Risk factors and Prognosis

Jyotsana Thakkar MD

Risk factors for severe COVID infection

Characteristics of and Important Lessons From the
Coronavirus Disease 2019 (COVID-19) Outbreak in China
Summary of a Report of 72 314 Cases From the Chinese
Center for Disease Control and Prevention

4672 confirmed cases updated to Feb 2020
Case fatality rate of 2.3%

Risk of mortality was elevated with
10.5%-Cardiovascular disease
7.3%- Diabetes
6.3% -Chronic respiratory disease
6.0% -Hypertension
5.6%- Cancer

Comorbid conditions associated with severe illness and mortality

- Cardiovascular disease
- Diabetes mellitus
- Chronic obstructive pulmonary disease and other lung diseases
- Cancer
- Chronic kidney disease
- Solid organ or hematopoietic stem cell transplantation
- Obesity
- Smoking

Other factors

Socioeconomic factors and Sex

- Males
- Blacks, Hispanics and South Asians

Clinical Outcomes in Young US Adults Hospitalized With COVID-19

Figure. Death and Mechanical Ventilation in Young Adults With and Without Morbid Obesity, Hypertension, and Diabetes
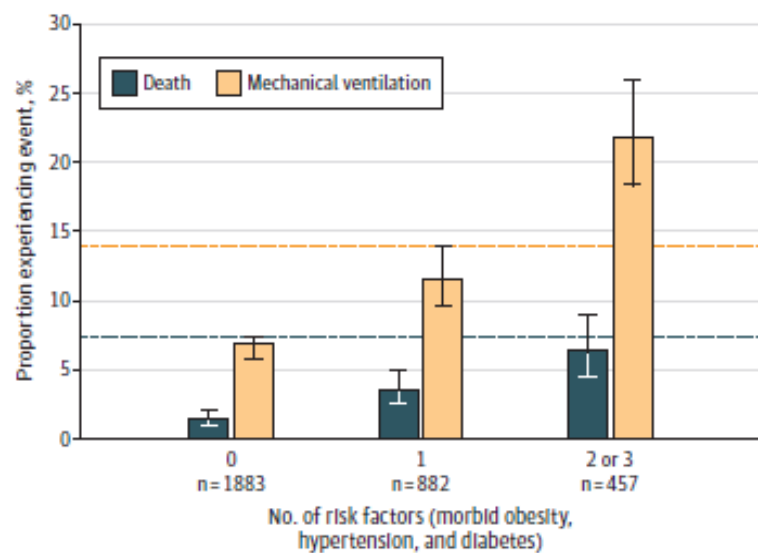

Table. Baseline Characteristics of Young Adults Age 18 to 34 Years With COVID-19[a]

Characteristic	No. (%) Full case series (N = 3222)	No death or ventilation (n = 2879)	Death or ventilation (n = 343)	P value
Age, mean (SD), y	28.3 (4.4)	28.3 (4.4)	28.3 (4.5)	.90
Men	1849 (57.6)	1626 (56.7)	223 (65.0)	.003
Race/ethnicity				
White non-Hispanic	536 (16.6)	479 (16.6)	57 (16.6)	
White Hispanic	350 (10.9)	324 (11.3)	26 (7.6)	
Black non-Hispanic	748 (23.2)	675 (23.4)	73 (21.3)	.14
Black Hispanic	14 (0.4)	13 (0.5)	1 (0.3)	
Other/unknown	1574 (48.9)	1388 (48.2)	186 (54.2)	
Black and/or Hispanic	1838 (57.0)	1669 (58.0)	169 (49.3)	.002
Discharge month				
April 2020	1680 (52.1)	1495 (51.9)	185 (53.9)	
May 2020	1063 (33.0)	936 (32.5)	127 (37.0)	.004
June 2020	479 (14.9)	448 (15.6)	31 (9.0)	
Region				
Northeast	1298 (40.3)	1161 (40.4)	137 (39.9)	
South	1130 (35.1)	1032 (35.9)	98 (28.6)	
Midwest	558 (17.3)	488 (17.0)	70 (20.4)	.002
West	233 (7.2)	195 (6.8)	38 (11.1)	
Any obesity, BMI ≥ 30	1187 (36.8)	1007 (35.0)	180 (52.5)	<.001
Morbid obesity, BMI ≥ 40	789 (24.5)	649 (22.5)	140 (40.8)	<.001
Asthma	545 (16.9)	495 (17.2)	50 (14.6)	.22
Hypertension	519 (16.1)	412 (14.3)	107 (31.2)	<.001
Smoking	513 (15.9)	472 (16.4)	41 (12.0)	.03
Diabetes	588 (18.2)	494 (17.2)	94 (27.4)	<.001

