

Title: Acute Kidney Injury in Hospitalized Patients with COVID-19

Supplemental Methods:

Mount Sinai COVID Informatics Center (MSCIC) Data Platform

This dataset of clinical data is the first part of a larger effort that aims to create an heterogeneous collection of COVID-19 patient data. This effort brings together different stakeholders from MSHS, including research faculty, data scientists, clinicians, and hospital administrators, among others. The resulting dataset includes or will include longitudinal electronic health record (EHR) patient clinical data, multi-omics, such as genomics, imaging, such as chest CT scans, among others. The data, which are updated on a daily basis, is made available within a secure computational framework based on internal Microsoft Azure Cloud to researchers and analysts within the MSHS and the Icahn School of Medicine at Mount Sinai. This dataset is intended to foster research projects to improve the knowledge of this disease and augment clinical operations with machine intelligence.

Supplemental Figure 1: Study flow diagram

Supplemental Figure 2: Proportion of patients with hematuria, leukocyturia, and proteinuria by AKI status in subset of patients with urine studies (N=656)

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

Supplemental Table 1: ICD codes used for identification of ESKD cohort. ESKD was defined as having both an ESKD diagnosis code and an ESKD procedure code.

Supplemental Table 2: Definitions of acute kidney disease

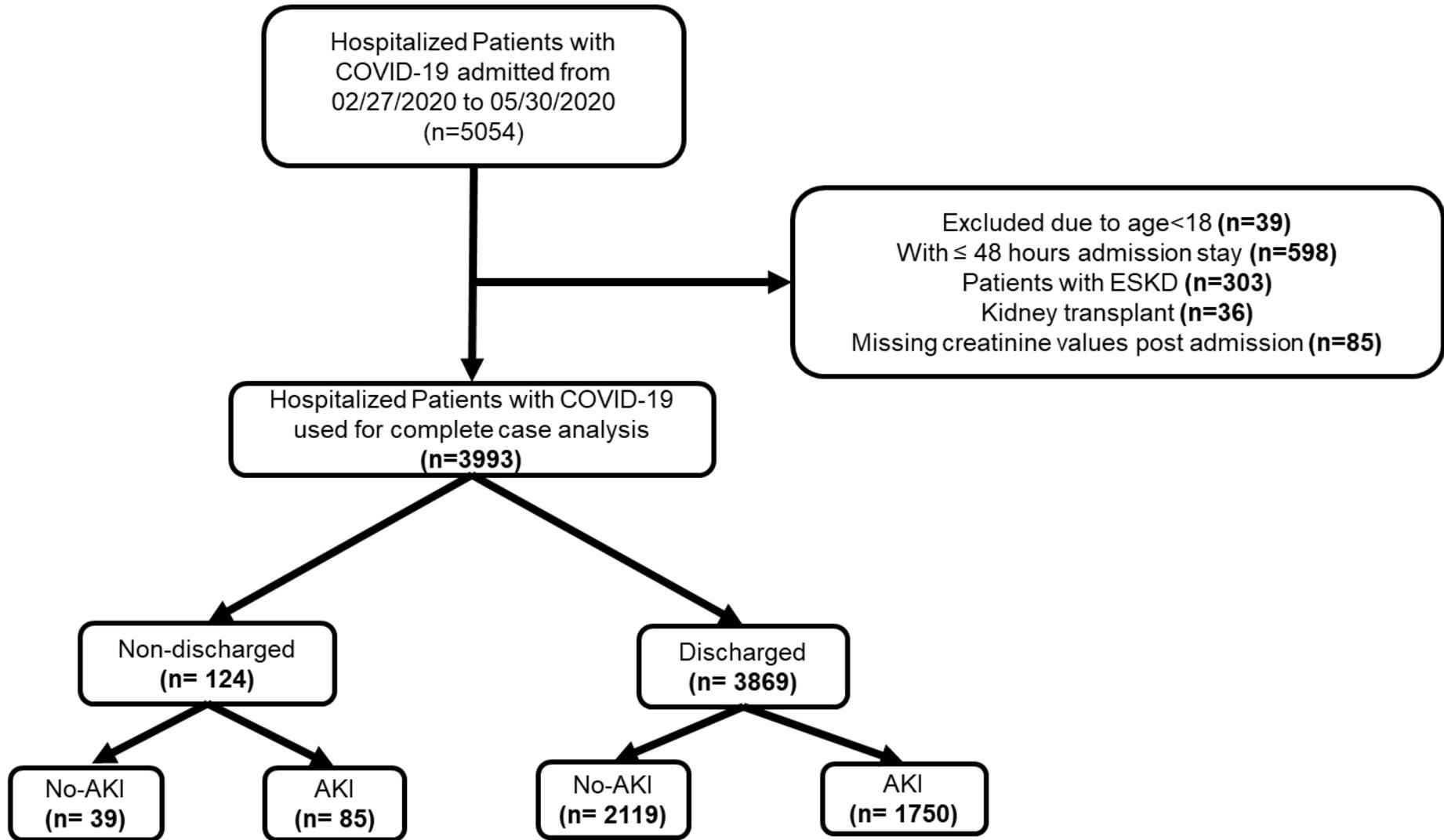
Supplemental Table 3: Incidence of AKI in patients admitted to the ICU by MSHS hospital, P<0.001)

