data (dead/discharged).

Analysis of the outcome variables: Death and days of hospital stay.

Quantitative variables were presented as mean and standard deviation (for normally distributed data); median and interquartile range (IQR), for the data which was not normally distributed. Frequency distribution was done for categorical variables and determined as proportions. For each categorical variable, the distribution of deaths and discharges were estimated. Since we defined outcome as either discharge or death, the patients who remained hospitalized till the end of study period (October 26, 2020) were included as censored data in analysis. We used Chi-square test or Fisher’s exact test to compare the differences between survivors and nonsurvivors where appropriate.

The Cox proportional hazard regression model was used to calculate hazard ratios (HRs) to assess the association between death rate (hazard) and patients’ sociodemographic characteristics, clinical features, and comorbidities. In the regression model, $P$ value of 0.05 was set for the inclusion and 0.10 for exclusion. The 95% confidence interval (CI) was calculated for each HR. Data were analyzed using Statistical package for the social sciences version 16 (IBM Corp. Released 2012. IBM SPSS statistics for Windows, Armonk, NY).

Ethical considerations: Approval from institutional ethical committee was taken, before the study was conducted (GU/HREC/EC/2020/1826). All data was anonymized before the analyses. Informed consent was not required due to the characteristics of the design.

### Results

All the 824 patients, who were included in the study were cases of COVID19, confirmed by RTPCR test. The mean age of the patients was 48.14 years (standard deviation – 16.2), ranging from 10 to 80 years, and most patients (64.3%) were males. Forty-eight patients died during hospitalization; 776 (94.1%) recovered and were subsequently discharged. Barely more than half (54.6%) of the patients belonged to Hindu religion (96%) and socioeconomic class II (78.6%) according to modified BG Prasad classification. Comorbidities were found to be there in 15.2% patients, with hypertension being the most common
comorbidity (58.4%), followed by diabetes (32%); six (4.8%) patients had both hypertension and diabetes, while six (4.8%) patients had either Chronic kidney disease or cardiovascular disease. At the time of admission, almost half of the patients (49.8%) presented with the combination of symptoms, followed by fever (10.1%) and breathlessness (9.6%) [Table 1]. The median time from time of admission in hospital to discharge was about 8 days (IQR 5–11), whereas the median time to death was 5 days (4–10).

Table 2 shows the proportions of deaths among the admitted patients with stratified baseline characteristics. Forty-eight (5.8%) patients in the present study died. No patients younger than 30 years died; as age increased, the proportion of deaths also increased, e.g., 1.6% in patients aged 30–39 years (95% CI 1.1–12.6), 2.4% in those aged 40–49 (95% CI 1.8–14.8), 7.6% in those aged 50–59 (95% CI 5.6–15.2), 8.4% in those aged 60–69 (95% CI 6.8–17.1), 19.7% in those aged 70 to 79 (95% CI 13.6–26.2), and 23.5% in those 80 years old or more (95% CI 19.1–30.7). About 7.3% (33 out of 450) of the patients belonging to urban area died, while 4% (15 out of 374) from rural area died, and difference was statistically significant. Table 2 also shows that 13.9% (11 out of 79) of patients who presented with breathlessness at the time of admission died; 7.1% (29 out of 410) of patients presented with the combination of symptoms (fever, cough, breathlessness) died and 3.6% (3 out of 83) of the patients who had only fever at the time of admission died. None of the patients who presented with only anosmia or cough died. Out of 125 patients who presented with comorbidities, 33.3% (2 out of 6) patients who had both diabetes and hypertension died; 10% (4 out of 40) of patients with diabetes died and 8.2% (6 out of 73) patients with hypertension died. In our study, 5% (35 out of 699) of the patients with no comorbidities died.

To quantify the association between outcome or hazard of death and characteristics recorded at the time of admission, we calculated HRs with the Cox stepwise regression model [Table 3]. The variables which were included in the final model and were found to be associated with higher mortality were age (HR 1.17; 95% CI 1.15–1.24), residing in urban area (HR 1.29; 95% CI 1.17–2.15), DM (HR 1,3; CI 1.02–5.57) and patients having both DM and HTN (HR 2.4; CI 1.69–3.14).

