

# Supplementary Materials

## **Assessing Acute Kidney Injury Risk After COVID Vaccination and Infection in a Large Cohort Study**

**Supplementary Table 1:** Concept IDs Used to Define COVID-19 Vaccination, COVID-19 Infection and Acute Kidney Injury in N3C

**Supplementary Table 2:** Baseline Characteristics of AKI Patients of COVID-19 Vaccination Group and Infection Group

**Supplementary Figure 1 a, d, c:** Comparative Kaplan-Meier Analysis of Acute Kidney Injury Incidence within 30 Days Following the Exposure to COVID-19 Antigens by Different Phases Based on Predominant Strains Phases

**Supplementary Figure 2 a, b:** Comparative Kaplan-Meier Analysis of Acute Kidney Injury Incidence after Exposure to COVID-19 Antigens in 60-day and 90-day Follow-up Periods

**Supplementary Figure 3:** Association of COVID-19 Vaccination and Infection with AKI Outcomes: Multivariable-Adjusted Cox Model Results by Follow-up Periods, AKI Measurements, and Dominant COVID-19 Strains Phases

**Supplementary Table 1 a, b, c, d: Concept IDs Used to Define COVID-19 Vaccination, COVID-19 Infection and Acute Kidney Injury (AKI) in N3C**

**Supplementary Table 1.a: COVID-19 Vaccines Concepts IDs**

<b>Concept IDs</b>	<b>Concept name</b>
42649039	MODERNA COVID-19 VACCINE, BIVALENT - moderna covid-19 vaccine, bivalent injection, suspension
37003432	SARS-CoV-2 (COVID-19) vaccine, mRNA spike protein
37003434	SARS-CoV-2 (COVID-19) vaccine, mRNA spike protein Injectable Product
37003435	SARS-CoV-2 (COVID-19) vaccine, mRNA spike protein Injectable Suspension
1759205	SARS-CoV-2 (COVID-19) vaccine, mRNA spike protein Injectable Suspension [Comirnaty]
779678	SARS-CoV-2 (COVID-19) vaccine, mRNA spike protein Injectable Suspension [Spikevax]
1525539	SARS-CoV-2 (COVID-19) vaccine, mRNA spike protein Injection
722118	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, bivalent, preservative free, 10 mcg/0.2 mL dose
722117	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, bivalent, preservative free, 10 mcg/0.2 mL dose, tris-sucrose formulation
722119	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, bivalent, preservative free, 3 mcg/0.2 mL dose, tris-sucrose formulation
722120	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, bivalent, preservative free, 30 mcg/0.3 mL dose, tris-sucrose formulation
778267	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, bivalent, preservative free, 50 mcg/0.5 mL or 25 mcg/0.25 mL dose
702678	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, 10 mcg/0.2mL dose, tris-sucrose formulation
724906	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, 100 mcg/0.5mL dose or 50 mcg/0.25mL dose
702676	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, 3 mcg/0.2mL dose, tris-sucrose formulation
724907	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, 30 mcg/0.3mL dose
702677	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, 30 mcg/0.3mL dose, tris-sucrose formulation
905420	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, 50 mcg/0.5 mL dose
778266	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, pediatric 25 mcg/0.25 mL dose
778265	SARS-COV-2 (COVID-19) vaccine, mRNA, spike protein, LNP, preservative free, pediatric 50 mcg/0.5 mL dose
37003516	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273
742036	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.025 MG/ML
42647483	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.025 MG/ML / SARS-CoV-2 (COVID-19) vaccine, mRNA-1273OMICRON (BA.4/BA.5) 0.025 MG/ML Injectable Suspension
1525540	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.05 MG/ML
36868353	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.05 MG/ML / SARS-CoV-2 (COVID-19) vaccine, mRNA-1273OMICRON (BA.4/BA.5) 0.05 MG/ML Injectable Suspension
779413	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.1 MG/ML

