

## OBSERVATION: BRIEF RESEARCH REPORT

**Characteristics and Mortality of Hospitalized Patients With COVID-19 in Iran: A National Retrospective Cohort Study**

**Background:** Coronavirus disease 2019 (COVID-19) is a serious health care concern in Iran, with 259 652 confirmed cases since the first report on 18 February 2020, and Iran has the ninth highest national death toll in the world, with more than 13 000 deaths (1). Despite the immensity of the problem, there are limited data available about the characteristics and mortality of hospitalized patients in Iran.

**Objective:** To assess the characteristics and mortality of hospitalized patients with COVID-19 in Iran.

**Methods and Findings:** The Medical Care Monitoring Center of the Ministry of Health and Medical Education (MOHME) of Iran mandated all hospitals to register patients admitted with a diagnosis of confirmed or suspected COVID-19 in a national registry. The registry included patient demographic characteristics, coexisting diseases, and presenting signs and symptoms. Fever and hypoxemia were evaluated by the health care provider, and other variables were reported by the patient. The Information Technology Center of MOHME provided access to this database.

In this retrospective cohort study, we enrolled all consecutively hospitalized adults and children with laboratory-

confirmed COVID-19 who were admitted to any of the 1034 hospitals in Iran from 20 February to 20 April 2020. We defined laboratory confirmation as at least 1 positive result on real-time reverse transcriptase polymerase chain reaction assay of a specimen collected on a nasopharyngeal swab according to World Health Organization protocols. Patients who had a negative or pending test result at the cutoff of the study period were excluded. Pregnant patients were also excluded.

The institutional review board of Tehran University of Medical Sciences approved the study protocol. The requirement for informed consent was waived because this study was regarded as minimal-risk research using data collected for routine clinical practice. Furthermore, researchers analyzed only deidentified data.

We used the Kaplan-Meier method to estimate the probability of death (final event) from the date of hospital entry (starting event). Patients who had been discharged were assumed to be alive at the end of the study period; those who had been discharged or were still hospitalized at the study closeout were censored, and the last day of the study period was used to compute the time at risk.

Among 62 955 patients admitted to the designated hospitals during the study period, 29 111 tested positive for severe acute respiratory syndrome coronavirus 2. A total of 130 were excluded because of pregnancy, leaving 28 981 patients in the study population. At study closeout, 23 367 patients

**Table 1.** Demographic and Clinical Characteristics of Hospitalized Patients With Laboratory-Confirmed COVID-19

Variable	Total (n = 28 981)	Discharged Alive or Censored (n = 23 288)	Died (n = 5693)
<b>Mean age (SD), y</b>	57.33 (17.67)	54.85 (17.33)	67.49 (15.28)
<b>Sex, n (%)</b>			
Male	16 361 (56)	12 911 (55)	3450 (61)
Female	12 620 (44)	10 377 (45)	2243 (39)
<b>Coexisting diseases, n (%)</b>			
Any	6666 (23)	4830 (21)	1836 (32)
Cardiovascular disease*	3098 (11)	2165 (9)	933 (16)
Diabetes	3288 (11)	2397 (10)	891 (16)
Chronic obstructive pulmonary disease	683 (2)	485 (2)	198 (3)
Asthma	573 (2)	432 (2)	141 (2)
Chronic kidney disease	584 (2)	391 (2)	193 (3)
Cancer	370 (1)	249 (1)	121 (2)
Chronic liver disease	118 (0)	94 (0)	24 (0)
<b>Known exposure†, n (%)</b>			
Yes	8731 (30)	7156 (31)	1575 (28)
No	20 250 (70)	16 132 (69)	4118 (72)
<b>Signs and symptoms on presentation, n (%)</b>			
Hypoxemia‡	11 986 (41)	10 699 (46)	1287 (23)
Cough	15 144 (52)	12 441 (53)	2703 (47)
Fever§	13 107 (45)	10 389 (45)	2718 (48)
Shortness of breath	13 081 (45)	9813 (42)	3268 (57)
Myalgia	6026 (21)	4968 (21)	1058 (19)
Altered mental status	1203 (4)	516 (2)	687 (12)

COVID-19 = coronavirus disease 2019.

\* Includes hypertension, coronary artery disease, and congestive heart failure.

† Defined as exposure to persons with confirmed COVID-19 within the past 2 wk.

‡ Defined as peripheral blood oxygen saturation <93% on room air.

§ Defined as body temperature  $\geq 37.3^{\circ}\text{C}$ .

|| Any change in alertness from baseline.

