

1 Title: "Vaccination saves lives: A real-time study of patients with chronic diseases and severe COVID-19
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3 **109 Abstract**
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6 111 Objectives: This study aims to describe the demographic and clinical profile and ascertain the
7 112 determinants of outcome among hospitalised COVID-19 adult patients enrolled in the National
8 113 Clinical Registry for COVID-19 (NCRC).
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11 115 Methods: NCRC is an on-going data collection platform operational in 42 hospitals across India. Data
12 116 of hospitalized COVID-19 patients enrolled in NCRC between 1st September 2020 to 26th October
13 117 2021 were examined.
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16 119 Results: Analysis of 29,509 hospitalised, adult COVID-19 patients [mean (SD) age: 51.1 (16.2) year;
17 120 male: 18752 (63.6%)] showed that 15678 (53.1%) had at least one comorbidity. Among 25715
18 121 (87.1%) symptomatic patients, fever was the commonest symptom (72.3%) followed by shortness of
19 122 breath (48.9%) and dry cough (45.5%). In-hospital mortality was 14.5% (n=3957). Adjusted odds of
20 123 dying were significantly higher in age-group ≥ 60 years, males, with diabetes, chronic kidney diseases,
21 124 chronic liver disease, malignancy, and tuberculosis, presenting with dyspnea and neurological
22 125 symptoms. WHO ordinal scale 4 or above at admission carried the highest odds of dying [5.6 (95%
23 126 CI: 4.6, 7.0)]. Patients receiving one [OR: 0.5 (95% CI: 0.4, 0.7)] or two doses of anti-SARS CoV-2
24 127 vaccine [OR: 0.4 (95% CI: 0.3, 0.7)] were protected from in-hospital mortality.
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27 129 Conclusions: WHO ordinal scale at admission is the most important independent predictor for in-
28 130 hospital death in COVID-19 patients. Anti-SARS-CoV2 vaccination provides significant protection
29 131 against mortality.

30 132 Keywords: SARS-CoV2, mortality, risk factors, outcome, COVID-Vaccine
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136 **Introduction**

137 Globally, and in India, the pandemic of SARS-CoV-2 have resulted in unprecedented morbidity and
138 mortality with detrimental effect on healthcare systems and economies. As a response to the
139 pandemic, the 'National Clinical Registry for COVID-19' was initiated by the Indian Council of
140 Medical Research (ICMR) in September 2020, with a broad objective to collect good quality, real-
141 time data for evidence-based decision making in clinical practice, public health program and policy.

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143 Hospital mortality among COVID-19 patients has varied from 19-39% across various studies.¹⁻⁶ It has
144 been observed that men, elderly (>60 years of age), and those with comorbidity such as asthma,
145 chronic obstructive pulmonary disease, tuberculosis, pneumonia, diabetes mellitus,
146 hypertension, renal, hepatic, and cardiac diseases and individuals with history of smoking or
147 substance use, history of kidney transplant are at higher risk of developing severe disease or
148 progression to death. The factors associated with such outcomes have been varied; older age being
149 consistent among many populations while others varied amongst studies.¹⁻⁸

150 Indian investigations have reported association of old age, presence of diabetes mellitus, presence of
151 severe acute respiratory infection, raised inflammatory markers including interleukin-6, ferritin,
152 lactate dehydrogenase and d-dimer with progression of COVID and/ or related in-hospital mortality⁹⁻
153 ¹². Majority of these studies enrolled a small number of participants located at a single centre. Here,
154 we present data from a large cohort of hospitalized COVID-19 patients from 42 hospitals across the
155 country.

156 The aim of this analysis is to study the demographic profile, clinical characteristics, and outcomes
157 among hospitalised COVID-19 adult patients, enrolled in the National Clinical Registry for COVID-
158 19 (NCRC) and to ascertain the factors associated with predefined outcomes.

160 **Methods**

161 The National Clinical Registry for COVID-19 (NCRC) is a platform for on-going prospective data
162 collection, developed and maintained by ICMR in collaboration with the Ministry of Health & Family
163 Welfare (MOHFW), Government of India, All India Institute of Medical Sciences, New Delhi
164 (AIIMS) and the ICMR-National Institute of Medical Statistics (NIMS). The structure and protocol of
165 the registry are available in the public domain (<https://www.icmr.gov.in/tab1ar1.html>). A hub and
166 spoke model has been adopted for this registry. At the beginning, an expression of intent was invited
167 for participation in the registry network; willing hospitals were screened based on a site feasibility
168 matrix. A steering committee with subject experts guides the conduct of the registry and suggests
169 solutions to roadblocks, if any. A monitoring committee consisting of institutional principal
170 investigators oversees the progress of the registry and explores newer ideas and initiatives, to keep the
171 registry dynamic. The central implementation team at ICMR headquarters remains responsible for the
172 overall execution of the project.

