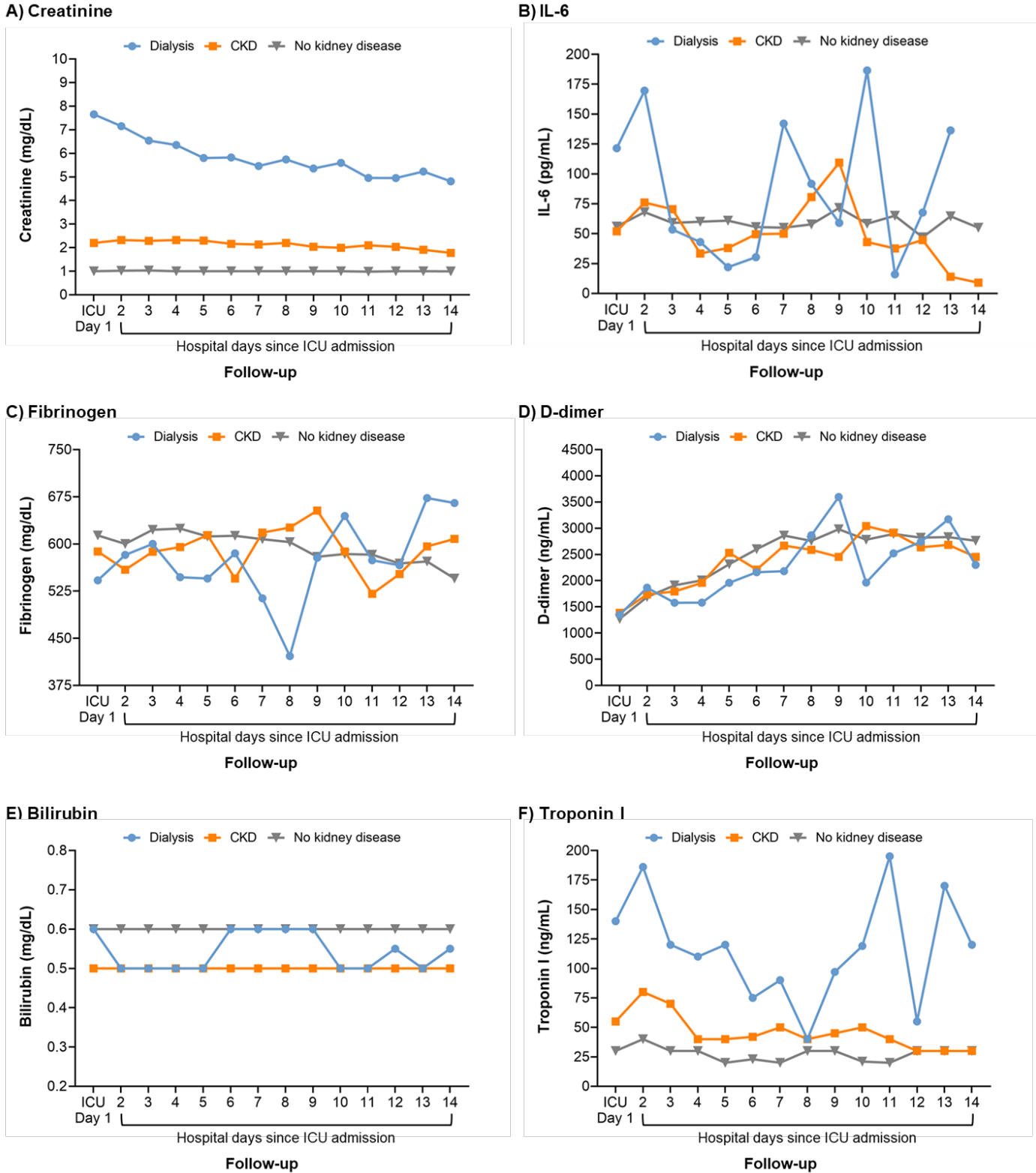


Figure S1. Trajectories of other laboratory values in the first 14 days after ICU admission

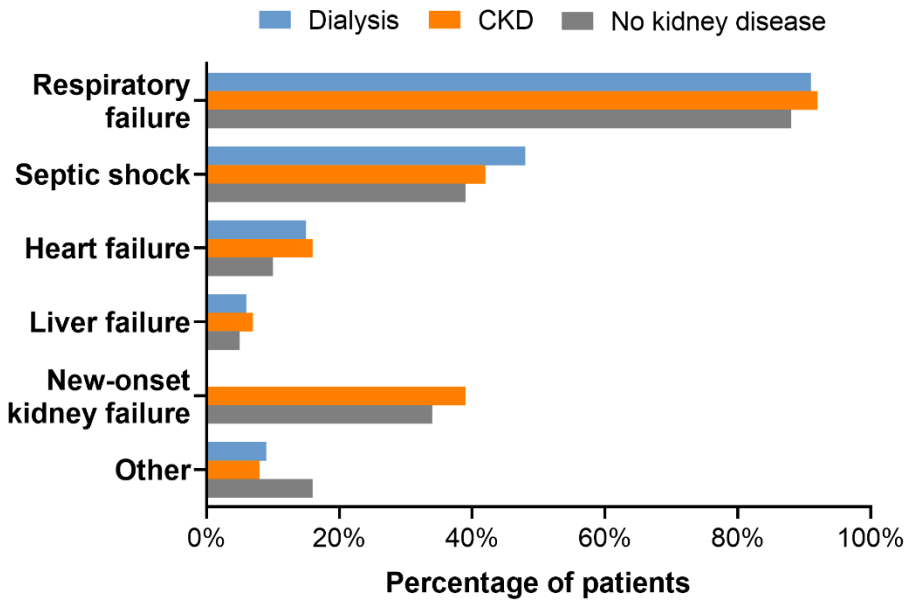


Values presented in the figure are medians. Dialysis represents patients with pre-existing kidney failure receiving maintenance dialysis. CKD represents patients with pre-existing non-dialysis dependent CKD. No kidney disease represents patients without pre-existing CKD.

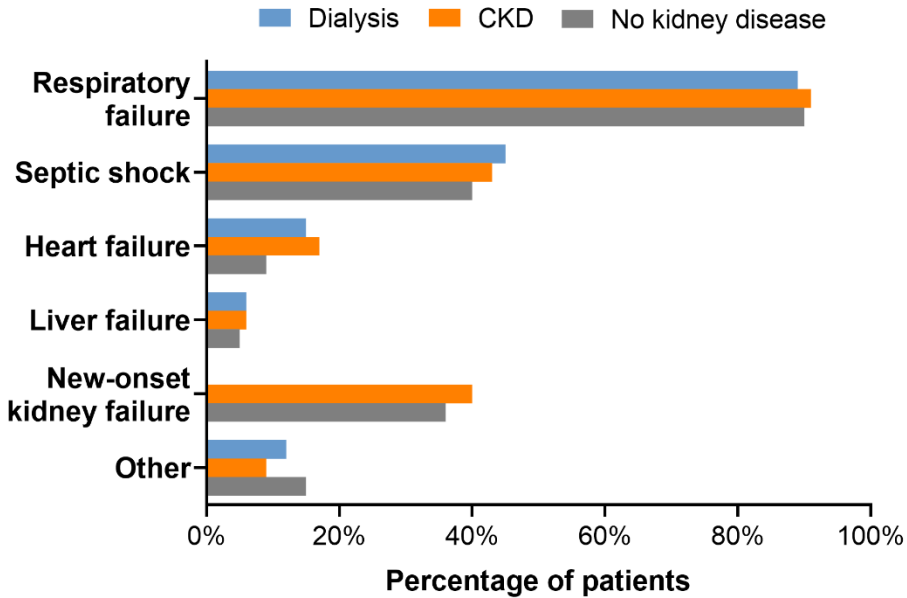
Abbreviations: CKD, chronic kidney disease; ICU, intensive care unit; IL, interleukin.

Figure S2. Contributing cause(s) of death

A) Deaths occurring within 14 days of ICU admission



B) Deaths occurring within 28 days of ICU admission



Dialysis represents patients with pre-existing kidney failure receiving maintenance dialysis. CKD represents patients with pre-existing non-dialysis dependent CKD. No kidney disease represents patients without pre-existing CKD. Patients could have more than one contributing cause of death documented in their medical record.

Abbreviations: CKD, chronic kidney disease; ICU, intensive care unit.