Supplemental Table 4: Patient characteristics by kidney recovery and acute kidney disease stages.

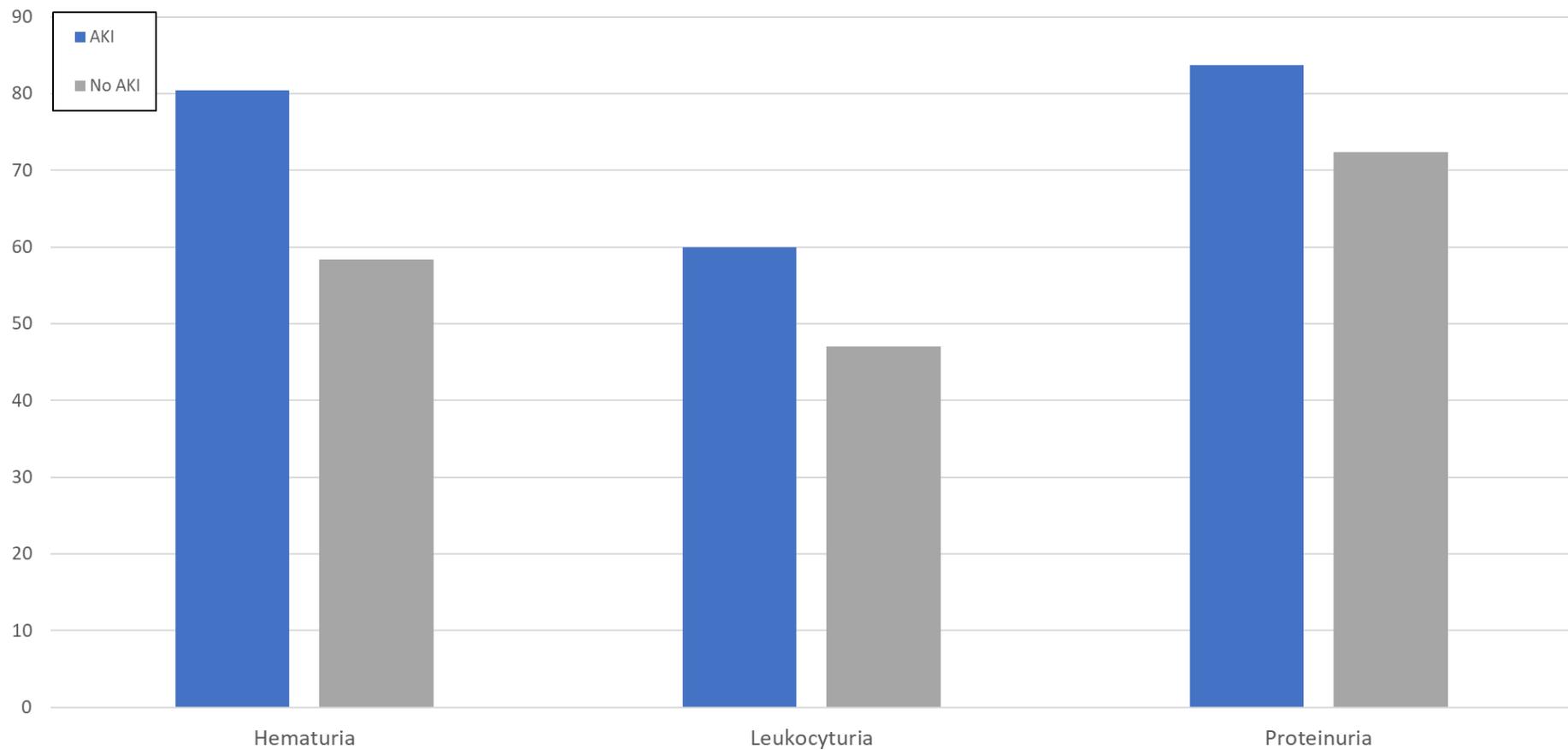
Supplemental Table 5: Outcomes in patients with AKI and without AKI in the full cohort