42631341	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.1 MG/ML Injectable Suspension
37003517	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.2 MG/ML
779676	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.2 MG/ML [Spikevax]
42796198	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.2 MG/ML Injectable Suspension
779679	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273 0.2 MG/ML Injectable Suspension [Spikevax]
1525541	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273OMICRON (BA.4/BA.5)
742037	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273OMICRON (BA.4/BA.5) 0.025 MG/ML
1525542	SARS-CoV-2 (COVID-19) vaccine, mRNA-1273OMICRON (BA.4/BA.5) 0.05 MG/ML
37003431	Immunization administration by intramuscular injection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (coronavirus disease [COVID-19]) vaccine, DNA, spike protein, adenovirus type 26 (Ad26) vector, preservative free, 5x10 <sup>10</sup> viral particles/0.5 mL dosage; booster dose
742039	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.0075 MG/ML
36873496	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.0075 MG/ML / SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2OMICRON (BA.4/BA.5) 0.0075 MG/ML Injectable Suspension
779947	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.015 MG/ML
1799557	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.015 MG/ML Injectable Suspension
742008	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.025 MG/ML
36873497	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.025 MG/ML / SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2OMICRON (BA.4/BA.5) 0.025 MG/ML Injectable Suspension
702117	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.05 MG/ML
36873120	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.05 MG/ML / SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2OMICRON (BA.4/BA.5) 0.05 MG/ML Injectable Suspension
1525545	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.05 MG/ML / SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2OMICRON (BA.4/BA.5) 0.05 MG/ML Injection
1799562	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.05 MG/ML Injectable Suspension
37003433	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.1 MG/ML
1759203	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.1 MG/ML [Comirnaty]
42797616	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.1 MG/ML Injectable Suspension
36900252	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2 0.1 MG/ML Injectable Suspension [Comirnaty]
1525509	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2OMICRON (BA.4/BA.5)
742040	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2OMICRON (BA.4/BA.5) 0.0075 MG/ML
1525544	SARS-CoV-2 (COVID-19) vaccine, mRNA-BNT162b2OMICRON (BA.4/BA.5) 0.05 MG/ML
780154	SARS-COV-2 (COVID-19) vaccine, subunit, recombinant spike protein Injectable Product
780155	SARS-COV-2 (COVID-19) vaccine, subunit, recombinant spike protein Injectable Suspension
702679	SARS-COV-2 (COVID-19) vaccine, subunit, recombinant spike protein-nanoparticle+Matrix-M1 Adjuvant, preservative free, 0.5mL dose
739901	SARS-COV-2 (COVID-19) vaccine, vector - Ad26
739903	SARS-COV-2 (COVID-19) vaccine, vector - Ad26 100000000000 UNT/ML
1226309	SARS-COV-2 (COVID-19) vaccine, vector - Ad26 100000000000 UNT/ML Injectable Suspension

766241	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,DNA,spikeprotein,adenovirustype26(Ad26)vector,preservativefree,5x10 <sup>10</sup> viral particles/0.5mLdosage,forintramuscularuse
766240	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,DNA,spikeprotein,chimpanzeeadenovirusOxford1(ChAdOx1)vector,preservativefree,5x10 <sup>10</sup> viralparticles/0.5mLdosage,forintramuscularuse
759696	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,monovalent,preservativefree,5mcg/0.5mLdosage,adjuvantAS03emulsion,forintramuscularuse
777323	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,bivalentspikeprotein,preservativefree,10mcg/0.2mLdosage,diluentreconstituted,tris-sucroseformulation,forintramuscularuse
733013	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,bivalentspikeprotein,preservativefree,3mcg/0.2mLdosage,diluentreconstituted,tris-sucroseformulation,forintramuscularuse
777320	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,bivalentspikeprotein,preservativefree,30mcg/0.3mLdosage,tris-sucroseformulation,forintramuscularuse
733014	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,bivalent,preservativefree,10mcg/0.2mLdosage,forintramuscularuse
777322	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,bivalent,preservativefree,25mcg/0.25mLdosage,forintramuscularuse
777321	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,bivalent,preservativefree,50mcg/0.5mLdosage,forintramuscularuse
759738	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,preservativefree,10mcg/0.2mLdosage,diluentreconstituted,tris-sucroseformulation,forintramuscularuse
766239	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,preservativefree,100mcg/0.5mLdosage,forintramuscularuse
777319	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,preservativefree,25mcg/0.25mLdosage,forintramuscularuse
759694	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,preservativefree,3mcg/0.2mLdosage,diluentreconstituted,tris-sucroseformulation,forintramuscularuse
766238	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,preservativefree,30mcg/0.3mLdosage,diluentreconstituted,forintramuscularuse
759736	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,preservativefree,30mcg/0.3mLdosage,tris-sucroseformulation,forintramuscularuse
759737	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-LNP,spikeprotein,preservativefree,50mcg/0.25mLdosage,forintramuscularuse
759695	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,mRNA-