Item S1. List of participating STOP-COVID sites

Northeastern United States

Beth Israel Deaconess Medical Center
Brigham and Women's Faulkner Hospital
Brigham and Women's Hospital
Cooper University Health Care
Hackensack Meridian Health Hackensack University Medical Center
Hackensack Mountainside Hospital
Johns Hopkins Hospital
Kings County Hospital Center
Lowell General Hospital
Massachusetts General Hospital
MedStar Georgetown University Hospital
Montefiore Medical Center
Mount Sinai
Newton Wellesley Hospital
New York-Presbyterian Queens Hospital
New York-Presbyterian/Weill Cornell Medical Center
New York University Langone Hospital
Rutgers/New Jersey Medical School
Rutgers/Robert Wood Johnson Medical School
Temple University Hospital
Thomas Jefferson University Hospital
Tufts Medical Center
United Health Services Hospitals
University of Pennsylvania Health System
University of Pittsburgh Medical Center
Westchester Medical Center
Yale University Medical Center

Southern United States

Baylor College of Medicine, Houston
Baylor University Medical Center/Baylor Scott White and Health
Duke University Medical Center
Mayo Clinic, Florida
Memphis VA Medical Center
Methodist University Hospital
Ochsner Medical Center
Tulane Medical Center
University of Alabama-Birmingham Hospital
University of Florida Health-Gainesville
University of Florida Health-Jacksonville
University of Miami Health System
University of North Carolina Hospitals
University of Texas Southwestern Medical Center
University of Virginia Health System

Midwestern United States

Barnes-Jewish Hospital
Cook County Health
Froedtert Hospital
Indiana University Health Methodist Hospital
Mayo Clinic, Saint Mary's Campus, Minnesota
Northwestern Memorial Hospital
Promedica Health System
Rush University Medical Center

University Hospitals Cleveland Medical Center
University of Chicago Medical Center
University of Illinois Hospital and Health Sciences System
University of Kentucky Hospital
University of Michigan Hospital
University of Oklahoma Health Sciences Center

Western United States

Loma Linda University Medical Center
Mayo Clinic, Arizona
Oregon Health and Science University Hospital
Renown Health
Stanford Healthcare
University of California-Davis Medical Center
University of California-Los Angeles Medical Center
University of California-San Diego Medical Center
University of California-San Francisco Medical Center
UC Health University of Colorado
University Medical Center of Southern Nevada
University of Washington Medical Center

Item S2. List of STOP-COVID investigators

Baylor College of Medicine: Carl P. Walther*, Samaya J. Anumudu

Baylor University Medical Center: Justin Arunthamakun*, Kathleen F. Kopecky, Gregory P. Milligan, Peter A. McCullough, Thuy-Duyen Nguyen

Beth Israel Deaconess Medical Center: Shahzad Shaefi*, Megan L. Krajewski, Sidharth Shankar, Aameeka Pannu, Juan D. Valencia

Boston Medical Center: Sushrut S. Waikar*, Zoe A. Kibbelaar

Cook County Health: Ambarish M. Athavale*, Peter Hart, Shristi Upadhyay, Ishaan Vohra

Cooper University Health Care: Adam Green*, Jean-Sebastien Rachoin, Christa A. Schorr, Lisa Shea

Duke University Medical Center: Daniel L. Edmonston*, Christopher L. Mosher

Hackensack Meridian Health Mountainside Medical Center: Alexandre M. Shehata*, Zaza Cohen, Valerie Allusson, Gabriela Bambrick-Santoyo, Noor ul aain Bhatti, Bijal Mehta, Aquino Williams

Hackensack Meridian Health Hackensack University Medical Center: Samantha K. Brenner*, Patricia Walters, Ronaldo C. Go, Keith M. Rose

Icahn School of Medicine at Mount Sinai: Lili Chan*, Kusum S. Mathews*, Steven G. Coca, Deena R. Altman, Aparna Saha, Howard Soh, Huei Hsun Wen, Sonali Bose, Emily A. Leven, Jing G. Wang, Gohar Mosoyan, Girish N. Nadkarni, Pattharawin Pattharanitima, Emily J. Gallagher

Indiana University School of Medicine/Indiana University Health: Allon N. Friedman*, John Guirguis, Rajat Kapoor, Christopher Meshberger, Katherine J. Kelly

Johns Hopkins Hospital: Chirag R. Parikh*, Brian T. Garibaldi, Celia P. Corona-Villalobos, Yumeng Wen, Steven Menez, Rubab F. Malik, Elena Cervantes, Samir Gautam

Kings County Hospital Center: Mary C. Mallappallil*, Jie Ouyang, Sabu John, Ernie Yap, Yohannes Melaku, Ibrahim Mohamed, Siddhartha Bajracharya, Isha Puri, Mariah Thaxton, Jyotsna Bhattacharya, John Wagner, Leon Boudourakis

Loma Linda University: H. Bryant Nguyen*, Afshin Ahoumim

Mayo Clinic: Kianoush Kashani*, Shahrzad Tehranian

Mayo Clinic, Arizona: Leslie F. Thomas*, Dheeraj Reddy Sirganagari

Mayo Clinic, Florida: Pramod K. Guru*

Medical College of Wisconsin: Yan Zhou,* Paul A. Bergl, Jesus Rodriguez, Jatan A. Shah, Mrigank S. Gupta

MedStar Georgetown University Hospital: Princy N. Kumar*, Deepa G. Lazarous, Seble G. Kassaye

Montefiore Medical Center/Albert Einstein College of Medicine: Michal L. Melamed*, Tanya S. Johns. Ryan Mocerino, Kalyan Prudhvi, Denzel Zhu, Rebecca V. Levy, Yorg Azzi, Molly Fisher, Milagros Yunes, Kaltrina Sedaliu, Ladan Golestaneh, Maureen Brogan, Neelja Kumar, Michael Chang, Jyotsana Thakkar

New York-Presbyterian Queens Hospital: Ritesh Raichoudhury*, Akshay Athreya, Mohamed Farag

New York-Presbyterian/Weill Cornell Medical Center: Edward J. Schenck*, Soo Jung Cho, Maria Plataki, Sergio L. Alvarez-Mulett, Luis G. Gomez-Escobar, Di Pan, Stefi Lee, Jamuna Krishnan, William Whalen

New York University Langone Hospital: David Charytan*, Ashley Macina, Sobaata Chaudhry, Benjamin Wu, Frank Modersitzki

Northwestern Memorial Hospital: Northwestern University Feinberg School of Medicine - Anand Srivastava*, Alexander S. Leidner, Carlos Martinez, Jacqueline M. Kruser, Richard G. Wunderink, Alexander J. Hodakowski

Ochsner Medical Center: Juan Carlos Q. Velez*, Eboni G. Price-Haywood, Luis A. Matute-Trochez, Anna E. Hasty, Muner MB. Mohamed

Oregon Health and Science University Hospital: Rupali S. Avasare*, David Zonies*

Partners Healthcare: Brigham and Women's Hospital, Brigham and Women's Faulkner Hospital, Massachusetts General Hospital, and Newton Wellesley Hospital - David E. Leaf*, Shruti Gupta*, Meghan E. Sise, Erik T. Newman, Samah Abu Omar, Kapil K. Pokharel, Shreyak Sharma, Harkarandeep Singh, Simon Correa, Tanveer Shaikat, Omer Kamal, Wei Wang, Heather Yang, Jeffery O. Boateng, Meghan Lee, Ian A. Strohhahn, Jiahua Li, Ariel L. Mueller

ProMedica Health System: Roberta Redfern*, Nicholas S. Cairl, Gabriel Naimy, Abeer Abu-Saif, Danyell Hall, Laura Bickley

Renown Health: Chris Rowan*, Farah Madhai-Lovely*

Rush University Medical Center: Vasil Peev*, Jochen Reiser, John J. Byun, Andrew Vissing, Esha M. Kapania, Zoe Post, Nilam P. Patel, Joy-Marie Hermes

Rutgers/New Jersey Medical School: Anne K. Sutherland*, Ameer Patrawalla, Diana G. Finkel, Barbara A. Danek, Sowminya Arikapudi, Jeffrey M. Paer, Peter Cangialosi, Mark Liotta

Rutgers/Robert Wood Johnson Medical School: Jared Radbel*, Sonika Puri, Jag Sunderram, Matthew T. Scharf, Ayesha Ahmed, Ilya Berim, Jayanth S. Vatson