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3 173 Across the network of NCRC, participating hospitals recruited consecutive in-patients, who had
4 174 COVID-19 infection confirmed by real time- polymerase chain reaction (RT-PCR), Nucleic acid
5 175 amplification test (NAAT) or Rapid Antigen Test (RAT). Demographic, clinical and outcome data are
6 176 collected in an on-going manner by the NCRC network. A dedicated team at the respective sites is
7 177 responsible for data collection and data entry under the supervision of the institutional primary
8 178 investigator and the central implementation team at ICMR. All the researchers were trained by the
9 179 central implementation team at ICMR via an online platform. Regular refresher trainings are
10 180 conducted in order to minimise errors, and to address the gaps created by change of personnel in the
11 181 teams.

12 182 Data is collected using a pre-structured case report form (CRF) and is entered into an electronic
13 183 portal, which has been developed and is being maintained by the ICMR-NIMS, Delhi. The CRFs
14 184 include socio-demographic information, symptom and comorbidity profile at the baseline, clinical
15 185 examination findings at the time of admission and on alternate days during the course of hospital stay,
16 186 results of laboratory investigations conducted as per treating physician and the outcomes of the
17 187 hospital stay.

18 188 The database platform is hosted on a secure server and is audited by the National Informatics Centre
19 189 (NIC). Information contained in the database, the configuration of the information within the
20 190 database, as well as the database itself are fully encrypted. Every client-server data transfer is
21 191 encrypted through a valid certificate. Data loss is prevented by frequent backup runs.

22 192 *Data Analysis*

23 193 Socio-demographic, clinical, laboratory and hospital outcome data were analysed; categorical data
24 194 presented as frequency and proportions and continuous data as mean (standard deviation) or median
25 195 (Inter-quartile range), as appropriate. Logistic regression model was used to determine the factors
26 196 associated with the outcome of the patients. For the purpose of outcome analysis, death was defined
27 197 as death due to any cause of a COVID-19 positive patient occurring during hospital stay. Patients who
28 198 were transferred to another hospital or left against medical advice were excluded from the outcome
29 199 analyses, though their baseline characteristics were analysed. Age, gender, body mass index, pre-
30 200 existing comorbidities, lag between symptom onset and admission, laboratory parameters at
31 201 admission including lactate dehydrogenase (LDH), ferritin, d-dimer, C-reactive protein (CRP) and
32 202 neutrophil to lymphocyte ratio (NLR), severity assessment by WHO ordinal scale¹³ and status of anti-
33 203 covid19 vaccination were used as explanatory variables in univariate analysis. Chi Square test, t-test
34 204 or rank sum test was used to examine the association between explanatory variables and outcome, as
35 205 appropriate. The variables with significant association and those with known clinical or contextual
36 206 importance were included in the multivariate logistic regression model. As laboratory values were

207 available for a limited number of participants, separate models were used for each of the biomarkers.
208 Data analysis was carried out using STATA v14 (College Station, TX, US).

209 *Ethical Aspects*

210 Approval was obtained from the Central Ethics Committee for Human Research at ICMR as well as
211 from the respective Institutional Ethics Committee of each of the participating centres. Considering
212 the observational nature of the registry, and collection of anonymised data being done primarily from
213 the routine case records of the patients, a waiver of consent was granted by the Ethics Committees.

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215 **Results**

216 We present here an analysis of 29,509 hospitalised COVID-19 patients over the age of 18 years who
217 were enrolled in NCRC from 1st September 2020 till 26th October 2021. The mean \pm SD age of the
218 study population was 51.1 ± 16.2 years; men (51.1 ± 16 years) being similar to that of women ($51 \pm$
219 16.5 years). Almost three fourth of the participants were at 40 years of age or above and two-thirds of
220 the study participants in this group were men. The mean \pm SD body mass index of the participants
221 was 24.8 ± 4.1 kg/m², with one-third of the participants being within normal range, while over 64%
222 were obese or overweight. (Table 1) Four per cent of the enrolled study participants were health care
223 workers.