LNP,spikeprotein,preservativefree,50mcg/0.5mLdosage,forintramuscularuse

759735	Severeacuterespiratorysyndromecoronavirus2(SARS-CoV-2)(coronavirusdisease[COVID-19])vaccine,recombinantspikeproteinnanoparticle,saponin-basedadjuvant,preservativefree,5mcg/0.5mLdosage,forintramuscularuse
702866	SARS-COV-2(COVID-19)vaccine,vectornon-replicating,recombinantspikeprotein-Ad26,preservativefree,0.5mL

### Supplementary Table 1.b: Acute Kidney Injury (AKI) Diagnostic Concept IDs

Concept IDs	Concept name
4027117	Acute diffuse nephritis
4030519	Acute drug-induced renal failure
4137752	Acute drug-induced tubulointerstitial nephritis
4058837	Acute focal nephritis
761083	Acute injury of kidney
37116430	Acute kidney failure stage 1
37116431	Acute kidney failure stage 2
37116432	Acute kidney failure stage 3
36716182	Acute kidney injury due to circulatory failure
36716183	Acute kidney injury due to hypovolemia
36716312	Acute kidney injury due to sepsis
37111531	Acute kidney injury due to trauma
44809061	Acute kidney injury stage 1
44809062	Acute kidney injury stage 2
44809063	Acute kidney injury stage 3
3180351	Acute on chronic kidney injury
45765710	Acute on chronic tubulointerstitial nephritis
4232873	Acute postoperative renal failure
197329	Acute renal failure due to acute cortical necrosis
45757398	Acute renal failure on dialysis
3180540	Acute renal failure secondary to lithium toxicity
197320	Acute renal failure syndrome
4160274	Acute renal failure with oliguria
4126305	Acute renal impairment
36716946	Acute renal insufficiency
4126439	Acute scleroderma renal crisis
444044	Acute tubular necrosis
4128067	Acute-on-chronic renal failure

**Supplementary Table 1.c: COVID-19 Infection Diagnostic Concept IDs**

<b>Concept IDs</b>	<b>Concept name</b>
3661405	Acute bronchitis caused by SARS-CoV-2
3655976	Acute hypoxemic respiratory failure due to disease caused by severe acute respiratory syndrome coronavirus 2
3661748	Acute kidney injury due to disease caused by severe acute respiratory syndrome coronavirus 2
756044	Acute respiratory distress syndrome (ARDS) caused by COVID-19
3661406	Acute respiratory distress syndrome due to disease caused by severe acute respiratory syndrome coronavirus 2
756061	Asymptomatic COVID-19
3662381	Asymptomatic SARS-CoV-2
756031	Bronchitis caused by COVID-19
3656667	Cardiomyopathy due to disease caused by severe acute respiratory syndrome coronavirus 2
3656668	Conjunctivitis due to disease caused by severe acute respiratory syndrome coronavirus 2
37311061	COVID-19
37310269	COVID-19
703441	COVID-19 confirmed by laboratory test
3656669	Dyspnea caused by severe acute respiratory syndrome coronavirus 2
702953	Emergency use of U07.1   COVID-19
45756093	Emergency use of U07.1   COVID-19, virus identified
37310284	Encephalopathy due to disease caused by severe acute respiratory syndrome coronavirus 2
3661885	Fever caused by severe acute respiratory syndrome coronavirus 2
37310283	Gastroenteritis caused by SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2)
756081	Infection of lower respiratory tract caused by COVID-19
37310286	Infection of upper respiratory tract caused by severe acute respiratory syndrome coronavirus 2
3663281	Lower respiratory infection caused by SARS-CoV-2
3661631	Lymphocytopenia due to severe acute respiratory syndrome coronavirus 2
37310287	Myocarditis due to disease caused by severe acute respiratory syndrome coronavirus 2
37310254	Otitis media due to disease caused by severe acute respiratory syndrome coronavirus 2
713860	Personal history of COVID-19
3661408	Pneumonia caused by SARS-CoV-2
713857	Pneumonia due to coronavirus disease 2019
766502	Post COVID-19 condition
710708	Post COVID-19 condition
766503	Post COVID-19 condition, unspecified
705076	Post-acute COVID-19
756039	Respiratory infection caused by COVID-19