Stanford Healthcare: Stanford University School of Medicine – Shuchi Anand*, Joseph E. Levitt, Pablo Garcia

Temple University Hospital: Suzanne M. Boyle*, Rui Song

Thomas Jefferson University Hospital: Jingjing Zhang*, Sang Hoon Woo, Xiaoying Deng, Goni Katz-Greenberg, Katharine Senter

Tulane Medical Center: Moh'd A. Sharshir*, Vadym V. Rusnak

United Health Services Hospitals: Muhammad Imran Ali

University of Colorado Anschutz Medical Campus: Anip Bansal*, Amber S. Podoll, Michel Chonchol, Sunita Sharma, Ellen L. Burnham

University Hospitals Cleveland Medical Center: Arash Rashidi*, Rana Hejal

University of Alabama-Birmingham Hospital: Eric Judd*, Laura Latta, Ashita Tolwani

University of California-Davis Medical Center: Timothy E. Albertson*, Jason Y. Adams

University of California-Los Angeles Medical Center: Ronald Reagan-UCLA Medical Center - Steven Y. Chang*, Rebecca M. Beutler; UCLA Medical Center, Santa Monica – Carl E. Schulze

University of California-San Diego Medical Center: Etienne Macedo*, Harin Rhee

University of California-San Francisco Medical Center: Kathleen D. Liu*, Vasantha K. Jotwani

University of Chicago Medical Center: Jay L. Koyner*

University of Florida Health-Gainesville: Chintan V. Shah*

University of Florida-Health-Jacksonville: Vishal Jaikaransingh*

University of Illinois Hospital and Health Sciences System: Stephanie M. Toth-Manikowski*, Min J. Joo*, James P. Lash

University of Kentucky Medical Center: Javier A. Neyra*, Nourhan Chaaban

University Medical Center of Southern Nevada: Alfredo Iardino, Elizabeth H. Au, Jill H. Sharma

University of Miami Health System: Marie Anne Sosa*, Sabrina Taldone, Gabriel Contreras, David De La Zerda, Hayley B. Gershengorn

University of Michigan: Salim S. Hayek*, Penelope Blakely, Hanna Berlin, Tariq U. Azam, Husam Shadid, Michael Pan, Patrick O' Hayer, Chelsea Meloche, Rafey Feroze, Rayan Kaakati, Danny Perry, Abbas Bitar, Elizabeth Anderson, Kishan J. Padalia, John P. Donnelly, Andrew J. Admon

University of North Carolina School of Medicine: Jennifer E. Flythe*, Matthew J. Tugman, Emily H. Chang

University of Oklahoma Health Sciences Center: Brent R. Brown*

University of Pennsylvania Health System: Amanda K. Leonberg-Yoo*, Ryan C. Spiardi, Todd A. Miano, Meaghan S. Roche, Charles R. Vasquez

University of Pittsburgh Medical Center: Amar D. Bansal*, Natalie C. Ernecoff, Sanjana Kapoor, Siddharth Verma, Huiwen Chen

University of Tennessee Health Science Center and Memphis VA Medical Center/Methodist University Hospital – Csaba P. Kovesdy*, Miklos Z. Molnar*, Ambreen Azhar

University of Texas Southwestern Medical Center and Parkland Health and Hospital System: S. Susan Hedayati*, Mridula V. Nadamuni, Shani Shastri, Duwayne L. Willett

University of Vermont Larner College of Medicine: Samuel A.P. Short

University of Virginia Health System: Amanda D. Renaghan*, Kyle B. Enfield

University of Washington Medical Center: Pavan K. Bhatraju*, A. Bilal Malik

Vanderbilt University Medical Center: Matthew W. Semler

Washington University in St. Louis/Barnes Jewish Hospital: Anitha Vijayan*, Christina Mariyam Joy, Tingting Li, Seth Goldberg, Patricia F. Kao

Wellforce Health System: Lowell General Hospital - Greg L. Schumaker*, Tufts Medical Center - Nitender Goyal*, Anthony J. Faugno, Greg L. Schumaker, Caroline M. Hsu, Asma Tariq, Leah Meyer, Ravi K. Kshirsagar, Daniel E. Weiner, Aju Jose

Westchester Medical Center: Marta Christov*, Jennifer Griffiths, Sanjeev Gupta, Aromma Kapoor

Yale School of Medicine: Perry Wilson*, Tanim Arora, Ugochukwu Ugwuowo

*Site Principal Investigator

Table S1. Outcome definitions

Outcome	Definition
In-hospital death	In-hospital death due to any cause
Respiratory failure	Requiring invasive mechanical ventilation
Shock	Requiring 2 or more vasopressors
Ventricular arrhythmia or cardiac arrest	Occurrence of ventricular tachycardia, ventricular fibrillation, or cardiac arrest
Major bleed	Bleeding in a critical area or organ (e.g. intracranial, retroperitoneal, pericardial, intramuscular with compartment syndrome) or bleeding requiring a procedural intervention (e.g. EGD, embolization by interventional radiology)
Thromboembolic event	Occurrence of a deep vein thrombosis, pulmonary embolism, or stroke
Acute liver injury	Bilirubin > 3.0 mg/dL <i>and</i> either an AST > 100 units/L or ALT > 100 units/L ^a

^a Based on a modified version of the Common Terminology Criteria for Adverse Events criteria.

Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; EGD, esophagogastroduodenoscopy.

Table S2. Characteristics of critically ill COVID-19 patients with pre-existing kidney failure receiving maintenance dialysis and non-dialysis dependent CKD on ICU day 1

Characteristic	Maintenance dialysis patients n = 143	Patients with non-dialysis CKD n = 521	Standardized difference
Demographics			
Age (years)	65 [56-71]	69 [60-76]	0.31
Male	77 (54%)	323 (62%)	0.17
Race ^a			
White	48 (34%)	184 (35%)	0.04
Black	71 (50%)	232 (45%)	0.10
Other race	5 (3%)	34 (7%)	0.14
Unknown/not reported	19 (13%)	71 (14%)	0.01
Ethnicity ^a			
Hispanic	29 (20%)	66 (13%)	0.21
Non-Hispanic	107 (75%)	411 (79%)	0.10
Unknown/not reported	7 (5%)	44 (8%)	0.14
BMI (kg/m ²)	28.3 [23.8-34.7]	30.3 [26.3-36.3]	0.25
U.S. geographic region			
Northeast	78 (55%)	241 (46%)	0.17
South	27 (19%)	65 (12%)	0.18
Midwest	31 (22%)	169 (32%)	0.24
West	7 (5%)	46 (9%)	0.16
Comorbid conditions			
Diabetes	97 (68%)	329 (63%)	0.10
Hypertension	125 (87%)	451 (87%)	0.03
Coronary artery disease	55 (38%)	146 (28%)	0.22
Heart failure	44 (31%)	136 (26%)	0.10
Atrial fibrillation or flutter	31 (22%)	70 (13%)	0.22
Asthma or COPD	21 (15%)	118 (23%)	0.21
Chronic liver disease	7 (5%)	33 (6%)	0.06
Home medications			
ACE inhibitor or ARB	35 (24%)	243 (47%)	0.48
Beta blocker	98 (69%)	264 (51%)	0.37
Other antihypertensive	69 (48%)	296 (57%)	0.17
Statin	80 (56%)	317 (61%)	0.10
Aspirin	65 (45%)	213 (41%)	0.09
Anticoagulant	38 (27%)	95 (18%)	0.20
NSAIDs	3 (2%)	26 (5%)	0.16
HCQ or CQ ^b	5 (3%)	16 (3%)	0.02
Azithromycin ^b	6 (4%)	25 (5%)	0.03
HCQ or CQ + azithromycin ^b	3 (2%)	6 (1%)	0.08
Source of admission to the ICU			
Emergency department	82 (57%)	299 (57%)	0.001
Hospital ward	47 (33%)	165 (32%)	0.03
Transfer from another hospital	12 (8%)	50 (10%)	0.04
Other	2 (1%)	6 (1%)	0.01