### Table 1: Sociodemographic variables, clinical features, and comorbidities among the study participants

| Variables                  | n (Total) | Percentage | n (Deaths) | Percentage |
|---------------------------|-----------|------------|------------|------------|
| Gender                    |           |            |            |            |
| Male          | 530       | 64.3       | 30         | 5.7        |
| Female        | 294       | 34.7       | 18         | 6.1        |
| Age           |           |            |            |            |
| <20           | 10        | 1.2        | 0          | 0          |
| 20-29         | 125       | 15.2       | 0          | 0          |
| 30-39         | 125       | 15.2       | 2          | 1.6        |
| 40-49         | 166       | 20.1       | 4          | 2.4        |
| 50-59         | 172       | 20.9       | 13         | 7.6        |
| 60-69         | 143       | 17.4       | 12         | 8.4        |
| 70-79         | 66        | 8.7        | 13         | 19.7       |
| ≥80           | 17        | 2.1        | 4          | 23.5       |
| Residence     |           |            |            |            |
| Urban         | 450       | 54.6       | 33         | 7.3        |
| Rural         | 374       | 45.4       | 15         | 4          |
| Religion      |           |            |            |            |
| Hindu         | 792       | 96.1       | 46         | 5.8        |
| Muslim        | 27        | 3.3        | 2          | 7.4        |
| Christian     | 5         | 0.6        | 0          | 0          |
| Socioeconomic status |             |            |            |            |
| Class I       | 124       | 15         | 6          | 4.8        |
| Class II      | 648       | 78.6       | 40         | 6.2        |
| Class III     | 52        | 6.4        | 2          | 3.8        |
| Exposure history |         |            |            |            |
| Yes           | 793       | 96.2       | 45         | 5.6        |
| No            | 31        | 3.8        | 3          | 9.6        |
| Clinical features |       |            |            |            |
| Fever         | 83        | 10.1       | 3          | 3.6        |
| Cough         | 65        | 7.9        | 0          | 0          |
| Breathlessness| 79        | 9.6        | 11         | 13.9       |
| Combination   | 410       | 49.8       | 29         | 7.1        |
| Anosmia       | 4         | 0.5        | 0          | 0          |
| Myalgia       | 50        | 6.1        | 1          | 2          |
| No symptoms   | 133       | 16.1       | 4          | 3          |
| Comorbidities |           |            |            |            |
| HTN           | 73        | 8.9        | 4          | 5.5        |
| DM            | 40        | 4.9        | 3          | 7.5        |
| Both HTN and DM | 6       | 0.7        | 2          | 33.3       |
| Others        | 6         | 0.7        | 1          | 16.7       |
| No comorbidity| 699       | 84.8       | 38         | 5.4        |
| Total         | 824       | 100        | 48         | 5.82       |
The mean age of the patients was 48.14 ± 16.2 years, which is comparable to other studies done in India but lower than that of other countries.\textsuperscript{[11,12,15]} This can be attributed in part to the greater population aging in developed nations, where people aged 65 years or more account for nearly 50% of the population vs. 10% in India.\textsuperscript{[15,16]}

Similar to other studies, increasing age was significantly associated with higher mortality with HR of 1.17 (95% CI 1.15–1.24).\textsuperscript{[11,15]}

Females (34.7%) were affected less than males (64.3%). This finding is similar to a study done in Jaipur, where 39% females were affected as compared to 61% of males.\textsuperscript{[12]}

In our study, about 55% of patients were residents of urban area and were found to have significantly greater hazard of death (HR 1.29, 95% CI 1.17–2.15) than rural patients. This can be due to higher population density in urban India as compared to rural area. Since COVID 19 is highly transmissible disease, the urban individuals living in densely populated areas
have more possibility of coming in close contact with others and consequently infection spreads quickly. Bhandari A et al.\(^{[17]}\) demonstrated moderate association between Covid-19 spread and population density; on the average, both the infected and the death cases due to COVID 19 were higher for larger population density. The moderate association (R\(^2\) value not very high) between infection/mortality rate and population density implies that only a part of mortality due to COVID 19 can be explained in the terms of population density. This can be explained by the facts that the COVID 19-related mortality may depend on various other factors including geographical factors, socioeconomic conditions, prevailing health conditions, health infrastructure, average age of the residents of area, testing rate, etc.\(^{[17]}\) In our study, we explored other socio epidemiological factors such as religion, socioeconomic status; however, no significant association with the mortality was found. More research is required to understand these aspects.