3655977	Rhabdomyolysis due to disease caused by severe acute respiratory syndrome coronavirus 2
3655975	Sepsis due to disease caused by severe acute respiratory syndrome coronavirus 2
3661632	Thrombocytopenia due to severe acute respiratory syndrome coronavirus 2

### Supplementary Table 1.d: COVID-19 Infection Laboratory Test Concept IDs

Concept IDs	Concept name
756055	Measurement of Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
40763330	SARS coronavirus RNA [Presence] in Isolate by NAA with probe detection
3031852	SARS coronavirus RNA [Presence] in Specimen by NAA with probe detection
586515	SARS-CoV-2 (COVID-19) Ab [Presence] in Serum or Plasma by Immunoassay
586522	SARS-CoV-2 (COVID-19) Ab [Units/volume] in Serum or Plasma by Immunoassay
706179	SARS-CoV-2 (COVID-19) Ab panel - Serum or Plasma by Immunoassay
706176	SARS-CoV-2 (COVID-19) Ab panel - Serum, Plasma or Blood by Rapid immunoassay
36032419	SARS-CoV-2 (COVID-19) Ag [Presence] in Upper respiratory specimen by Immunoassay
36033641	SARS-CoV-2 (COVID-19) Ag [Presence] in Upper respiratory specimen by Rapid immunoassay
723473	SARS-CoV-2 (COVID-19) IgA Ab [Presence] in Serum or Plasma by Immunoassay
586527	SARS-CoV-2 (COVID-19) IgG Ab [Presence] in DBS by Immunoassay
706181	SARS-CoV-2 (COVID-19) IgG Ab [Presence] in Serum, Plasma or Blood by Rapid immunoassay
706177	SARS-CoV-2 (COVID-19) IgG Ab [Units/volume] in Serum or Plasma by Immunoassay
723479	SARS-CoV-2 (COVID-19) IgG+IgM Ab [Presence] in Serum or Plasma by Immunoassay
723475	SARS-CoV-2 (COVID-19) IgM Ab [Presence] in Serum or Plasma by Immunoassay
706180	SARS-CoV-2 (COVID-19) IgM Ab [Presence] in Serum, Plasma or Blood by Rapid immunoassay
706178	SARS-CoV-2 (COVID-19) IgM Ab [Units/volume] in Serum or Plasma by Immunoassay
706157	SARS-CoV-2 (COVID-19) N gene [Cycle Threshold #] in Specimen by Nucleic acid amplification using CDC primer-probe set N1
706155	SARS-CoV-2 (COVID-19) N gene [Cycle Threshold #] in Specimen by Nucleic acid amplification using CDC primer-probe set N2
715272	SARS-CoV-2 (COVID-19) N gene [Presence] in Nasopharynx by NAA with probe detection
36033644	SARS-CoV-2 (COVID-19) N gene [Presence] in Nose by NAA with non-probe detection
757678	SARS-CoV-2 (COVID-19) N gene [Presence] in Nose by NAA with probe detection
36661378	SARS-CoV-2 (COVID-19) N gene [Presence] in Saliva (oral fluid) by NAA with probe detection