Days from symptom onset to ICU admission	4 [2-9]	7 [3-10]	0.25
Symptoms			
Shortness of breath	85 (59%)	360 (69%)	0.20
Cough	81 (57%)	322 (62%)	0.11
Sputum production	17 (12%)	58 (11%)	0.02
Hemoptysis	4 (3%)	7 (1%)	0.10
Nasal congestion	10 (7%)	32 (6%)	0.03
Sore throat	6 (4%)	42 (8%)	0.16
Fever	82 (57%)	294 (56%)	0.02
Chills	28 (20%)	88 (17%)	0.07
Headache	4 (3%)	27 (5%)	0.12
Altered mental status	36 (25%)	106 (20%)	0.12
Fatigue or malaise	45 (31%)	184 (35%)	0.08
Myalgia or arthralgia	15 (10%)	94 (18%)	0.22
Nausea or vomiting	27 (19%)	60 (12%)	0.21
Diarrhea	26 (18%)	115 (22%)	0.10
Vital signs			
Highest temperature (°C)	37.8 [37.1-38.5]	37.7 [37.1-38.4]	0.04
Fever (>38°C)	65 (45%)	213 (41%)	0.09
Lowest systolic BP (mmHg)	92 [81-108]	96 [84-112]	0.16
Highest heart rate (beats/min)	101 [88-119]	101 [87-116]	0.08
Highest respiratory rate (breaths/min)	29 [23-35]	30 [26-36]	0.16
Severity of illness			
Invasive mechanical ventilation	80 (56%)	311 (60%)	0.08
PEEP (cm H ₂ O)	10 [8-14]	10 [10-15]	0.22
PaO ₂ :FiO ₂ ratio (mmHg)	164 [101-267]	125 [79-190]	0.37
Non-invasive mechanical ventilation	3 (2%)	16 (3%)	0.06
High-flow nasal cannula or non-rebreather mask	29 (20%)	121 (23%)	0.07
AKI requiring dialysis	--	27 (5%)	--
Renal SOFA score ^c			
0 (creatinine < 1.2 mg/dL)	0 (0%)	62 (12%)	0.52
1 (creatinine 1.2-1.9 mg/dL)	0 (0%)	168 (32%)	0.98
2 (creatinine 2.0-3.4 mg/dL)	0 (0%)	143 (27%)	0.87
3 (creatinine 3.5-4.9 mg/dL)	0 (0%)	68 (13%)	0.55
4 (creatinine ≥ 5.0 mg/dL or RRT)	143 (100%)	80 (15%)	3.32
Liver SOFA score ^d			
0 (bilirubin < 1.2 mg/dL)	132 (92%)	482 (93%)	0.01
1 (bilirubin 1.2-1.9 mg/dL)	7 (5%)	28 (5%)	0.02
≥ 2 (bilirubin ≥ 2.0 mg/dL)	4 (3%)	11 (2%)	0.04
Coagulation SOFA score ^e			
0 (platelet count ≥ 150 K/mm ³)	90 (63%)	408 (78%)	0.01
1 (platelets count 100-149 K/mm ³)	37 (26%)	80 (15%)	0.02
≥ 2 (platelet count < 100 K/mm ³)	16 (11%)	33 (6%)	0.04
Vasopressor or inotrope use	72 (50%)	219 (42%)	0.17
Shock ^f	17 (12%)	75 (14%)	0.07

Other infections

Bacterial pneumonia	24 (17%)	85 (16%)	0.01
Bacteremia or endocarditis	11 (8%)	16 (3%)	0.21

Laboratory findings

White cell count (K/mm ³)	7.5 [5.7-10.4]	8.2 [5.8-11.6]	0.15
Lymphocyte count (K/mm ³)	9.7 [5.4-15.1]	9.4 [5.7-14.9]	0.01
Hemoglobin (g/dL)	10.3 [9.0-11.8]	11.4 [9.5-12.9]	0.41
Platelet count (K/mm ³)	167 [124-212]	202 [155-258]	0.43
Creatinine (mg/dL)	7.7 [5.6-10.1]	2.2 [1.5-3.6]	1.77
Albumin (g/dL)	3.3 [2.9-3.6]	3.1 [2.6-3.5]	0.28
AST (units/L)	46 [30-72]	48 [33-80]	0.05
ALT (units/L)	23 [17-40]	28 [18-47]	0.17
Bilirubin (mg/dL)	0.6 [0.4-0.7]	0.5 [0.3-0.8]	0.10
Lactate (mmol/L)	1.6 [1.0-2.6]	1.6 [1.0-2.4]	0.03
CRP (mg/L)	170.0 [73.0-277.7]	142.4 [84.8-217.5]	0.17
IL-6 (pg/mL)	121.4 [41.3-320.4]	52.0 [19.0-175.3]	0.43
Arterial pH	7.37 [7.28-7.43]	7.34 [7.26-7.40]	0.27
Fibrinogen (mg/dL)	542 [369-619]	588 [442-732]	0.38
D-dimer (ng/mL)	1347 [609-2623]	1385 [670-3018]	0.01
Ferritin (ng/mL)	3406 [1795-6271]	984 [450-1981]	1.10
Troponin T (ng/mL)	175 [95-364]	51 [25-110]	0.98
Troponin I (ng/mL)	140 [70-330]	55 [20-170]	0.58

Values are n (%) for categorical variables and median [quartile 1 – quartile 3] for continuous variables. An absolute standardized mean difference > 0.1 represents a meaningful difference between groups. Variables with missing values are listed in Supplemental Table S13.

^a Information on ethnicity and race were abstracted from the electronic health record of each patient. In the U.S., people of Hispanic ethnicity are those of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race.

^b The anti-infective medication categories HCQ or CQ, azithromycin, and HCQ or CQ + azithromycin are not mutually exclusive.

^c Renal component of the SOFA score was based on serum creatinine levels. Patients who did not have a serum creatinine drawn on ICU day 1 were classified as having a renal SOFA score of 0, and patients on RRT were classified as having a renal SOFA score of 4.⁴⁹

^d Liver component of the SOFA score. Patients who did not have a serum bilirubin drawn on ICU day 1 were classified as having a liver SOFA score of 0.⁴⁹

^e Coagulation component of the SOFA score. Patients who did not have a platelet count drawn on ICU day 1 were classified as having a coagulation SOFA score of 0.⁴⁹

^f Shock is defined as the requirement of ≥ 2 vasopressors or inotropes.

Abbreviations: ACE, angiotensin converting enzyme; AKI, acute kidney injury; ALT, alanine aminotransferase; ARB, angiotensin II receptor blocker; AST, aspartate aminotransferase; BMI, body mass index; BP, blood pressure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; CQ, chloroquine; CRP, C-reactive protein; FiO₂, fraction of inspired oxygen; HCQ, hydroxychloroquine; ICU, intensive care unit; IL, interleukin; NSAIDs, non-steroidal anti-inflammatory drug; PaO₂, partial pressure of oxygen; PEEP, positive end-expiratory pressure; RRT, renal replacement therapy; SOFA, Sequential Organ Failure Assessment; U.S., United States.

Table S3. Characteristics of critically ill COVID-19 patients with pre-existing kidney failure receiving maintenance dialysis and without pre-existing CKD on ICU day 1

Characteristic	Maintenance dialysis patients n = 143	Patients without pre-existing CKD n = 3600	Standardized difference
Demographics			
Age (years)	65 [56-71]	61 [51-70]	0.25
Male	77 (54%)	2314 (64%)	0.21
Race ^a			
White	48 (34%)	1403 (39%)	0.11
Black	71 (50%)	963 (27%)	0.49
Other race	5 (3%)	309 (9%)	0.22
Unknown/not reported	19 (13%)	925 (26%)	0.32
Ethnicity ^a			
Hispanic	29 (20%)	919 (26%)	0.13
Non-Hispanic	107 (75%)	2,218 (62%)	0.29
Unknown/not reported	7 (5%)	463 (13%)	0.28
BMI (kg/m ²)	28.3 [23.8-34.7]	30.4 [26.5-35.6]	0.25
U.S. geographic region			
Northeast	78 (55%)	2175 (60%)	0.12
South	27 (19%)	388 (11%)	0.23
Midwest	31 (22%)	717 (20%)	0.04
West	7 (5%)	320 (9%)	0.16
Comorbid conditions			
Diabetes	97 (68%)	1337 (37%)	0.65
Hypertension	125 (87%)	2036 (57%)	0.73
Coronary artery disease	55 (38%)	374 (10%)	0.69
Heart failure	44 (31%)	233 (6%)	0.66
Atrial fibrillation or flutter	31 (22%)	211 (6%)	0.47
Asthma or COPD	21 (15%)	617 (17%)	0.07
Chronic liver disease	7 (5%)	103 (3%)	0.11
Home medications			
ACE inhibitor or ARB	35 (24%)	1127 (31%)	0.15
Beta blocker	98 (69%)	768 (21%)	1.08
Other antihypertensive	69 (48%)	937 (26%)	0.47
Statin	80 (56%)	1226 (34%)	0.45
Aspirin	65 (45%)	668 (19%)	0.60
Anticoagulant	38 (27%)	294 (8%)	0.50
NSAIDs	3 (2%)	322 (9%)	0.30
HCQ or CQ ^b	5 (3%)	134 (4%)	0.01
Azithromycin ^b	6 (4%)	261 (7%)	0.13
HCQ or CQ + azithromycin ^b	3 (2%)	68 (2%)	0.02
Source of admission to the ICU			
Emergency department	82 (57%)	1981 (55%)	0.05
Hospital ward	47 (33%)	1114 (31%)	0.04
Transfer from another hospital	12 (8%)	487 (14%)	0.17
Other	2 (1%)	18 (1%)	0.09