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226 Of the 29509 patients enrolled, 3794 (12.9%) were asymptomatic at the time of admission and were
227 admitted due to conditions other than COVID-19 and later diagnosed to have COVID-19 or
228 developed COVID-19 during the course of hospitalisation. Among 25715 (87.1%) patients who were
229 admitted with symptoms, fever was the most common symptom (72.3%). Shortness of breath and dry
230 cough was recorded in 48.9% and 45.5% of patients, respectively. Some of the other symptoms were
231 fatigue (20.7%), cough with sputum (14.5%), sore throat (13.5%), muscle ache (12.3%) and headache
232 (11.2%). (S1 Figure)

233 Median haemoglobin, leucocytes count, neutrophils and lymphocytes were largely within normal
234 limits while the inflammatory markers were raised. (Table 1)

235 No comorbidities were present in 13831 (46.9%) patients; 15678 (53.1%) participants had at least one
236 comorbidity. Hypertension and diabetes mellitus were the commonest comorbidities reported among
237 32.4% and 26.2% of patients, respectively. Chronic cardiac disease and chronic kidney disease was
238 present among 5.7% and 3.6% of the study participants, respectively. Other diseases including
239 asthma, malignancy, chronic pulmonary disease, chronic liver disease, stroke, tuberculosis, chronic
240 neurological disease, rheumatologic disease, autoimmune disease, and haematological disorders, HIV
241 infection, Hepatitis B and Hepatitis C infection were each reported in less than 2% of patients. (Figure
242 1)

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3 243 Figure 1: Comorbidity profile of patients, n=29509
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6 244 (Figure JPG Image submitted separately)
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8 245 Image footnote: HIV: Human Immunodeficiency Virus, HBV: Hepatitis B Virus, HCV: Hepatitis C
9 246 Virus
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11 247 The most commonly used drugs were anticoagulants and steroids administered to 60.9% and 60% of
12 248 patients, respectively. Doxycycline, ivermectin, remdesivir and azithromycin were the other
13 249 commonly used drugs, while hydroxychloroquine, oseltavimvir, faviparavir, IL-6 inhibitors including
14 250 tocilizumab or itolizumab and convalescent plasma each was administered to less than 5% of patients.
15 251 More than half of the admitted patients (15922, 54%) required oxygen support during their hospital
16 252 course, while 2307 (7.8%) required mechanical ventilation. (S1 Table)
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22 253 Figure 2 shows the monthly trend of selected therapies since the inception of the registry. A marked
23 254 increase is noticeable in the use of steroid, oxygen supplementation and remdesivir in May 2021,
24 255 coinciding with the 2nd wave of the pandemic in India dominated by the delta variant of SARS-CoV-
25 256 2 infection. The use of hydroxychloroquine considerably declined after September 2020, while the use
26 257 of convalescent plasma has been low throughout.
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31 258 Figure 2: Trends of selected drugs and oxygen requirements

32 259 (Figure JPG Image submitted separately)
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35 260 Outcome data on death or discharge were available for 27251 patients; 689 patients who left against
36 261 medical advice and 1569 patients transferred to other hospitals were excluded from the outcome
37 262 analysis. In-hospital deaths were reported in 3957 (14.5%) participants and 23294 (85.5%) were
38 263 discharged. The median duration (IQR) of hospital stay among the study participants was 7 (5, 10)
39 264 days; 7 (5, 10) days among those discharged and 6 (2, 10) days among those who expired (p =
40 265 <0.001). Out of the 3957 patients who expired, 3418 (86.4%) died within first 14 days of hospital stay
41 266 and 539 (13.6%) died after 14 days of hospital admission.
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47 267 Table 2 shows the association of baseline factors with in-hospital mortality in univariate analysis. Age
48 268 ≥ 40 year, male gender, comorbidities such as diabetes mellitus, hypertension, chronic cardiac
49 269 disease, chronic kidney disease, chronic liver disease, malignancy, and stroke, tuberculosis well as
50 270 respiratory (fast or difficult breathing) or neurological symptoms (altered sensorium or seizures) at
51 271 presentation and WHO ordinal scale of 4 and above were associated with higher mortality. Receipt of
52 272 at least one dose of anti- SARS CoV-2 vaccine was associated with lower mortality as compared to
53 273 the unvaccinated patients [114 (13.3%) vs. 1306 (21.9%), $p < 0.001$]. Median concentrations of
54 274 random blood sugar, NLR, LDH, Interleukin-6 (IL-6), CRP, and D-dimer were significantly higher
55 275 among the patients who died as compared to those who were discharged from hospital. (Table 3)
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277 On sub group analysis of patients with diabetes mellitus, malignancy, tuberculosis and those admitted
278 with WHO ordinal scale 4 and above, mortality among vaccinated was significantly lower in each
279 individual subgroup. Among patients with liver disease and kidney disease, though the mortality was
280 lower among the vaccinated but the difference was not statistically significant (Not shown in table).