36032258	SARS-CoV-2 (COVID-19) N gene [Presence] in Saliva (oral fluid) by Nucleic acid amplification using CDC primer-probe set N1
706175	SARS-CoV-2 (COVID-19) N gene [Presence] in Specimen by NAA with probe detection
706156	SARS-CoV-2 (COVID-19) N gene [Presence] in Specimen by Nucleic acid amplification using CDC primer-probe set N1
706154	SARS-CoV-2 (COVID-19) N gene [Presence] in Specimen by Nucleic acid amplification using CDC primer-probe set N2
36033640	SARS-CoV-2 (COVID-19) ORF1ab region [Units/volume] (viral load) in Upper respiratory specimen by NAA with probe detection
715262	SARS-CoV-2 (COVID-19) RNA [Log #/volume] (viral load) in Specimen by NAA with probe detection
723476	SARS-CoV-2 (COVID-19) RNA [Presence] in Nasopharynx by NAA with non-probe detection
586526	SARS-CoV-2 (COVID-19) RNA [Presence] in Nasopharynx by NAA with probe detection
757677	SARS-CoV-2 (COVID-19) RNA [Presence] in Nose by NAA with probe detection
715260	SARS-CoV-2 (COVID-19) RNA [Presence] in Saliva (oral fluid) by NAA with probe detection
706170	SARS-CoV-2 (COVID-19) RNA [Presence] in Specimen by NAA with probe detection
706169	SARS-CoV-2 (COVID-19) RNA panel - Specimen by NAA with probe detection
723470	SARS-CoV-2 (COVID-19) RdRp gene [Cycle Threshold #] in Specimen by NAA with probe detection
706173	SARS-CoV-2 (COVID-19) RdRp gene [Presence] in Specimen by NAA with probe detection
586516	SARS-CoV-2 (COVID-19) [Presence] in Specimen by Organism specific culture
757680	SARS-CoV-2 (COVID-19) neutralizing antibody [Presence] in Serum by pVNT
757679	SARS-CoV-2 (COVID-19) neutralizing antibody [Titer] in Serum by pVNT
36031944	SARS-CoV-2 (COVID-19) specific TCRB gene rearrangements [Presence] in Blood by Sequencing
36033667	SARS-CoV-2 (COVID-19) variant [Type] in Specimen by Sequencing
706174	SARS-related coronavirus E gene [Presence] in Specimen by NAA with probe detection
706171	SARS-related coronavirus N gene [Presence] in Specimen by Nucleic acid amplification using CDC primer-probe set N3
723472	SARS-related coronavirus RNA [Presence] in Specimen by NAA with probe detection



**Supplementary Table 2: Baseline Characteristics of AKI Patients of COVID-19 Vaccination Group and Infection Group**

	<b>Overall AKI (N=196,352) no.(%)</b>	<b>AKI of the Vaccination Group (N=19,621) no.(%)</b>	<b>AKI of the Infection Group (N=176,731) no.(%)</b>	<b>P value*</b>
Age, mean(SD), y	63.94 (15.81)	63.91 (15.22)	63.95 (15.87)	<0.001
Age category, y				
<30	6,631 ( 3.4)	584 (3.0)	6,047 (3.4)	<0.001
30-49	29,173 (14.9)	2,780 (14.2)	26,393 (14.9)	
50-64	53,050 (27.0)	5,646 (28.8)	47,404 (26.8)	
65-90	107,498 (54.7)	10,611 (54.1)	96,887 (54.8)	
Race				
White	125,360 (63.8)	12,331 (62.8)	113,029 (64.0)	<0.001
Black	40,472 (20.6)	4,487 (22.9)	35,985 (20.4)	
Asian	4,416 ( 2.2)	463 (2.4)	3,953 (2.2)	
Other	7,451 ( 3.8)	549 (2.8)	6,902 (3.9)	
Unknown	18,653 ( 9.5)	1,791 (9.1)	16,862 (9.5)	
Gender				
Female	85,116 (43.3)	9,598 (48.9)	75,518 (42.7)	<0.001
Male	111,236 (56.7)	10,023 (51.1)	101,213 (57.3)	
Ethnicity				
Hispanic or Latino	17,264 (8.8)	1,272 (6.5)	15,992 (9.0)	<0.001
Not Hispanic or Latino	165,450 (84.3)	17,462 (89.0)	147,988 (83.7)	
Unknown	13,638 (6.9)	887 (4.5)	12,751 (7.2)	
AKI defined by				
Only diagnostic codes	26,466 (13.5)	3,518 (17.9)	22,948 (13.0)	<0.001
Only Scr# changes	96,724 (49.3)	11,351 (57.9)	85,373 (48.3)	
Both methods	73,162 (37.3)	4,752 (24.2)	68,410 (38.7)	
Previous AKI history	20,097 (10.2)	4138 (21.1)	15,959 ( 9.0)	<0.001
Hypertension	74,986 (38.2)	11,785 (60.1)	63,201 (35.8)	<0.001