Days from symptom onset to ICU admission	4 [2-9]	7 [4-10]	0.43
Symptoms			
Shortness of breath	85 (59%)	2733 (76%)	0.36
Cough	81 (57%)	2698 (75%)	0.39
Sputum production	17 (12%)	374 (10%)	0.05
Hemoptysis	4 (3%)	53 (1%)	0.09
Nasal congestion	10 (7%)	207 (6%)	0.05
Sore throat	6 (4%)	286 (8%)	0.16
Fever	82 (57%)	2486 (69%)	0.25
Chills	28 (20%)	698 (19%)	0.01
Headache	4 (3%)	343 (10%)	0.28
Altered mental status	36 (25%)	418 (12%)	0.36
Fatigue or malaise	45 (31%)	1118 (31%)	0.01
Myalgia or arthralgia	15 (10%)	815 (23%)	0.33
Nausea or vomiting	27 (19%)	573 (16%)	0.08
Diarrhea	26 (18%)	708 (20%)	0.04
Vital signs			
Highest temperature (°C)	37.8 [37.1-38.5]	38.0 [37.2-38.9]	0.24
Fever (>38°C)	65 (45%)	1837 (51%)	0.11
Lowest systolic BP (mmHg)	92 [81-108]	97 [85-110]	0.18
Highest heart rate (beats/min)	101 [88-119]	105 [92-121]	0.14
Highest respiratory rate (breaths/min)	29 [23-35]	32 [26-38]	0.31
Severity of illness			
Invasive mechanical ventilation	80 (56%)	2284 (63%)	0.15
PEEP (cm H ₂ O)	10 [8-14]	12 [10-15]	0.50
PaO ₂ :FiO ₂ ratio (mmHg)	164 [101-267]	122 [83-191]	0.36
Non-invasive mechanical ventilation	3 (2%)	86 (2%)	0.02
High-flow nasal cannula or non-rebreather mask	29 (20%)	801 (22%)	0.05
AKI requiring dialysis	--	55 (2%)	--
Renal SOFA score ^c			
0 (creatinine < 1.2 mg/dL)	0 (0%)	2347 (65%)	1.94
1 (creatinine 1.2-1.9 mg/dL)	0 (0%)	844 (23%)	0.78
2 (creatinine 2.0-3.4 mg/dL)	0 (0%)	255 (7%)	0.39
3 (creatinine 3.5-4.9 mg/dL)	0 (0%)	71 (2%)	0.20
4 (creatinine ≥ 5.0 mg/dL or RRT)	143 (100%)	83 (2%)	9.21
Liver SOFA score ^d			
0 (bilirubin < 1.2 mg/dL)	132 (92%)	3253 (90%)	0.07
1 (bilirubin 1.2-1.9 mg/dL)	7 (5%)	251 (7%)	0.09
≥ 2 (bilirubin ≥ 2.0 mg/dL)	4 (3%)	96 (3%)	0.01
Coagulation SOFA score ^e			
0 (platelet count ≥ 150 K/mm ³)	90 (63%)	2989 (83%)	0.46
1 (platelet count 100-149 K/mm ³)	37 (26%)	467 (13%)	0.33
≥ 2 (platelet count < 100 K/mm ³)	16 (11%)	144 (4%)	0.27
Vasopressor or inotrope use	72 (50%)	1482 (41%)	0.19
Shock ^f	17 (12%)	370 (10%)	0.05

Other infections

Bacterial pneumonia	24 (17%)	489 (14%)	0.09
Bacteremia or endocarditis	11 (8%)	80 (2%)	0.25

Laboratory findings

White cell count (K/mm ³)	7.5 [5.7-10.4]	8.5 [6.1-11.9]	0.22
Lymphocyte count (K/mm ³)	9.7 [5.4-15.1]	10.0 [6.0-15.1]	0.05
Hemoglobin (g/dL)	10.3 [9.0-11.8]	12.8 [11.4-14.2]	1.13
Platelet count (K/mm ³)	167 [124-212]	218 [167-281]	0.63
Creatinine (mg/dL)	7.7 [5.6-10.1]	1.0 [0.8-1.4]	2.35
Albumin (g/dL)	3.3 [2.9-3.6]	3.2 [2.8-3.6]	0.13
AST (units/L)	46 [30-72]	54 [36-85]	0.19
ALT (units/L)	23 [17-40]	38 [24-62]	0.52
Bilirubin (mg/dL)	0.6 [0.4-0.7]	0.6 [0.4-0.8]	0.17
Lactate (mmol/L)	1.6 [1.0-2.6]	1.6 [1.1-2.3]	0.04
CRP (mg/L)	170.0 [73.0-277.7]	151.0 [81.6-235.7]	0.13
IL-6 (pg/mL)	121.4 [41.3-320.4]	56.0 [18.0-156.6]	0.45
Arterial pH	7.37 [7.28-7.43]	7.38 [7.30-7.44]	0.09
Fibrinogen (mg/dL)	542 [369-619]	614 [491-764]	0.51
D-dimer (ng/mL)	1347 [609-2623]	1270 [652-3459]	0.002
Ferritin (ng/mL)	3406 [1795-6271]	947 [489-1919]	1.12
Troponin T (ng/mL)	175 [95-364]	12 [4-40]	1.62
Troponin I (ng/mL)	140 [70-330]	30 [10-110]	0.94

Values are n (%) for categorical variables and median [quartile 1 – quartile 3] for continuous variables. An absolute standardized mean difference > 0.1 represents a meaningful difference between groups. Variables with missing values are listed in Supplemental Table S13.

^a Information on ethnicity and race were abstracted from the electronic health record of each patient. In the U.S., people of Hispanic ethnicity are those of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race.

^b The anti-infective medication categories HCQ or CQ, azithromycin, and HCQ or CQ + azithromycin are not mutually exclusive.

^c Renal component of the SOFA score was based on serum creatinine levels. Patients who did not have a serum creatinine drawn on ICU day 1 were classified as having a renal SOFA score of 0, and patients on RRT were classified as having a renal SOFA score of 4.⁴⁹

^d Liver component of the SOFA score. Patients who did not have a serum bilirubin drawn on ICU day 1 were classified as having a liver SOFA score of 0.⁴⁹

^e Coagulation component of the SOFA score. Patients who did not have a platelet count drawn on ICU day 1 were classified as having a coagulation SOFA score of 0.⁴⁹

^f Shock is defined as the requirement of ≥ 2 vasopressors or inotropes.

Abbreviations: ACE, angiotensin converting enzyme; AKI, acute kidney injury; ALT, alanine aminotransferase; ARB, angiotensin II receptor blocker; AST, aspartate aminotransferase; BMI, body mass index; BP, blood pressure; COPD, chronic obstructive pulmonary disease; CQ, chloroquine; CRP, C-reactive protein; FiO₂, fraction of inspired oxygen; HCQ, hydroxychloroquine; ICU, intensive care unit; IL, interleukin; NSAIDs, non-steroidal anti-inflammatory drug; PaO₂, partial pressure of oxygen; PEEP, positive end-expiratory pressure; RRT, renal replacement therapy; SOFA, Sequential Organ Failure Assessment; U.S., United States.