Predictors of severe AKI
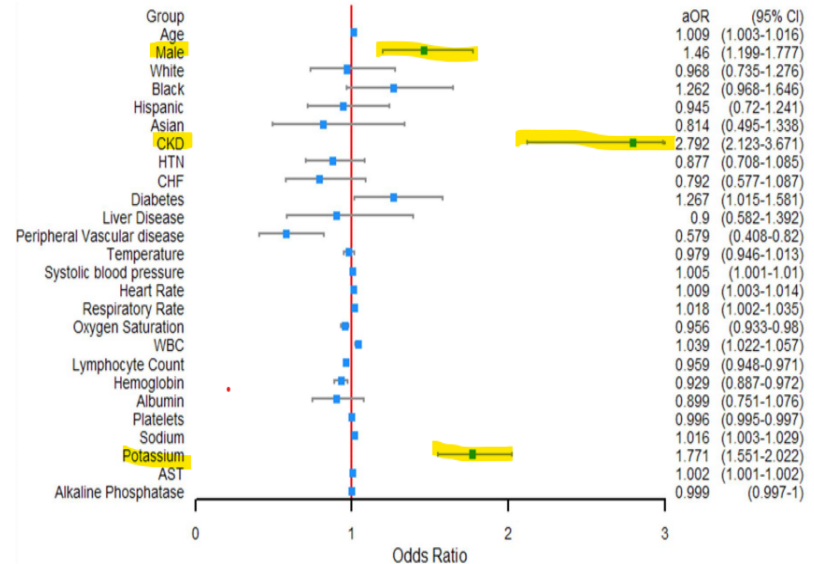
Stage 3 AKI

-Men

-Serum potassium level

-CKD

Chan L et al JASN August 2020

AKI in Hospitalized Patients with COVID-19

Supplemental Figure 3: Patient characteristics that were associated with severe AKI (Stage 3)

Group	aOR	(95% CI)
Age	1.009	(1.003-1.016)
Male	1.46	(1.199-1.777)
White	0.968	(0.735-1.276)
Black	1.262	(0.968-1.646)
Hispanic	0.945	(0.72-1.241)
Asian	0.814	(0.495-1.338)
CKD	2.792	(2.123-3.671)
HTN	0.877	(0.708-1.085)
CHF	0.792	(0.577-1.087)
Diabetes	1.267	(1.015-1.581)
Liver Disease	0.9	(0.582-1.392)
Peripheral Vascular disease	0.579	(0.408-0.82)
Temperature	0.979	(0.946-1.013)
Systolic blood pressure	1.005	(1.001-1.01)
Heart Rate	1.009	(1.003-1.014)
Respiratory Rate	1.018	(1.002-1.035)
Oxygen Saturation	0.956	(0.933-0.98)
WBC	1.039	(1.022-1.057)
Lymphocyte Count	0.959	(0.948-0.971)
Hemoglobin	0.929	(0.887-0.972)
Albumin	0.899	(0.751-1.076)
Platelets	0.996	(0.995-0.997)
Sodium	1.016	(1.003-1.029)
Potassium	1.771	(1.551-2.022)
AST	1.002	(1.001-1.002)
Alkaline Phosphatase	0.999	(0.997-1)

Odds Ratio

Adjusted for age, gender, race, comorbidities including chronic kidney disease, hypertension, congestive heart failure, diabetes mellitus, liver disease, peripheral vascular disease, lab values including white blood cell count, lymphocyte percentage, hemoglobin, platelets, sodium, potassium, AST, alkaline phosphatase, albumin, vitals including temperature, systolic BP, heart rate, respiratory rate, oxygen saturation
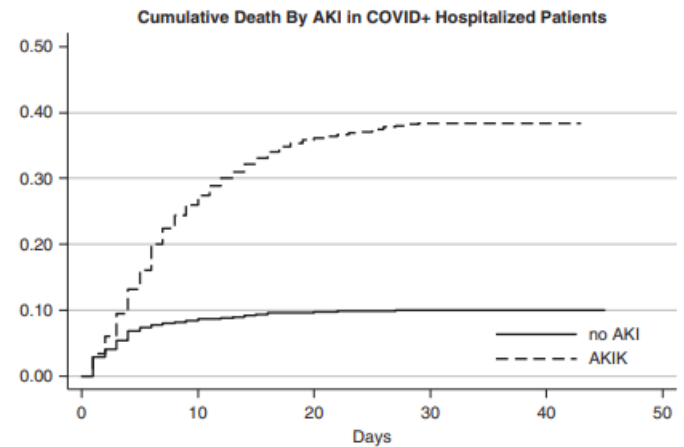
AKI in Hospitalized Patients with and without COVID-19: A Comparison Study