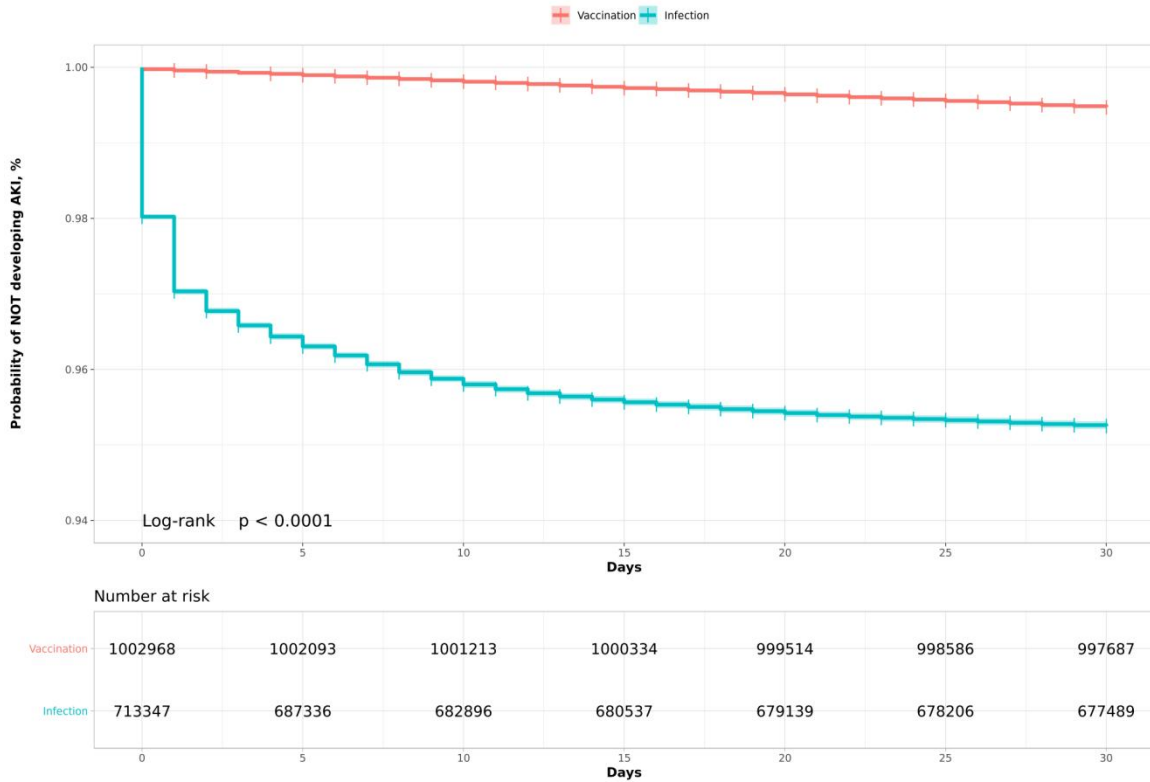
	<b>Overall AKI (N=196,352) no.(%)</b>	<b>AKI of the Vaccination Group (N=19,621) no.(%)</b>	<b>AKI of the Infection Group (N=176,731) no.(%)</b>	<b>P value*</b>
Diabetes mellitus	28,116 (14.3)	4,644 (23.7)	23,472 (13.3)	<0.001
Heart failure	27,353 (13.9)	5,052 (25.7)	22,,301 (12.6)	<0.001
Cardiovascular disease	58,310 (29.7)	9,781 (49.8)	48,529 (27.5)	<0.001
Obesity	25,097 (12.8)	4,245 (21.6)	20,852 (11.8)	<0.001
Period of strains				
P1: Alpha	-	-	33,881 (19.2)	<0.001
P2: Delta	-	-	65,215 (36.9)	<0.001
P3: Omicron	-	-	77,635 (43.9)	<0.001
Vaccine types				
mRNA	-	16,455(83.9)	-	<0.001
Viral vector	-	1,533(7.81)	-	<0.001
Unknown^	-	1,633(8.32)	-	<0.001
Deceased	-	610	25,366	<0.01

# Abbreviation for Serum Creatinine.

\* Comparisons are made between no AKI and AKI using t-test for continuous variable and Chi-square test for categorical variables.