Supplemental Table 6. Adjusted and Unadjusted OR of in-hospital mortality

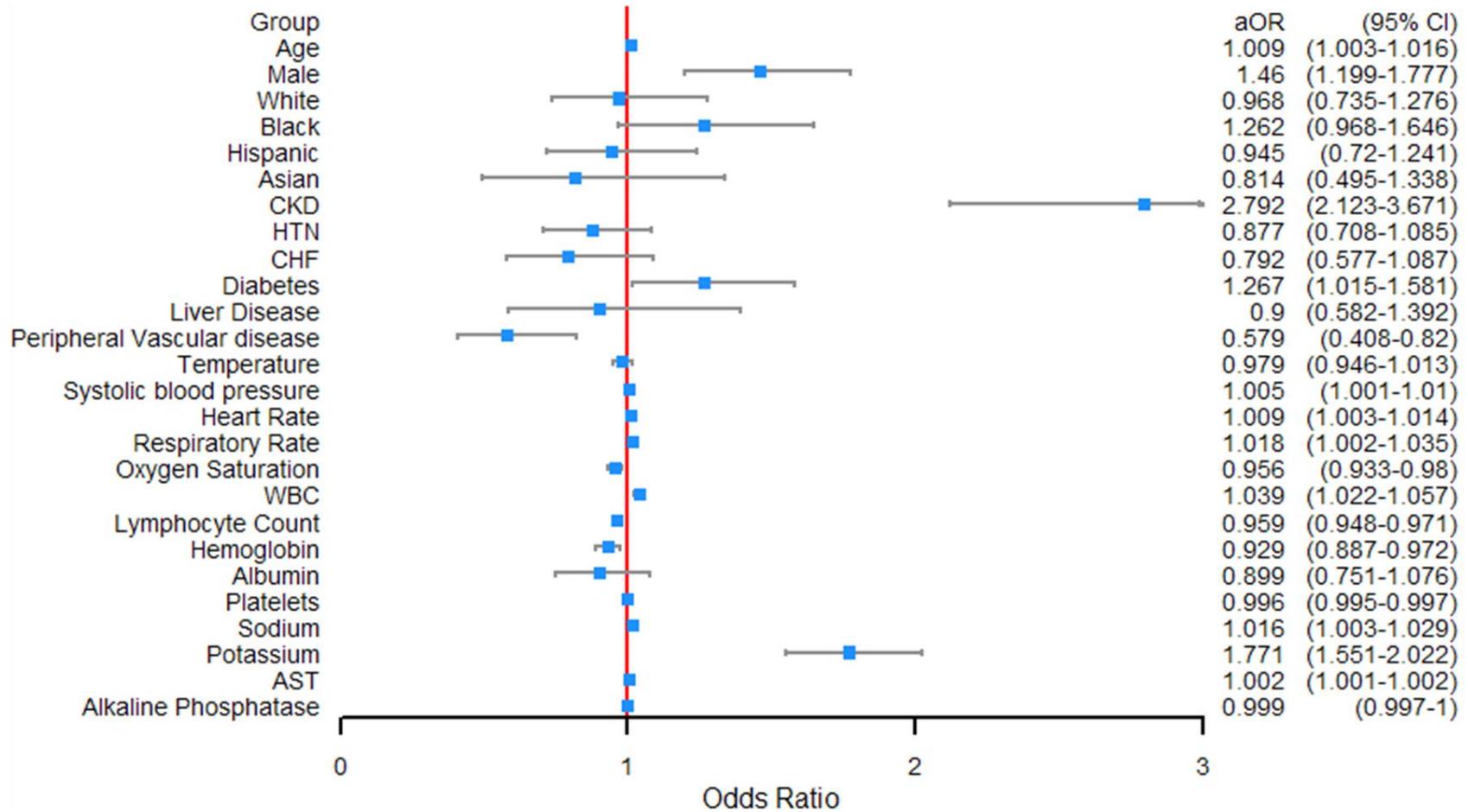
Supplemental Figure 1: Study flow diagram