281 Factors that were significantly associated with mortality in univariate analysis and those which had
282 clinical relevance were considered in the multivariate logistic models. Odds of in-hospital mortality
283 was significantly and independently higher among patients ≥ 40 year, male gender, with diabetes
284 mellitus, chronic kidney diseases, chronic liver disease, malignancy, and tuberculosis, and those who
285 presented with dyspnoea or neurological symptoms, after being adjusted for other comorbidities such
286 as hypertension, chronic cardiac disease, stroke, severity at admission (WHO ordinal scale), and
287 vaccination status. WHO ordinal scale being 4 and above at admission carried the highest odds of
288 dying [5.6 (95% CI: 4.6, 7.0)]. Patients vaccinated with one and two doses of anti-SARS CoV-2
289 vaccine had significantly lower odds of dying [OR: 0.5 (95% CI: 0.4, 0.7) for one dose & OR: 0.4
290 (95% CI: 0.3, 0.7) for two doses]. (Table 4)

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292 Data available for various baseline laboratory parameters at baseline were limited (as described in
293 table 3). Hence, separate models were tested for each of these parameters. The odds ratio for all
294 biomarkers including haemoglobin, LDH, IL-6, and CRP were statistically significant, but marginally
295 over 1. The odds of death increased by 1.1 for each unit rise in baseline values of NLR and D-dimer
296 separately [OR:1.1 95%CI: 1.1,1.1] after adjusting for age, comorbidities and severity of the illness at
297 admission. The logistic regression models (Model 2 to 8) that included laboratory values are
298 presented as S2 Table. The area under the curve for ROC (AUC ROC) for NLR was 0.79 (95%CI:
299 0.78, 0.80) and 0.7 (0.68, 0.71). (S2 Figure) Considering the optimal cut-off for NLR as 6.67, both the
300 sensitivity and specificity to classify in-hospital death was 72%; a cut-off of 0.82 mg/L for baseline
301 D-Dimer had a sensitivity and specificity 71% and 65%, respectively.

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303 Discussion

304 Our study includes data from 29509 hospitalised COVID-19 patients from 42 hospitals across the
305 country. Apart from the often cited factors such as diabetes mellitus, male gender and advanced age,
306 our study highlighted the association of other comorbidities such as chronic kidney disease, chronic
307 liver disease, malignancy and tuberculosis with increased in-hospital mortality of COVID-19 patients
308 in Indian settings. The importance of anti-SARS-CoV-2 vaccination in protecting against mortality
309 was also evident from our analysis.

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3 310 More than half of our study participants had at least one co-morbidity, most common being
4 311 hypertension & diabetes mellitus. The proportion of COVID-19 in-patients having hypertension is
5 312 similar to the overall population level frequency of hypertension recorded among adult Indians. On
6 313 the contrary proportion diabetics seem to be much higher in this cohort than the national
7 314 average.^{13,14,15} Multiple studies have confirmed that following SARS-CoV-2 infection, diabetics are
8 315 more likely to be hospitalised as compared to non-diabetics, especially if there is poor glycaemic
9 316 control.¹⁶ Diabetes causes an inhibition in neutrophil chemotaxis, phagocytosis, and intracellular
10 317 destruction of microbes, thus offering efficient virus entry and decreased viral clearance.¹⁷
11 318 In our study, patients above 40 years of age had 1.3 times higher adjusted odds of dying than the
12 319 younger patients, which increased to 2.1 time with advanced age ≥ 60 year. Advanced age, especially
13 320 ≥ 60 year, is an established independent risk factor for dying in COVID-19 patients, as shown in
14 321 various studies across multiple countries since the onset of the pandemic.^{18,15} However, the working
15 322 age population above 40 years of age also have been deeply affected as shown in our investigation. It
16 323 would be prudent to include them in all preventive measures and triaging strategies for severity. Age-
17 324 standardized mortalities for COVID-19 in India, analysed from the Integrated Disease Surveillance
18 325 Programme special surveillance data, showed that along with the elderly above 60 years of age, the
19 326 age group of 45-59 years were also affected.²⁰ This could be partly explained by the fact that forced
20 327 expiratory volume is generally seen to decline after the age of 30-40 years.²¹ Additionally, older age
21 328 group is known to have a higher prevalence of chronic diseases, which could further attenuate the
22 329 already dysregulated immune response.
23 330 Studies from various parts of India and the world have reported co-morbidities in various
24 331 combinations to be associated with in-patient mortality in COVID-19 patients.^{16,17,24,25,26} Along with
25 332 the more recognized risk factors such as diabetes mellitus, chronic kidney disease, and malignancy,
26 333 our investigation unearthed the independent association of chronic liver disease with higher odds of
27 334 dying among COVID-19 in-patients. Another retrospective analysis from a single centre in South
28 335 India linked chronic liver disease with in-hospital mortality of Covid-19 patients.²⁷ Increased systemic
29 336 inflammation, immune dysfunction, coagulopathy and intestine dysbiosis are the hypothesised
30 337 mechanisms. Important to note in this context is that, the pandemic has been associated with poor
31 338 eating habits and increased alcohol intake, which might lead to an increase in severity of liver
32 339 diseases.^{8,18,19,29}
33 340 Presence of tuberculosis (on-treatment TB) was an important factor associated with higher in-hospital
34 341 mortality in our cohort. This finding carries a significant relevance in a high TB burden country like
35 342 India. Increased severity and mortality have been reported in COVID-19 patients with tuberculosis in
36 343 two meta-analyses which included only 26 and 34 Indian patients, respectively ^{30,20}. Our study provides
37 344 more robust supportive evidence for association of present tuberculosis status with COVID-19
38 345 mortality.