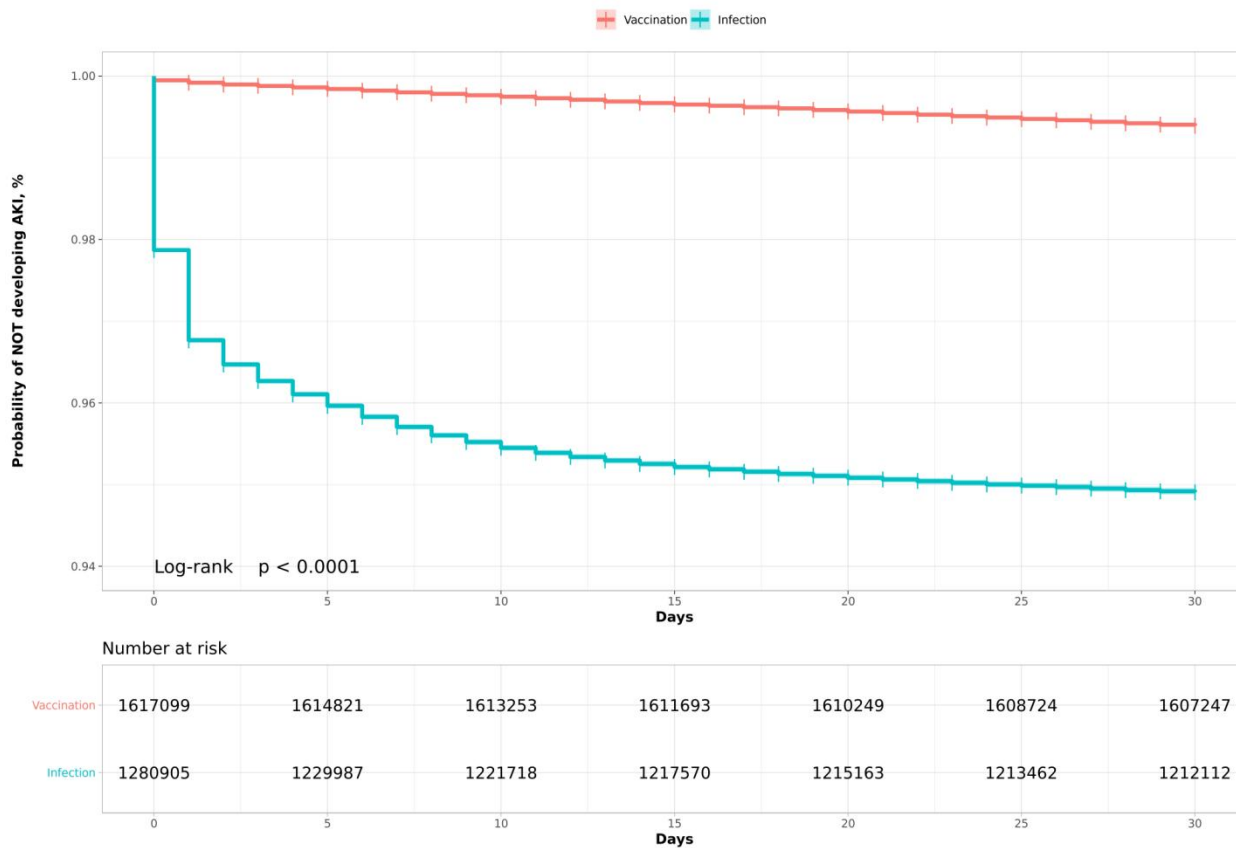
^ Types of COVID-19 vaccine were not reported.

## Supplementary Figure 1 a, b, c: Comparative Kaplan-Meier Analysis of Acute Kidney Injury Incidence within 30 Days Following the Exposure to COVID-19 Antigens by Different Phases Based on Predominant Strains Phases