Supplemental Figure 2: Proportion of patients with hematuria, leukocyturia, and proteinuria by AKI status in subset of patients with urine studies (N=656)



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



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

Supplemental Table 1: ICD codes used for identification of ESKD cohort. ESKD was defined as having both an ESKD diagnosis code and an ESKD procedure code.

| Study Variable | ICD9 | Description |
|--------------------------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagnosis Code | 585.6 | End Stage Kidney Disease (need this and any of below) |
| Dialysis procedures | 39.95 | Hemodialysis |
| Dialysis diagnosis | V45.11, V45.12, V56.0, V56.1 | Hemodialysis |
| Peritoneal Dialysis procedures | 54.98, V56.2, V56.8, 996.68, V56.32 | Peritoneal Dialysis, Fitting and adjustment of peritoneal dialysis catheter, Encounter for other dialysis, Infection and inflammatory reaction due to peritoneal dialysis catheter, Encounter for adequacy testing for peritoneal dialysis |

| Study Variable | ICD10 | Description |
|--------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diagnosis Code | N18.6 | End Stage Kidney Disease (need this and any of below) |
| Dialysis procedures | 5A1D70Z | Hemodialysis |
| Dialysis diagnosis | Z99.2, Z91.15, Z49.01, Z49.3, Z49.31, Z49.32 | Hemodialysis, Encounter for fitting and adjustment of extracorporeal dialysis catheter |
| Peritoneal Dialysis procedures | 3E1M39Z, Z49.02, Z49.32, T85.611x, T85.621x, T85.631, T85.691x, T85.71x, Z49.32 | Irrigation of Peritoneal Cavity using Dialysate, Percutaneous Approach, Encounter for fitting and adjustment of peritoneal dialysis catheter, Breakdown (mechanical) of intraperitoneal dialysis catheter, Displacement of intraperitoneal dialysis catheter, Leakage of intraperitoneal dialysis catheter, Other mechanical complication of intraperitoneal dialysis catheter, Infection and inflammatory reaction due to peritoneal dialysis catheter, Encounter for adequacy testing for peritoneal dialysis |

Supplemental Table 2: Definitions of acute kidney disease

| AKD Stage | Definitions |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Recovered | Difference in Creatinine is ≤ 0.3 and Creatinine change in % $\leq 25\%$ |
| Stage 1 | Difference in Creatinine > 0.3 and Creatinine change in % is $\leq 25\%$ Creatinine change in % is $> 25\%$ and $\leq 100\%$ |
| Stage 2 | Creatinine change in % is $> 100\%$ and $\leq 200\%$ |
| Stage 3 | Creatinine change in % is $> 200\%$ |

Supplemental Table 3: Incidence of AKI in patients admitted to the ICU by MSHS hospital, P=0.06)

| Hosp. facility | AKI (n=745) | No AKI (n=231) |
|--------------------------------------------------------------------------|--------------------|-----------------------|
| Mount Sinai Hospital located in East Harlem, Manhattan (MSH) | 312 (42) | 106 (46) |
| Mount Sinai Morningside located in Morningside Heights, Manhattan (STLH) | 147 (20) | 48 (21) |
| Mount Sinai West located in Midtown and the West Side, Manhattan (RVTH) | 73 (10) | 32 (14) |
| Mount Sinai Brooklyn located in Midwood, Brooklyn (BIKH) | 110 (15) | 24 (10) |
| Mount Sinai Queens located in Astoria, Queens | 103 (14) | 21 (9) |

Supplemental Table 4: Patient characteristics by kidney recovery and acute kidney disease stages in those who outcomes.