Molly Fisher,[1] Joel Neugarten,[1] Eran Bellin,[2] Milagros Yunes,[1] Lindsay Stahl,[3] Tanya S. Johns,[1] Matthew K. Abramowitz,[1] Rebecca Levy,[1] Neelja Kumar,[1] Michele H. Mokrzycki,[1] Maria Coco,[1] Mary Dominguez,[1] Kalyan Prudhvi,[1] and Ladan Golestaneh [1]

Development of AKI was significantly associated with

- Male sex
- Black race
- Older age

In the COVID-19–positive cohort, in-hospital death was 33.7% in those with AKI compared with 9.3% in those without AKI

Figure 2. Higher mortality in those with AKI.

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Table S6. Predictive Model for Stage 2 or 3 AKI in COVID-19 Infection

Variable	Odds Ratio, 95% CI
Age for every 1 year increase	1.0 (1.0-1.0)
Black race	1.8 (1.2-2.8)
Male sex	1.4 (1.1-1.7)
Diabetes mellitus	1.3 (1.0-1.7)
Nursing home resident	1.6 (1.2-2.1)
Respiratory rate for every increase in breath per minute*	1.0 (1.0-1.0)
WBC count (for every k/µL)	1.0 (1.0-1.1)
[1]Neutrophil/lymphocyte ratio*	1.5 (1.2-1.9)
[2]Lactate dehydrogenase*	2.1 (1.8-2.5)

*Initial value on hospitalization

Acute Kidney Injury in a National Cohort of Hospitalized US Veterans with COVID-19

Benjamin Bowe,[1,2,3] Miao Cai,[1,3] Yan Xie,[1,2,3] Andrew K. Gibson [ID],[1,3] Geetha Maddukuri,[4] and Ziyad Al-Aly [ID] [1,3,4,5,6]

Older age, Black race, male gender, obesity, diabetes, hypertension, and lower eGFR were significant predictors of AKI during hospitalization with COVID-19

Diuretic and angiotensin-converting enzyme inhibitor/angiotensin II receptor blocker use was associated with higher risk of any AKI and having a more severe AKI

Higher risk of AKI and AKI severity with decreasing eGFR category

AKI was associated with higher mechanical ventilation use and longer hospital stay

Acute kidney injury in patients hospitalized with COVID-19

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Table 5 | Univariate and multivariate logistic regression analyses of risk factors associated with the development of AKI

Variable	Unadjusted OR	95% CI	P value	Adjusted OR[a]	95% CI	P value
Age (yr)	1.03	1.02–1.03	<0.001	1.03	1.03–1.04	<0.001[b]
Male	1.21	1.08–1.35	0.001	1.14	0.97–1.33	0.10
White race	Reference	Reference	Reference	Reference	Reference	Reference
Asian	0.84	0.68–1.04	0.11	0.83	0.61–1.12	0.23
Black	0.93	0.80–1.08	0.32	1.23	1.01–1.50	0.04[b]
Other/mixed	0.81	0.71–0.93	0.003	0.84	0.69–1.03	0.09
Unknown	0.9	0.69–1.18	0.44	0.74	0.50–1.11	0.15
Tertiary hospital	0.89	0.79–1.00	0.05	0.90	0.77–1.06	0.20
Diabetes	1.84	1.64–2.06	<0.001	1.76	1.49–2.07	<0.001[b]
Hypertension	1.81	1.61–2.02	<0.001	1.25	1.04–1.50	0.02[b]
Cardiovascular disease[c]	2.05	1.77–2.37	<0.001	1.48	1.22–1.80	<0.001[b]
Respiratory disease[d]	1.09	0.93–1.26	0.29	—	—	—
Obesity, BMI ≥30 kg/m^2	1.12	1.00–1.26	0.05	1.11	0.94–1.31	0.22
HIV	0.69	0.33–1.44	0.33	—	—	—
Cancer	1.2	0.96–1.51	0.11	1.09	0.82–1.45	0.54
Chronic liver disease	1.01	0.69–1.49	0.95	—	—	—
Mechanical ventilation	31.60	25.80–38.60	<0.001	10.7	6.81–16.70	<0.001[b]
Vasoactive medication[e]	31.40	25.60–38.40	<0.001	4.53	2.88–7.13	<0.001[b]
ACE-I or ARB use	1.61	1.42–1.82	<0.001	0.87	0.73–1.04	0.12

ACE-I, angiotensin-converting enzyme inhibitor; AKI, acute kidney injury; ARB, angiotensin II receptor blocker; BMI, body mass index; CI, confidence interval; OR, odds ratio.
[a]Variables were entered into the model when the α level of risk factor was less than 0.15. Age, sex, and race were added into the model regardless of α level.
[b]Independent risk factors include increased age, black race, diabetes, hypertension, cardiovascular disease, mechanical ventilation, and vasoactive medication.
[c]Cardiovascular diseases include coronary artery disease, heart failure, and peripheral vascular disease.
[d]Respiratory diseases include asthma and chronic obstructive pulmonary disease.
[e]Vasoactive medications include inotropes and vasopressors.