Table S4. Characteristics of critically ill COVID-19 patients with pre-existing non-dialysis dependent CKD and without pre-existing CKD on ICU day 1

Characteristic	Patients with non-dialysis CKD n = 521	Patients without pre-existing CKD n = 3600	Standardized difference
Demographics			
Age (years)	69 [60-76]	61 [51-70]	0.55
Male	323 (62%)	2314 (64%)	0.05
Race ^a			
White	184 (35%)	1403 (39%)	0.08
Black	232 (45%)	963 (27%)	0.38
Other race	34 (7%)	309 (9%)	0.08
Unknown/not reported	71 (14%)	925 (26%)	0.31
Ethnicity ^a			
Hispanic	66 (13%)	919 (26%)	0.33
Non-Hispanic	411 (79%)	2218 (62%)	0.39
Unknown/not reported	44 (8%)	463 (13%)	0.14
BMI (kg/m ²)	30.3 [26.3-36.3]	30.4 [26.5-35.6]	0.001
U.S. geographic region			
Northeast	241 (46%)	2175 (60%)	0.30
South	65 (12%)	388 (11%)	0.05
Midwest	169 (32%)	717 (20%)	0.30
West	46 (9%)	320 (9%)	0.00
Comorbid conditions			
Diabetes	329 (63%)	1337 (37%)	0.54
Hypertension	451 (87%)	2036 (57%)	0.71
Coronary artery disease	146 (28%)	374 (10%)	0.46
Heart failure	136 (26%)	233 (6%)	0.55
Atrial fibrillation or flutter	70 (13%)	211 (6%)	0.26
Asthma or COPD	118 (23%)	617 (17%)	0.14
Chronic liver disease	33 (6%)	103 (3%)	0.17
Home medications			
ACE inhibitor or ARB	243 (47%)	1127 (31%)	0.32
Beta blocker	264 (51%)	768 (21%)	0.64
Other antihypertensive	296 (57%)	937 (26%)	0.66
Statin	317 (61%)	1226 (34%)	0.56
Aspirin	213 (41%)	668 (19%)	0.50
Anticoagulant	95 (18%)	294 (8%)	0.30
NSAIDs	26 (5%)	322 (9%)	0.16
HCQ or CQ ^b	16 (3%)	134 (4%)	0.04
Azithromycin ^b	25 (5%)	261 (7%)	0.10
HCQ or CQ + azithromycin ^b	6 (1%)	68 (2%)	0.06
Source of admission to the ICU			
Emergency department	299 (57%)	1981 (55%)	0.05
Hospital ward	165 (32%)	1114 (31%)	0.02
Transfer from another hospital	50 (10%)	487 (14%)	0.12
Other	6 (1%)	18 (1%)	0.09

Days from symptom onset to ICU admission	7 [3-10]	7 [4-10]	0.14
Symptoms			
Shortness of breath	360 (69%)	2733 (76%)	0.15
Cough	322 (62%)	2698 (75%)	0.29
Sputum production	58 (11%)	374 (10%)	0.02
Hemoptysis	7 (1%)	53 (1%)	0.01
Nasal congestion	32 (6%)	207 (6%)	0.02
Sore throat	42 (8%)	286 (8%)	0.004
Fever	294 (56%)	2486 (69%)	0.26
Chills	88 (17%)	698 (19%)	0.07
Headache	27 (5%)	343 (10%)	0.17
Altered mental status	106 (20%)	418 (12%)	0.24
Fatigue or malaise	184 (35%)	1118 (31%)	0.09
Myalgia or arthralgia	94 (18%)	815 (23%)	0.11
Nausea or vomiting	60 (12%)	573 (16%)	0.13
Diarrhea	115 (22%)	708 (20%)	0.06
Vital signs			
Highest temperature (°C)	37.7 [37.1-38.4]	38.0 [37.2-38.9]	0.29
Fever (>38°C)	213 (41%)	1,837 (51%)	0.26
Lowest systolic BP (mmHg)	96 [84-112]	97 [85-110]	0.01
Highest heart rate (beats/min)	101 [87-116]	105 [92-121]	0.23
Highest respiratory rate (breaths/min)	30 [26-36]	32 [26-38]	0.16
Severity of illness			
Invasive mechanical ventilation	311 (60%)	2284 (63%)	0.08
PEEP (cm H ₂ O)	10 [10-15]	12 [10-15]	0.26
PaO ₂ :FiO ₂ ratio (mmHg)	125 [79-190]	122 [83-191]	0.01
Non-invasive mechanical ventilation	16 (3%)	86 (2%)	0.04
High-flow nasal cannula or non-rebreather mask	121 (23%)	801 (22%)	0.02
AKI requiring dialysis	27 (5%)	55 (2%)	0.20
Renal SOFA score ^c			
0 (creatinine < 1.2 mg/dL)	62 (12%)	2347 (65%)	1.31
1 (creatinine 1.2-1.9 mg/dL)	168 (32%)	844 (23%)	0.20
2 (creatinine 2.0-3.4 mg/dL)	143 (27%)	255 (7%)	0.56
3 (creatinine 3.5-4.9 mg/dL)	68 (13%)	71 (2%)	0.43
4 (creatinine ≥ 5.0 mg/dL or RRT)	80 (15%)	83 (2%)	0.47
Liver SOFA score ^d			
0 (bilirubin < 1.2 mg/dL)	482 (93%)	3253 (90%)	0.08
1 (bilirubin 1.2-1.9 mg/dL)	28 (5%)	251 (7%)	0.07
≥ 2 (bilirubin ≥ 2.0 mg/dL)	11 (2%)	96 (3%)	0.04
Coagulation SOFA score ^e			
0 (platelet count ≥ 150 K/mm ³)	408 (78%)	2989 (83%)	0.12
1 (platelet count 100-149 K/mm ³)	80 (15%)	467 (13%)	0.07
≥ 2 (platelet count < 100 K/mm ³)	33 (6%)	144 (4%)	0.11
Vasopressor or inotrope use	219 (42%)	1482 (41%)	0.02
Shock ^f	75 (14%)	370 (10%)	0.13

Other infections

Bacterial pneumonia	85 (16%)	489 (14%)	0.08
Bacteremia or endocarditis	16 (3%)	80 (2%)	0.05

Laboratory findings

White cell count (K/mm ³)	8.2 [5.8-11.6]	8.5 [6.1-11.9]	0.08
Lymphocyte count (K/mm ³)	9.4 [5.7-14.9]	10.0 [6.0-15.1]	0.06
Hemoglobin (g/dL)	11.4 [9.5-12.9]	12.8 [11.4-14.2]	0.63
Platelet count (K/mm ³)	202 [155-258]	218 [167-281]	0.22
Creatinine (mg/dL)	2.2 [1.5-3.6]	1.0 [0.8-1.4]	1.56
Albumin (g/dL)	3.1 [2.6-3.5]	3.2 [2.8-3.6]	0.15
AST (units/L)	48 [33-80]	54 [36-85]	0.15
ALT (units/L)	28 [18-47]	38 [24-62]	0.39
Bilirubin (mg/dL)	0.5 [0.3-0.8]	0.6 [0.4-0.8]	0.26
Lactate (mmol/L)	1.6 [1.0-2.4]	1.6 [1.1-2.3]	0.07
CRP (mg/L)	142.4 [84.8-217.5]	151.0 [81.6-235.7]	0.05
IL-6 (pg/mL)	52.0 [19.0-175.3]	56.0 [18.0-156.6]	0.02
Arterial pH	7.34 [7.26-7.40]	7.38 [7.30-7.44]	0.38
Fibrinogen (mg/dL)	588 [442-732]	614 [491-764]	0.15
D-dimer (ng/mL)	1385 [670-3018]	1270 [652-3459]	0.01
Ferritin (ng/mL)	984 [450-1981]	947 [489-1919]	0.01
Troponin T (ng/mL)	51 [25-110]	12 [4-40]	0.86
Troponin I (ng/mL)	55 [20-170]	30 [10-110]	0.39

Values are n (%) for categorical variables and median [quartile 1 – quartile 3] for continuous variables. An absolute standardized mean difference > 0.1 represents a meaningful difference between groups. Variables with missing values are listed in Supplemental Table S13.

^a Information on ethnicity and race were abstracted from the electronic health record of each patient. In the U.S., people of Hispanic ethnicity are those of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race.

^b The anti-infective medication categories HCQ or CQ, azithromycin, and HCQ or CQ + azithromycin are not mutually exclusive.