| | Recovered (n= 673) | AKD Stage 1 (n= 387) | AKD Stage 2 (n= 199) | AKD Stage 3 (n= 491) | p-value |
|----------------------------------|-------------------------------|---------------------------------|---------------------------------|---------------------------------|----------------|
| Age Median (IQR) | 69 (58-79) | 74 (65-83) | 77 (68-85) | 70 (61-79) | <0.001 |
| Sex, n (%) | | | | | |
| Female | 292 (43) | 185 (48) | 72 (36) | 155 (32) | <0.001 |
| Race/Ethnicity, n (%) | | | | | 0.03 |
| White | 144 (21) | 101 (26) | 64 (32) | 117 (24) | |
| Black | 218 (32) | 14 (30) | 41 (21) | 143 (29) | |
| Hispanic | 174 (26) | 85 (22) | 43 (22) | 115 (23) | |
| Asian | 26 (4) | 13 (3) | 5 (3) | 21 (4) | |
| Other or unknown | 111 (17) | 74 (19) | 46 (23) | 95 (19) | |
| Comorbidities, n (%) | | | | | |
| Hypertension | 316 (47) | 189 (49) | 93 (47) | 196 (40) | 0.04 |
| Congestive Heart Failure | 96 (14) | 71 (18) | 27 (14) | 39 (8) | <0.001 |
| Diabetes Mellitus | 225 (33) | 139 (36) | 52 (26) | 128 (26) | 0.003 |
| Liver disease | 42 (6) | 17 (4) | 12 (6) | 21 (4) | 0.38 |
| Peripheral Vascular Disease | 81 (12) | 54 (14) | 15 (8) | 34 (7) | 0.002 |
| CKD | 112 (17) | 90 (23) | 39 (20) | 87 (18) | 0.06 |
| Lab values, Median (IQR) | | | | | |
| White blood cell count | 8.4 (5.82-12) | 7.8 (5.6-10.9) | 9.8 (6.7-14.5) | 9.3 (6.6-13.5) | <0.001 |
| Lymphocyte percentage | 11.3 (7.4-17.6) | 12.2 (5.6-10.9) | 8.8 (5.7-14.4) | 9.4 (6-15.3) | <0.001 |
| Hemoglobin (g/dL) | 12.4 (11-13.9) | 11.8 (10.2-13.3) | 12.4 (10.7-13.8) | 12.5 (10.9-13.9) | <0.001 |
| Platelets (109/L) | 210.5 (156-275) | 206 (145-269) | 205 (153-283) | 200 (150-269) | 0.2 |
| Sodium (mEq/L) | 139 (135-143) | 140 (136-143) | 140 (136-146) | 139 (136-143) | 0.1 |
| Potassium (mEq/L) | 4.3 (3.9-4.7) | 4.4 (4-4.8) | 4.4 (3.8-4.9) | 4.5 (4-4.9) | <0.001 |
| Chloride (mEq/L) | 104 (100-109) | 105 (101-109) | 105 (101-110) | 104 (100-109) | 0.14 |
| Bicarbonate (mEq/L) | 22.7 (19.5-25.3) | 22 (19-25) | 22 (19-25) | 22 (18-24.7) | 0.001 |
| BUN blood urea nitrogen (mg/dL) | 28 (16-45) | 34 (21-52) | 36 (22-60) | 33 (18-60) | <0.001 |
| Serum Creatinine (mg/dL) | 1.3 (0.9-1.9) | 1.5 (1.1-2.2) | 1.7 (1.1-2.4) | 1.7 (0.9-3.4) | <0.001 |
| AST (U/L) | 44 (29-68) | 42 (27-70) | 47 (30-78) | 60 (35-96) | <0.001 |
| ALT (U/L) | 30 (18-49) | 25 (15-45) | 27 (18-48) | 33 (21-61) | <0.001 |
| Alkaline phosphatase (U/L) | 75 (60-100) | 2.9 (2.5-3.2) | 75 (60-109) | 77 (59-103) | 0.94 |
| Albumin in (g/dL) | 2.9 (2.5-3.2) | 2.9 (2.5-3.2) | 2.7 (2.4-3.1) | 2.8 (2.5-3.2) | 0.06 |
| Vital signs, median (IQR) | | | | | |