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3 346 Severity of illness at admission as evident by presenting complaints of respiratory or neurological
4 347 symptoms and WHO ordinal scale 4 or above had higher odds of dying in our registry participants.
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6 348 Similar observations have been reported from a few single centre studies from India, where majority
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8 349 of non-survivors required early oxygen supplementation (oxygen requirement is at WHO ordinal scale
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10 350 4 and above)^{22,23}.
11 351 The baseline laboratory markers including neutrophil-lymphocyte ratio (NLR), LDH, D-Dimer, IL-6
12 352 and CRP were higher among the non-survivors, though on multivariate analysis, the odds ratio was
13 353 marginally above one with minimal clinical relevance, except for NLR and D-dimer. Previous studies
14 354 have shown that raised biomarkers such as IL-6, CRP, LDH, and NLR are associated with higher
15 355 mortality.³²⁻³⁵ Considering these markers are non-specific indicators of inflammation, the baseline
16 356 values of Il-6, CRP or LDH seem to offer limited benefit in meaningful prediction of mortality. NLR
17 357 being a readily available marker can be used to prognosticate outcomes at admission as can D-Dimer.
18
19 358 However, guidelines for clinical management from other countries have also stated that there is no
20 359 consensus in the evidence supporting use of any of the inflammatory markers or D-dimer at baseline
21 360 to stratify the risk and decide therapeutics.³⁶
22 361 Importantly, the current study underlined the protection provided by COVID-19 vaccination against
23 362 in-hospital mortality. COVID-19 vaccine, irrespective its type, reduced the odds of dying by 50%
24 363 with one dose and by 60% with two doses. Other smaller, single centre studies from both South and
25 364 North India have demonstrated the effectiveness of COVID-19 vaccination in reducing mortality.^{37,38}
26 365 These findings along with mathematical modelling based projections³⁹ underscore the key role of
27 366 vaccine in mitigating the impact of COVID pandemic and managing the burden it poses on the
28 367 healthcare system.

368

369

370 *Limitations*

371 As this was a record-based study in hospitals maintaining paper-based records, the identification of
372 symptoms, comorbidities, complications and laboratory parameters relied on the accuracy of the
373 records maintained. Secondly, the patients who were transferred to other institutes or who had left
374 against medical advice were not followed up and could not be included in mortality analysis as their
375 outcomes were unknown.

376

377 *Strengths*

378 The current analysis from the National Clinical Registry for COVID-19, to the best of our knowledge,
379 is the largest widely representative to examine the association of demographic, clinical characteristics,
380 and laboratory parameters with mortality among hospitalised COVID-19 patients in India. This data
381 captures information from various geographical zones of India involving multiple centres.

382

383 Conclusion

384 The current investigation highlights the importance of age ≥ 40 years and comorbidities like chronic
385 liver disease, and tuberculosis as predictors of in-patient mortality along with the oft-reported risk
386 factors such as male gender, diabetes mellitus, chronic kidney disease, and baseline severity of illness.
387 WHO ordinal scale 4 and above was an important independent factor associated with in-patient
388 mortality. Interestingly, the baseline values of CRP, IL-6 and LDH offered little help in predicting the
389 outcome, though NLR and D-dimer can be used to classify in-hospital outcomes with a sensitivity and
390 specificity ranging from 65% to 72%. On an encouraging note, vaccination against COVID-19
391 clearly lowered the risk of dying from the disease and featured as an important armamentarium in our
392 fight against COVID-19 pandemic.

393

394 Author statements

395

396 Author Contributions

397

398 SP is the guarantor. Study design, data analysis, data interpretation and manuscript writing team: AM, GK, AT,
399 AB, TCB, PB, TDB, SM, AT, YR, MJ, JRK, AHP, SB, RJ, GRM, DS, VVR, BB, SP, AA. Monitoring and
400 Conduct of the study: AM, GK, AT, LKS, PM, YP. Patient enrolment, conduct of study, clinical care and data
401 collection: AB, TCB, PB, TDB, SM, AT, YR, MJ, JRK, AHP, SB, RJ, GDP, VS, KS, RM, VSA, MAM, DK,
402 SS, SM, PKK, AK, AS, AP, SC, MD, TM, SC, BB, SRP, DM, SC, AA, DV, MT, NS, MP, SM, AD, KYL, MR,
403 CGS, UKO, RRJ, AK, AP, AS, MP, LS, MR, ADS, LK, PP, ND, SD, JS, AM, LP, JPS, SS, VKK, AK, NY,
404 RU, SS, AS, NNS, NMS, KR, HP, PRM, MKP, SS, AK, MP, MA, DP, VS, SA, RC, MR, ND, BKG, BK, JG,
405 SB, AA, MS, NF, SP, VN, SC, SM, SKS, ST, PL, HD, AG, VK, NS, RV, AP, MPK, ABR, NK, RK, KM, YSR,
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407