^c Renal component of the SOFA score was based on serum creatinine levels. Patients who did not have a serum creatinine drawn on ICU day 1 were classified as having a renal SOFA score of 0, and patients on RRT were classified as having a renal SOFA score of 4.⁴⁹

^d Liver component of the SOFA score. Patients who did not have a serum bilirubin drawn on ICU day 1 were classified as having a liver SOFA score of 0.⁴⁹

^e Coagulation component of the SOFA score. Patients who did not have a platelet count drawn on ICU day 1 were classified as having a coagulation SOFA score of 0.⁴⁹

^f Shock is defined as the requirement of ≥ 2 vasopressors or inotropes.

Abbreviations: ACE, angiotensin converting enzyme; AKI, acute kidney injury; ALT, alanine aminotransferase; ARB, angiotensin II receptor blocker; AST, aspartate aminotransferase; BMI, body mass index; BP, blood pressure; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; CQ, chloroquine; CRP, C-reactive protein; FiO₂, fraction of inspired oxygen; HCQ, hydroxychloroquine; ICU, intensive care unit; IL, interleukin; NSAIDs, non-steroidal anti-inflammatory drug; PaO₂, partial pressure of oxygen; PEEP, positive end-expiratory pressure; RRT, renal replacement therapy; SOFA, Sequential Organ Failure Assessment; U.S., United States.

Table S5. Standardized differences comparing therapies administered in the first 14 days after ICU admission

Therapy	Maintenance dialysis versus non-dialysis CKD	Maintenance dialysis versus without pre-existing CKD	Non-dialysis CKD versus without pre-existing CKD
Anti-infective agent			
HCQ or CQ ^a	0.20	0.23	0.03
Azithromycin ^a	0.17	0.21	0.04
HCQ or CQ + azithromycin ^a	0.02	0.14	0.16
Remdesivir	0.23	0.40	0.22
Ribavirin	0.09	0.09	0.00
Lopinavir/ritonavir	0.04	0.04	0.08
Anti-inflammatory agent			
Any corticosteroid ^b	0.06	0.03	0.03
Dexamethasone ^b	0.00	0.10	0.10
NSAID	0.11	0.24	0.14
Aspirin	0.19	0.49	0.30
Statin	0.07	0.34	0.27
Tocilizumab	0.15	0.28	0.12
Vitamin C	0.11	0.12	0.00
Respiratory and cardiac intervention			
Invasive mechanical ventilation	0.08	0.15	0.07
Neuromuscular blockade	0.29	0.46	0.17
Inhaled epoprostenol	0.28	0.27	0.02
Inhaled nitric oxide	0.05	0.05	0.00
Proned positioning	0.06	0.37	0.30
ECMO	0.02	0.24	0.25
Vasopressor or inotrope	0.09	0.10	0.02
Mechanical cardiac support ^c	0.08	0.09	0.01
Other			
Therapeutic anti-coagulation ^d	0.01	0.03	0.03
Convalescent serum	0.06	0.05	0.11

Values presented in the table are absolute standardized mean differences. Dialysis represents pre-existing dialysis-dependent kidney failure.

^a The anti-infective medication categories HCQ or CQ, azithromycin, and HCQ or CQ + azithromycin are not mutually exclusive.

^b The anti-inflammatory agent categories any corticosteroid and dexamethasone are not mutually exclusive.

^c Mechanical cardiac support included an intra-aortic balloon pump, Impella® heart pump, and left and right ventricular assist devices.

^d Therapeutic anticoagulation included continuous drips of heparin, argatroban, or bivalirudin; subcutaneous enoxaparin (1.5 mg/kg once per day), dalteparin (150-200 units/kg once per day or 100 units/kg twice per day, fondaparinux (≥5 mg per day); oral anticoagulants (e.g. warfarin, apixaban, rivaroxaban, edoxaban, dabigatran).

Abbreviations: CKD, chronic kidney disease; CQ, chloroquine; ECMO, extracorporeal membrane oxygenation; HCQ, hydroxychloroquine; ICU, intensive care unit; NSAID, non-steroidal anti-inflammatory drug.

Table S6. Percentage of 14- and 28-day in-hospital deaths that occurred earlier and later in the study period

<i>Admitted to the ICU earlier in the study period – March 4 to April 6, 2020</i>			
In-hospital mortality	Maintenance dialysis n = 76	Non-dialysis CKD n = 340	Without pre-existing CKD n = 2377
14-day	31 (41%)	132 (39%)	581 (24%)
28-day	38 (50%)	177 (52%)	829 (35%)
<i>Admitted to the ICU later in the study period – April 7 to May 10, 2020</i>			
In-hospital mortality	Maintenance dialysis n = 67	Non-dialysis CKD n = 181	Without pre-existing CKD n = 1223
14-day	28 (42%)	75 (41%)	295 (24%)
28-day	34 (51%)	88 (49%)	432 (35%)

Abbreviations: CKD, chronic kidney disease; ICU, intensive care unit.

Table S7. Association between pre-existing kidney disease and 14-day in-hospital outcomes among critically ill COVID-19 patients

Respiratory failure					
Patient group	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a	Model 2 HR (95% CI)^b
Without pre-existing CKD	1310	607	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Non-dialysis CKD	208	93	0.96 (0.78, 1.17)	0.96 (0.78, 1.18)	0.95 (0.77, 1.18)
Maintenance dialysis	63	26	0.85 (0.59, 1.13)	0.88 (0.61, 1.27)	0.87 (0.60, 1.27)
Shock					
Patient group	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a	Model 2 HR (95% CI)^b
Without pre-existing CKD	3200	851	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Non-dialysis CKD	443	146	1.30 (1.09, 1.54)	1.18 (0.99, 1.41)	1.10 (0.91, 1.32)
Maintenance dialysis	126	47	1.55 (1.16, 2.08)	1.49 (1.10, 2.01)	1.34 (0.98, 1.82)
Ventricular arrhythmia or cardiac arrest					
Patient group	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a	Model 2 HR (95% CI)^b
Without pre-existing CKD	3486	533	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Non-dialysis CKD	500	104	1.42 (1.15, 1.75)	1.23 (0.99, 1.53)	1.15 (0.92, 1.43)
Maintenance dialysis	136	29	1.48 (1.09, 2.15)	1.40 (0.96, 2.06)	1.25 (0.84, 1.87)
Thromboembolic event					
Patient group	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a	Model 2 HR (95% CI)^b
Without pre-existing CKD	3487	260	1.00 (ref.)	1.00 (ref.)	--
Non-dialysis CKD	504	34	0.92 (0.64, 1.31)	0.90 (0.62, 1.29)	--
Maintenance dialysis	143	8	0.76 (0.38, 1.54)	0.71 (0.35, 1.45)	--
Major bleed					
Patient group	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a	Model 2 HR (95% CI)^b
Without pre-existing CKD	3530	98	1.00 (ref.)	1.00 (ref.)	--

Non-dialysis CKD	507	13	0.94 (0.53, 1.68)	0.95 (0.54, 1.71)	0.87 (0.48, 1.56)
Maintenance dialysis	139	6	1.62 (0.71, 3.71)	1.80 (0.78, 4.17)	1.52 (0.61, 3.77)
Acute liver injury					
Patient group	n	No. events	Unadjusted (95% CI)	Model 1 HR (95% CI)^a	Model 2 HR (95% CI)^b
Without pre-existing CKD	3532	163	1.00 (ref.)	1.00 (ref.)	1.00 (ref.)
Non-dialysis CKD	508	18	0.76 (0.47, 1.25)	0.87 (0.53, 1.43)	--
Maintenance dialysis	142	9	1.40 (0.71, 2.74)	1.54 (0.78, 3.07)	--

Fine and Gray proportional subdistribution hazards models were used to estimate the association between the presence of pre-existing kidney disease (kidney failure receiving maintenance dialysis and non-dialysis dependent CKD, separately) vs. no pre-existing CKD and 14-day in-hospital outcomes. Death and hospital discharge were treated as competing events. Outcome definitions are listed in Supplemental Table S1.

^a Model 1 was adjusted for age, sex, race, and Hispanic ethnicity.

^b Model 2 was adjusted for model 1 covariates plus diabetes, hypertension, coronary artery disease, heart failure, and atrial fibrillation or flutter. Due the low number of event counts and potential for over-adjustment, Model 2 HRs are not presented for thrombotic events, major bleeding events, and acute liver injury.