| | | | | | |
|--------------------------------------------------------------------------|------------------|------------------|----------------|------------------|--------|
| Temperature (F) | 98.5 (97.7-99.4) | 98.3 (97.7-99.1) | 98.3 (97.6-99) | 98.4 (97.7-99.5) | 0.04 |
| Systolic BP (mmHg) | 123 (110-139) | 125 (112-144) | 126 (110-141) | 128 (112-146) | 0.01 |
| Diastolic BP (mmHg) | 70 (62-79) | 70 (62-79) | 70 (60-81) | 70 (61-81) | 0.72 |
| Heart rate (BPM) | 86 (75-98) | 85 (76-98) | 84 (74-98) | 89 (79-101) | 0.002 |
| Respiratory rate (per min) | 19 (18-21) | 19 (18-20) | 20 (18-22) | 20 (18-22) | 0.002 |
| Oxygen saturation, % | 96 (94-98) | 96 (95-98) | 96 (93-98) | 95 (93-98) | <0.001 |
| Hosp. facility | | | | | <.001 |
| Mount Sinai Hospital located in East Harlem, Manhattan (MSH) | 276 (41) | 131 (34) | 57 (29) | 154 (31) | |
| Mount Sinai Morningside located in Morningside Heights, Manhattan (STLH) | 148 (22) | 82 (21) | 25 (13) | 74 (15) | |
| Mount Sinai West located in Midtown and the West Side, Manhattan (RVTH) | 70 (10) | 25 (7) | 26 (13) | 35 (7) | |
| Mount Sinai Brooklyn located in Midwood, Brooklyn (BIKH) | 77 (11) | 89 (23) | 39 (20) | 130 (26) | |
| Mount Sinai Queens located in Astoria, Queens | 102 (15) | 60 (16) | 52 (26) | 98 (20) | |

Supplemental Table 5: Outcomes in patients with AKI and without AKI in the full cohort (N=3993)

| Outcomes, n (%) | AKI | No AKI | p-value |
|--------------------------------------------------|---------------|---------------|----------------|
| Full cohort | N=1835 | N=2158 | |
| ICU admission | 745 (41) | 231 (11) | <0.001 |
| Mechanical ventilation | 803 (44) | 126 (6) | <0.001 |
| Vasopressor use | 783 (43) | 210 (10) | <0.001 |
| Still admitted at time of manuscript | 85 (5) | 39 (2) | <0.001 |
| Length of stay for those discharged, median(IQR) | 10 (6-18) | 7 (4-11) | <0.001 |
| In-hospital Mortality | 918 (50) | 167 (8) | <0.001 |

Supplemental Table 6. Adjusted and Unadjusted OR of in-hospital mortality in patients with outcomes data available

| AKI vs no-AKI | Unadjusted OR | Adjusted OR^a |
|----------------------------------------------------------------|----------------------|--------------------------------|
| All patients with outcome data (n=3869) | 12.9 (10.7-15.5) | 9.2 (7.5-11.3) |
| All patients with outcome data that had ICU admissions (n=899) | 13.3 (8.8-20.2) | 11.4 (7.2-18) |
| | | |
| AKI Stage vs. no-AKI (all patients) | Unadjusted OR | Adjusted OR^a |
| Stage 1 (n=683) | 5.9 (4.7-7.3) | 4.5 (3.5-5.6) |
| Stage 2 (n=336) | 10.9 (8.3-14.2) | 6.6 (4.9-8.9) |
| Stage 3 – no dialysis (n=411) | 29.7 (22.8-38.8) | 20.2 (15-27.3) |
| Stage 3 – requiring dialysis (n=320) | 31.3 (23.4-41.9) | 38.7 (27.4-54.6) |
| | | |
| AKI Stage vs. no-AKI (ICU patients) | Unadjusted OR | Adjusted OR^a |
| Stage 1 (n=179) | 4.9 (3-8) | 4.5 (2.7-7.7) |
| Stage 2 (n=105) | 11.1 (6.3-19.2) | 8 (4.4-14.8) |
| Stage 3 – no dialysis (n=178) | 24.7 (14.5-42.1) | 19.9 (11.1-35.6) |
| Stage 3 – requiring dialysis (n=219) | 27.9 (15-41.4) | 30.2 (16.8-54.4) |

^a 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