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410

411 Conflict of interest disclosure

412 AM, GK, AT, LKS, SP are employed by the Indian Council of Medical Research, the funding source of the
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Table 1: Demographic, symptom and laboratory profile at the time of admission (n=29509)

Characteristic	Values
Age groups	
18-39 year	7742 (26.2)
40-59 year	11664 (39.5)
60 year and above	10103 (34.2)
Gender	
Male	18752 (63.6)
Female	10754 (36.4)
Transgender	3 (0.01)
Patients who had taken at least one dose of anti- SARS CoV-2 vaccine, n=7438	909 (12.2)
#BMI, kg/m ² , mean \pm SD, n=12046	24.8 \pm 4.1
Underweight	361 (3)
Normal	3863 (32.1)
Overweight	2765 (22.9)
Obese	5057 (42)
Symptom onset to admission in days, Median (IQR)	4 (2,6)
Total bilirubin, mg/dL Median (IQR), n=15091	0.6 (0.4, 0.8)
Hemoglobin, g/dL (Mean \pm SD), n= 18506	12.2 \pm 2.2
WBC count (Cells /mm ³), Median (IQR), n=18171	7400 (5200, 11000)
Neutrophils, % , Median (IQR), n=16053	76.5 (65.5, 85)
Lymphocytes, % , Median (IQR), n= 15971	17 (10, 26.6)
Neutrophil to lymphocyte ratio (NLR), Median (IQR), n=15942	4.4 (2.5, 8.5)
Platelet count, 1000s/ml ³ Median (IQR), n=18089	212 (158, 278)
Ferritin, ng/mL, Median (IQR), n=7166	2059 (1019, 3192)
LDH, IU/L, Median (IQR), n=8515	400 (265, 649)
CRP, mg/dL, Median (IQR), n=9962	32 (7.7, 90.3)
IL-6, pg/mL Median (IQR), n=2192	17 (5.8, 53.3)
D-Dimer, mg/L, Median (IQR), n=8142	0.6 (0.3, 1.9)
WHO Ordinal scale ^{##} on day 1 of admission, n=26909	
• 3	13860 (51.5)
• 4	9864 (36.7)
• 5	2580 (9.6)
• 6	526 (2)
• 7	79 (0.3)

Values expressed in n (%) unless specified.

#(Underweight: <18.5 kg/m², normal weight: 18.5-22.9 kg/m², overweight: 23-24.9 kg/m², obese: \geq 25 kg/m²) Ref: WHO expert consultation group. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet Public Health*. 2004; 363 (9403):157-163.

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Table 2: Proportional mortality among hospitalized COVID-19 patients