Abbreviations: CI, confidence interval; CKD, chronic kidney disease; HR, hazard ratio; No., number; ref., referent.

Table S8. Sensitivity analyses evaluating the association between pre-existing kidney disease and 14-day in-hospital major bleeding and thromboembolic events excluding patients on therapeutic anticoagulation on ICU day 1

Thromboembolic event				
Patient group	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a
Without pre-existing CKD	2976	221	1.00 (ref.)	1.00 (ref.)
Non-dialysis CKD	402	28	0.95 (0.64, 1.40)	0.92 (0.62, 1.37)
Maintenance dialysis	113	6	0.73 (0.32, 1.64)	0.68 (0.29, 1.55)
Major bleed				
Patient group	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a
Without pre-existing CKD	2967	57	1.00 (ref.)	1.00 (ref.)
Non-dialysis CKD	403	9	1.19 (0.59, 2.40)	1.12 (0.55, 2.26)
Maintenance dialysis	110	3	1.48 (0.46, 4.77)	1.60 (0.48, 5.32)

Fine and Gray proportional subdistribution hazards models were used to estimate the association between the presence of pre-existing kidney disease (kidney failure receiving maintenance dialysis and non-dialysis dependent CKD, separately) vs. no pre-existing CKD and 14-day in-hospital thromboembolic and major bleeding events. Death and hospital discharge were treated as competing events. Patients on therapeutic anticoagulation on ICU day 1 were excluded from these analyses. Outcome definitions are listed in Supplemental Table S1.

^a Model 1 was adjusted for age, sex, race, and Hispanic ethnicity. Due the low number of event counts and potential for over-adjustment, Model 2 HRs (additionally adjusted for diabetes, hypertension, coronary artery disease, heart failure, and atrial fibrillation or flutter are not presented.

Abbreviations: CI, confidence interval; HR, hazard ratio; No., number; ref., referent.

Table S9. Sensitivity analyses evaluating the association between pre-existing kidney disease and 14-day in-hospital acute liver injury excluding patients with histories of liver disease

<i>Acute liver injury</i>				
Patient group	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a
Without pre-existing CKD	3436	153	1.00 (ref.)	1.00 (ref.)
Non-dialysis CKD	478	15	0.70 (0.42, 1.20)	0.80 (0.45, 1.38)
Maintenance dialysis	135	9	1.53 (0.78, 3.01)	1.73 (0.87, 3.42)

Fine and Gray proportional subdistribution hazards models were used to estimate the association between the presence of pre-existing kidney disease (kidney failure receiving maintenance dialysis and non-dialysis dependent CKD, separately) vs. no pre-existing CKD and 14-day in-hospital acute liver injury. Death and hospital discharge were treated as competing events. Patients with chronic liver disease were excluded from these analyses. Outcome definitions are listed in Supplemental Table S1.

^a Model 1 was adjusted for age, sex, race, and Hispanic ethnicity. Due the low number of event counts and potential for over-adjustment, Model 2 HRs (additionally adjusted for diabetes, hypertension, coronary artery disease, heart failure, and atrial fibrillation or flutter are not presented.

Abbreviations: CI, confidence interval; HR, hazard ratio; No., number; ref., referent.

Table S10. Association between baseline serum creatinine and 14- and 28-day in-hospital mortality among critically ill non-dialysis dependent CKD patients with COVID-19

14-day in-hospital mortality				
Baseline creatinine	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a
< 1.2 mg/dL	72	25	1.00 (ref.)	1.00 (ref.)
1.2 – 1.9 mg/dL	229	83	1.05 (0.68, 1.63)	0.99 (0.63, 1.54)
≥ 2.0 mg/dL	96	39	1.22 (0.75, 2.00)	1.26 (0.77, 2.05)
28-day in-hospital mortality				
Baseline creatinine	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a
< 1.2 mg/dL	72	34	1.00 (ref.)	1.00 (ref.)
1.2 – 1.9 mg/dL	229	107	0.99 (0.68, 1.44)	0.96 (0.65, 1.41)
≥ 2.0 mg/dL	96	52	1.21 (0.79, 1.85)	1.26 (0.83, 1.91)

Of the 521 non-dialysis dependent CKD patients, 397 had a baseline serum creatinine measurement 7 to 365 days prior to hospital admission recorded in their electronic health care record. Fine and Gray proportional subdistribution hazards models were used to estimate the association between baseline serum creatinine and 14- and 28-day in-hospital mortality. Hospital discharge was treated as a competing event.

^a Model 1 was adjusted for age, sex, race, and Hispanic ethnicity. Due the low number of event counts and potential for over-adjustment, Model 2 HRs (additionally adjusted for diabetes, hypertension, coronary artery disease, heart failure, and atrial fibrillation or flutter are not presented.

Abbreviations: CI, confidence interval; CKD, chronic kidney disease; HR, hazard ratio; No., number; ref., referent.

Table S11. Association between vascular access type and 14- and 28-day in-hospital mortality among critically ill hemodialysis patients with COVID-19

14-day in-hospital mortality				
Catheter access	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a
No	93	33	1.00 (ref.)	1.00 (ref.)
Yes	35	19	1.92 (1.10, 3.36)	2.26 (1.24, 4.11)
28-day in-hospital mortality				
Catheter access	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a
No	93	42	1.00 (ref.)	1.00 (ref.)
Yes	35	20	1.61 (0.94, 2.78)	1.94 (1.09, 3.44)

A total of 128 hemodialysis patients were included in these analyses. Fine and Gray proportional subdistribution hazards models were used to estimate the association between vascular access type and 14- and 28-day in-hospital mortality. Hospital discharge was treated as a competing event.

^a Model 1 was adjusted for age, sex, race, and Hispanic ethnicity. Due the low number of event counts and potential for over-adjustment, Model 2 HRs (additionally adjusted for diabetes, hypertension, coronary artery disease, heart failure, and atrial fibrillation or flutter are not presented.

Abbreviations: CI, confidence interval; HR, hazard ratio; No., number; ref., referent.

Table S12. Association between dialysis vintage and 14- and 28-day in-hospital mortality among critically ill hemodialysis patients with COVID-19

14-day in-hospital mortality				
Vintage	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a
≥ 5.0 years	52	16	1.00 (ref.)	1.00 (ref.)
< 5.0 years	52	26	1.77 (0.96, 3.26)	1.56 (0.83, 2.96)
28-day in-hospital mortality				
Vintage	n	No. events	Unadjusted HR (95% CI)	Model 1 HR (95% CI)^a
≥ 5.0 years	52	20	1.00 (ref.)	1.00 (ref.)
< 5.0 years	52	30	1.70 (0.98, 2.96)	1.53 (0.85, 2.76)

Of the 128 hemodialysis patients, 24 had an unknown dialysis vintage and were excluded from these analyses. Fine and Gray proportional subdistribution hazards models were used to estimate the association between dialysis vintage and 14- and 28-day in-hospital mortality. Hospital discharge was treated as a competing event.

^a Model 1 was adjusted for age, sex, race, and Hispanic ethnicity. Due the low number of event counts and potential for over-adjustment, Model 2 HRs (additionally adjusted for diabetes, hypertension, coronary artery disease, heart failure, and atrial fibrillation or flutter are not presented.

Abbreviations: CI, confidence interval; HR, hazard ratio; No., number; ref., referent.

Table S13. ICU day 1 variables with missing data

Variables with missing data	All patients N = 4264
BMI	185 (4%)
Days from symptom onset to ICU admission	4 (0%)
White cell count	202 (5%)
Lymphocyte count	796 (19%)
Hemoglobin	201 (5%)
Platelet count	204 (5%)
Creatinine	165 (4%)
Albumin	784 (18%)
AST	764 (18%)
ALT	742 (17%)
Bilirubin	753 (18%)
Lactate	1569 (37%)
CRP	1599 (38%)
IL-6	3451 (81%)
Arterial pH	1290 (30%)
Fibrinogen	3388 (79%)
D-dimer	1926 (45%)
Ferritin	1741 (41%)
Troponin T	3423 (80%)
Troponin I	2731 (64%)

Values presented are n (%). Of the 2 675 patients receiving invasive mechanical ventilation on ICU day 1, PEEP was missing for 291 (11%) of patients, and PaO₂:FiO₂ ratio was missing for 466 (17%) patients.

Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; BMI, body mass index; CRP, C-reactive protein; ICU, intensive care unit; IL, interleukin.