Regarding the distribution of comorbidities and clinical symptoms on hospital admission, results are comparable to that of earlier studies, with hypertension (58\%) being the most common comorbidity followed by diabetes mellitus (32\%). Other comorbidities were coronary vascular disease and chronic kidney diseases.\(^{[8,11,15]}\)

In our study, it was found that having diabetes was associated with higher risk of death (HR 1.3, 95\% CI 1.02–5.57). Similarly, patients with both diabetes and hypertension had even higher mortality (HR 2.4, 95\% CI 1.69–3.14). Study done by Rivera-Izquierdo, M et al.\(^{[13]}\) revealed that diabetes mellitus (HR 2.42, 95\% CI 1.4–4.1) was associated with a greater hazard of death. The meta-analysis done by Kumar A et al.\(^{[14]}\) which included 33 studies (around 16,000 patients), found diabetes to be significantly associated with COVID 19 mortality with a pooled odds ratio of 1.9 (95\% CI 1.37–2.64; P < 0.01). Diabetes was also reported to be associated with severe infection with an odds ratio of 2.75 (95\% CI 2.09–3.62; P < 0.01). The combined odds ratio of mortality/severity was 2.16 (95\% CI 1.74–2.68; P < 0.01).

In our study, the most common symptom at the time of presentation was combination of two or more symptoms, low-grade fever being the most common. Bhandari et al.\(^{[15]}\) found that among symptomatic patients, fever (55.90\%) was the most common symptom followed by cough (52.75\%), sore throat (49.60\%), and shortness of breath (46.45\%). In the present study, the median time from time of admission to discharge was 8 days (IQR 5–11), whereas the median time to death was 5 days (4–10). Similar results were shown in study by Bhandari et al.\(^{[11]}\) in which majority of patients had early mortality after admission to hospital (within initial 3 days) and time to recovery/discharge varied from 5.4 to 7.6 days.

In India, the number of cases of COVID 19 is escalating, but the mortality has remained at a lower level than in other countries with almost similar numbers of COVID-19 infections. Our study also found mortality to be 5.8\%, which is remarkably lower than that of developed countries.\(^{[13]}\) Jain et al.\(^{[13]}\) did a comprehensive review of the differential mortality in COVID-19 patients from India and western countries. One of the rationales for lower mortality in India was believed to be India's stringent nationwide lockdown, supported by the findings in a study which reported that most of the Indians had favorable attitude and practices toward lockdown restrictions.\(^{[18]}\) So it could be one of the reasons for comparatively lower deaths in India. Also, it can be seen that recent unlocking of restrictions in India and migration of people has led to a rise in the number of reported infections and deaths.\(^{[13]}\)

Another opinion is that India's sociodemographic characteristics, which are very different from developed countries, play a crucial role in its fight against Covid-19. It is acknowledged that COVID 19 mortality is greater among elderly people, across all countries, and western countries have higher proportion of older people.\(^{[23]}\) India on the other hand is relatively younger nation. As per report by Ministry of Statistics and Program Implementation youth in India will comprise 34.33\% of total population in near future.\(^{[23]}\) It is believed that younger population can combat the virus better. India also has much more rural population, which has lesser population density and is far less mobile than urban population. Inherent immunity against respiratory viruses and BCG vaccination in India are other possible explanations, given for lower mortality in India. However, evidence is still inconclusive and research to understand these aspects is needed. Our study highlights the factors associated with significant mortality due to COVID 19, which includes comorbidity (diabetes and hypertension), older age and urban residents. As per Indian Council of Medical Research, there was 30\% rise in mortality during second Covid-19 wave,\(^{[23]}\) emphasizing the importance of analyzing the mortality variables in a resource-constrained setting like ours, and devising the appropriate prevention and control strategies for vulnerable population.

**Conclusion**

COVID 19 has affected countries all over the world and impacted lives and economy. Even after almost a year or so, the nations with much robust health facilities are still struggling to control the pandemic. Developing countries like India, which already suffer from poor infrastructure/health facilities and growing population need to have more vigorous and specific approach to avoid the crisis due to COVID 19. Our study highlights the determinants of COVID 19 mortality in India. Older age, having diabetes, and being from urban area were found to be significantly associated with greater hazards of death. These characteristics define a profile of patients with an elevated death rate for whom a specific approach to management is needed.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other
clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

**Financial support and sponsorship**
Nil.

**Conflicts of interest**
There are no conflicts of interest.

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