**Table 2.** Cumulative Risk for Death in 30 Days Among 28 981 Patients With Confirmed COVID-19 Hospitalized During the Study Period, Calculated by Kaplan-Meier Analysis

Patients	Mortality Rate (95% CI)
<b>All</b>	24.4 (23.8-25.0)
<b>Age</b>	
<65 y	14.8 (14.2-15.4)
≥65 y	41.6 (40.5-42.8)
<b>Sex</b>	
Female	22.6 (21.7-23.4)
Male	25.7 (24.9-26.5)
<b>Coexisting diseases</b>	
None	21.3 (20.7-22.0)
Any	35.0 (33.6-36.4)
<b>History of cardiovascular disease*</b>	
Yes	37.7 (35.7-39.8)
No	22.8 (22.2-23.4)
<b>History of diabetes</b>	
Yes	34.7 (32.8-36.7)
No	23.1 (22.5-23.7)
<b>History of chronic obstructive pulmonary disease</b>	
Yes	36.5 (32.1-40.9)
No	24.1 (23.5-24.7)
<b>History of asthma</b>	
Yes	30.6 (26.3-35.0)
No	24.3 (23.7-24.9)
<b>History of chronic kidney disease</b>	
Yes	42.7 (37.7-45.6)
No	24.0 (23.5-24.6)
<b>History of active cancer</b>	
Yes	40.2 (34.3-46.1)
No	24.2 (23.6-24.8)
<b>History of chronic liver disease</b>	
Yes	25.2 (16.1-34.3)
No	24.4 (23.8-25.0)
<b>Known exposure†</b>	
Yes	21.9 (20.9-22.9)
No	25.5 (24.8-26.2)

COVID-19 = coronavirus disease 2019.

\* Includes hypertension, coronary artery disease, and congestive heart failure.

† Defined as exposure to persons with confirmed COVID-19 within the past 2 wk.

had either been discharged or died. Patients' demographic and clinical characteristics are shown in Table 1. Overall, 23 367 patients had a definitive outcome during the study period. When all patients admitted during the study period were used in the Kaplan-Meier analysis of survival, the cumulative risk for in-hospital mortality in 30 days was 24.4%. Table 2 presents the 30-day risk for death in different patient groups.

**Discussion:** We describe the characteristics and mortality among hospitalized patients with laboratory-confirmed COVID-19 in Iran. The high case-fatality rate we saw is consis-

tent with the hospitalized population; milder cases were likely excluded. Consistent with other studies, hypoxemia, fever, and cough were common presenting symptoms, as were comorbidities (2-5).

Although this was a large nationwide study that evaluated patients with laboratory-confirmed COVID-19, it has several notable limitations. The study population is from 1 country. Criteria for hospitalization may vary among countries, and this may make it difficult to compare mortality rates. Most of the patient variables were self-reported and could not be verified. Although guidelines on how to record data in the database were provided, no assessment of interrater reliability was done, and reporting among hospitals may have varied. Moreover, this national database lacks detailed clinical information. Our database included only the admission data, and we did not have access to the exact time of symptom onset or patients' data during hospitalization. Some symptoms not initially recognized as presentations of COVID-19 (for example, anosmia) were not included in this registry from the beginning, so we did not have those data for all participants. Although national guidelines are in place, we have no data to compare the quality of the diagnostic and therapeutic measures in different hospitals. Active follow-up of discharged patients to ascertain vital status was not feasible, but we believe it is unlikely that a discharged patient died without returning to a designated hospital, where they would be registered again in the national database. Further studies are required to identify independent predictors of mortality for patients with COVID-19.

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**Reproducible Research Statement:** Study protocol: Available from Dr. Jalili (e-mail, [mjalili@tums.ac.ir](mailto:mjalili@tums.ac.ir)). Statistical code and data set: Not available.

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#### References

1. World Health Organization. Coronavirus disease (COVID-2019) situation reports. Accessed at [www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports](http://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports) on 2 May 2020.
2. Du RH, Liang LR, Yang CQ, et al. Predictors of mortality for patients with COVID-19 pneumonia caused by SARS-CoV-2: a prospective cohort study. *Eur Respir J.* 2020;55. [PMID: 32269088] doi:10.1183/13993003.00524-2020
3. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet.* 2020;395:1054-1062. [PMID: 32171076] doi:10.1016/S0140-6736(20)30566-3
4. Lian J, Jin X, Hao S, et al. Analysis of epidemiological and clinical features in older patients with coronavirus disease 2019 (COVID-19) out of Wuhan. *Clin Infect Dis.* 2020. [PMID: 32211844] doi:10.1093/cid/ciaa242
5. Liang WH, Guan WJ, Li CC, et al. Clinical characteristics and outcomes of hospitalised patients with COVID-19 treated in Hubei (epicentre) and outside Hubei (non-epicentre): a nationwide analysis of China. *Eur Respir J.* 2020;55. [PMID: 32269086] doi:10.1183/13993003.00562-2020