Acute kidney injury in patients hospitalized with COVID-19

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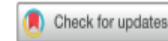
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Risk Factor	Severity of COVID Y/N	COVID associated AKI – Y/N
Age- older age	Y	Y
Male	Y	Y
Higher BMI	Y	N
Race Hispanic	Y	N
Race Black	Y	Y
RAAS Inhibition use	Y	N

AKI Treated with Renal Replacement Therapy in Critically Ill Patients with COVID-19

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Older age, receipt of two or more vasopressors at the time of RRT initiation, and severe oliguria at the time of RRT initiation were each associated with a higher risk of 28-day mortality

CKD stage 4 or 5 was associated with a lower risk of 28-day mortality

METHODS

Multicenter cohort study

N = 3099 critically ill adults with COVID-19

Data from 67 hospitals across the United States

Logistic regression to identify risk factors for AKI-RRT
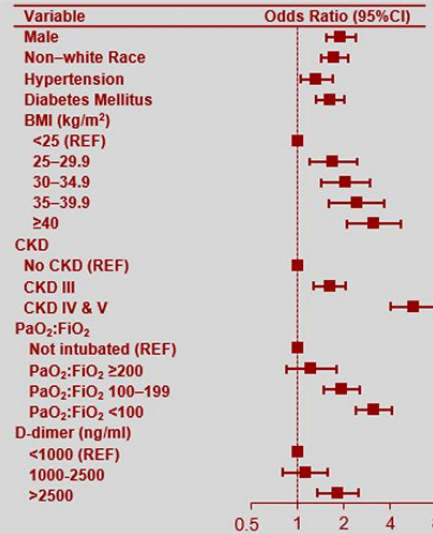
OUTCOME

21% of patients developed AKI-RRT

63% of AKI-RRT patients died in the hospital

34% of survivors remained RRT-dependent on discharge

Risk Factors for AKI-RRT

Variable	Odds Ratio (95%CI)
Male	
Non–white Race	
Hypertension	
Diabetes Mellitus	
BMI (kg/m²)	
<25 (REF)	
25–29.9	
30–34.9	
35–39.9	
≥40	
CKD	
No CKD (REF)	
CKD III	
CKD IV & V	
PaO₂:FiO₂	
Not intubated (REF)	
PaO₂:FiO₂ ≥200	
PaO₂:FiO₂ 100–199	
PaO₂:FiO₂ <100	
D-dimer (ng/ml)	
<1000 (REF)	
1000-2500	
>2500	

0.5 1 2 4 8

Conclusion
AKI-RRT is common in critically ill patients with COVID-19 and is associated with high inpatient mortality and persistent RRT dependence among survivors.

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Risk factors and prognosis for COVID-19-induced acute kidney injury: a meta-analysis

Lirong Lin,[1] Xiang Wang,[2] Jiangwen Ren,[3] Yan Sun,[1] Rongjie Yu,[1] Kailong Li,[1] Luquan Zheng,[1] Jurong Yang [1]

79 research articles, including 49 692 patients with COVID-19

In North America, more patients who were aged ≥65 years and also developed AKI.

European patients had significantly higher mortality and a higher CRRT rate

Risk factors for COVID-19 combined with AKI showed that age ≥60 years and severe COVID-19 were independent risk factors for AKI

CRRT rate in patients with severe COVID-19 was significantly higher than in patients with non-severe COVID-19

Risk of death in patients with COVID-19 and AKI was significantly increased

Risk factors for higher mortality when infected with COVID-19

- Increased age

- Higher BMI

- Smoking

- Male sex

- African Americans /Hispanics ethnicity

- Other comorbidities, especially cardiovascular diseases

Conclusion:

Risk factor and prognosis for COVID associated AKI

1) Age- Older age

2) Sex- Males

3) Race- Blacks

4) Pre-existing CKD

5) DM, HTN, Cardiovascular diseases- seen in some studies, not consistent

6) Mechanical Ventilator and use of vasopressors