Characteristic	Mortality (%)	Odds ratio (95% CI)	P value
Age			
• 18-39 years (n=7169)	529 (7.4)	(Reference)	-
• 40-59 years (n=10760)	1455 (13.5)	2 (1.8, 2.2)	<0.001
• 60+ years (n=9322)	1973 (21.2)	3.4 (3.0, 3.7)	<0.001
Gender			
• Male (n=17240)	2613 (15.2)	1.2 (1.1, 1.2)	<0.001
• Female (n=10008)	1344 (13.4)	(reference)	-
Vaccinated with Anti-SARS CoV-2 vaccine			
• Unvaccinated (n= 5964)	1306 (21.9)	(Reference)	
• Vaccinated with one dose (n=550)	85 (15.5)	0.7 (0.5, 0.8)	<0.001
• Vaccinated with two doses (n=305)	29 (9.5)	0.4 (0.3, 0.6)	<0.001
Diabetes Mellitus			
• Yes (n=7126)	1397 (19.6)	1.7 (1.6, 1.8)	<0.001
• No (n=20125)	2560 (12.7)	(Reference)	
Hypertension			
• Yes (n=8872)	1686 (19)	1.7 (1.6, 1.8)	<0.001
• No (n=18379)	2272 (12.4)	(Reference)	
Chronic Cardiac Disease			
• Yes (n=1519)	296 (19.5)	1.5 (1.3, 1.7)	<0.001
• No (n=25732)	3661 (14.2)		
Chronic Kidney Disease			
• Yes (n=934)	323 (34.6)	3.3 (2.9, 3.8)	<0.001
• No (n=26317)	3634 (13.8)	(Reference)	
Chronic Liver Disease			
• Yes (n=250)	80 (32)	2.8 (2.1, 3.7)	<0.001
• No (n=27001)	3877 (14.4)	(Reference)	
Malignancy			
• Yes (n=413)	89 (21.6)	1.6 (1.3, 2.1)	<0.001
• No (n=26838)	3868 (14.4)	(Reference)	
Stroke			
• Yes (n=190)	64 (33.7)	3.0 (2.2, 4.1)	<0.001
• No (n=27061)	3893 (14.4)	(Reference)	
Tuberculosis			
• Yes (n=169)	41 (24.3)	1.9 (1.3, 2.7)	<0.001
• No (n=27082)	3916 (14.5)	(reference)	
Shortness of breath or fast breathing at admission			
• Yes (n=11798)	2772 (23.5)	3.7 (3.4, 4.0)	<0.001
• No (n=15453)	1185 (7.7)	(Reference)	
Altered sensorium/ seizures at admission			
• Yes (n=412)	185 (44.9)	5.0 (4.1, 6.1)	<0.001
• No (n=26839)	3772 (14.1)	(Reference)	
Ordinal scale 4 or above at admission			
• Yes (n=13860)	3101 (26.3)	10.3 (9.2, 11.4)	<0.001
• No (n=13049)	433 (3.4)	(Reference)	
BMI			
• Underweight & normal (n= 3944)	387 (9.8)	(Reference)	-
• Overweight & obese (n= 7307)	766 (10.5)	1.1 (0.9, 1.2)	0.26

*P value calculated by bivariate logistic regression

Table 3: Median laboratory parameters among patients who died and those who survived

Laboratory Parameter	Median (IQR)	P Value
Hemoglobin Median (IQR), g/dL <ul style="list-style-type: none"> Among those who died (n=2160) Among survivors (n=15098) 	12 (10.1, 13.4) 12.5 (11.1, 13.8)	<0.001
Random Blood Sugar, Median (IQR) <ul style="list-style-type: none"> Among those who died (n=980) Among the survivors (n=7003) 	180 (132, 255) 138 (105, 228)	<0.001
Neutrophil lymphocyte Ratio Median (IQR) <ul style="list-style-type: none"> Among those who died (n=1762) Among survivors (n=13156) 	10.7 (6.1, 19) 3.9 (2.3, 7.3)	<0.001
LDH Median (IQR), IU/L <ul style="list-style-type: none"> Among those who died (n=1021) Among survivors (n=6962) 	690.6 (458, 959) 365 (248, 575)	<0.001
IL-6 Median (IQR), pg/mL <ul style="list-style-type: none"> Among those who died (n=347) Among survivors (n=1711) 	59.2 (21, 180) 13 (4.7, 36.7)	<0.001
CRP Median (IQR), mg/dL <ul style="list-style-type: none"> Among those who died (n=1231) Among survivors (n=8156) 	84.3 (39.6, 141.8) 25.1 (6.1, 78.6)	<0.001
D-Dimer Median (IQR), mg/L <ul style="list-style-type: none"> Among those who died (n=1007) Among survivors (n=6658) 	1.6 (0.7, 5.9) 0.5 (0.3, 1.4)	<0.001
Symptom onset to admission <ul style="list-style-type: none"> Among those who died (n=21382) Among survivors (n=3502) 	4 (2,6) 4 (2,6)	0.54

*p value calculated by rank sum test

Table 4: Adjusted odds ratio Determinants of hospital deaths using logistic regression

	Model 1 (n=6159) Odds ratio (95% CI)
Age Categories <ul style="list-style-type: none"> 18-39 years 40-59 years 60 years and above 	(Reference) 1.3 (1.1, 1.6) 1.9 (1.6, 2.3)
Gender (Male)	1.3 (1.1, 1.5)
Vaccinated with Anti-SARS CoV-2 vaccine <ul style="list-style-type: none"> One dose Two doses 	0.5 (0.4, 0.7) 0.4 (0.3, 0.7)
Diabetes Mellitus	1.4 (1.2, 1.6)
Hypertension	0.9 (0.8, 1.1)
Chronic Cardiac Disease	0.8 (0.6, 1.0)
Chronic Kidney Disease	2.8 (2.0, 3.7)
Chronic Liver Disease	2.4 (1.1, 5.2)
Malignancy	1.9 (1.2, 3.2)
Stroke	1.0 (0.5, 2.3)
Tuberculosis	3.0 (1.5, 6.1)
Shortness of breath or fast breathing	1.3 (1.1, 1.5)
Altered sensorium/ seizures	3.6 (2.4, 5.4)
WHO ordinal scale 4 and above at admission	5.6 (4.6, 7.0)

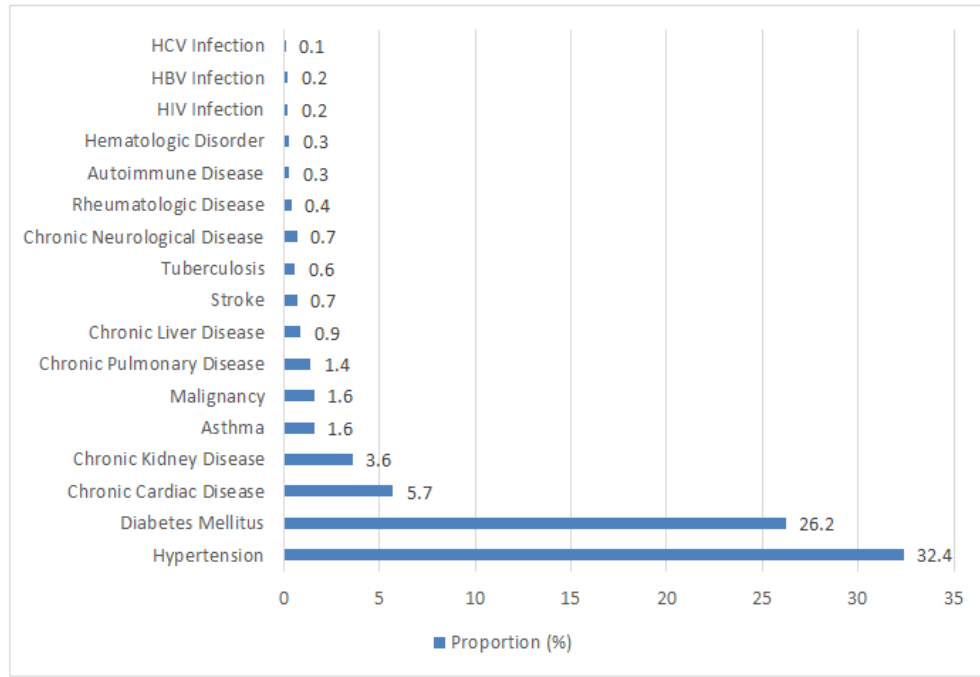


Figure 1: Comorbidity profile of patients, n=29509

151x107mm (118 x 118 DPI)

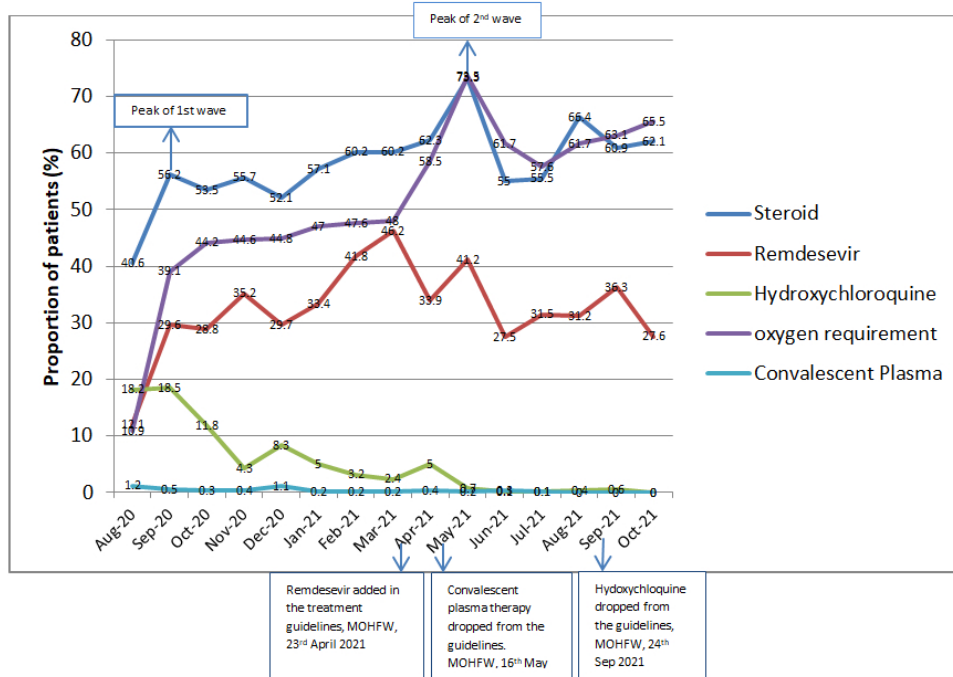


Figure 2: Trends of selected drugs and oxygen requirements

194x137mm (118 x 118 DPI)