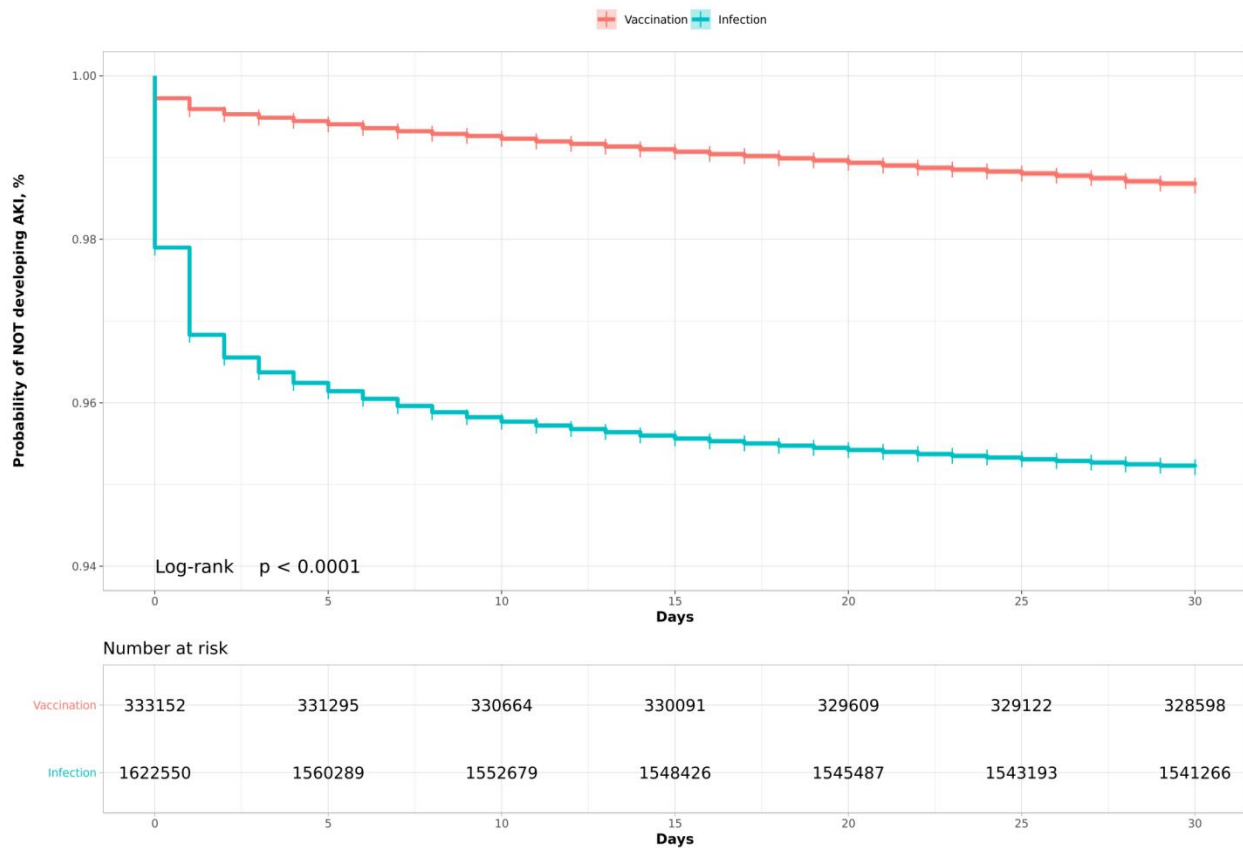
**Fig 1a. Comparative Kaplan-Meier Analysis of AKI Incidence in 30 Days after Exposure to COVID-19 Antigens in P1**

Note: Adults included in the study were categorized in two groups based on their initial exposure to COVID-19 in the phase over December 2020 to August 2023. The vaccine group: those whose first recorded COVID-19 vaccine dose preceded any infection formed the vaccine group; The infection group: those whose first documented COVID-19 infection occurred prior to any vaccination. This figure presents three panels corresponding to study phases aligned with COVID-19 strains. Phase 1 covers the Alpha variant from December 11, 2020, to April 1, 2021 (Fig 2a). Phase 2 spans the Delta variant era from April 1 to November 30, 2021 (Fig 2b). Phase 3 focuses on Omicron and its subvariants from December 1, 2021, to the study's end date (Fig 2c). The probability of developing AKI in the infection group was significantly higher than that in the vaccination group from day 0 to day 30 in every phase. Abbreviation: AKI-acute kidney injury



**Fig 1b. Comparative Kaplan-Meier Analysis of AKI Incidence in 30 Days after Exposure to COVID-19 Antigens in P2**

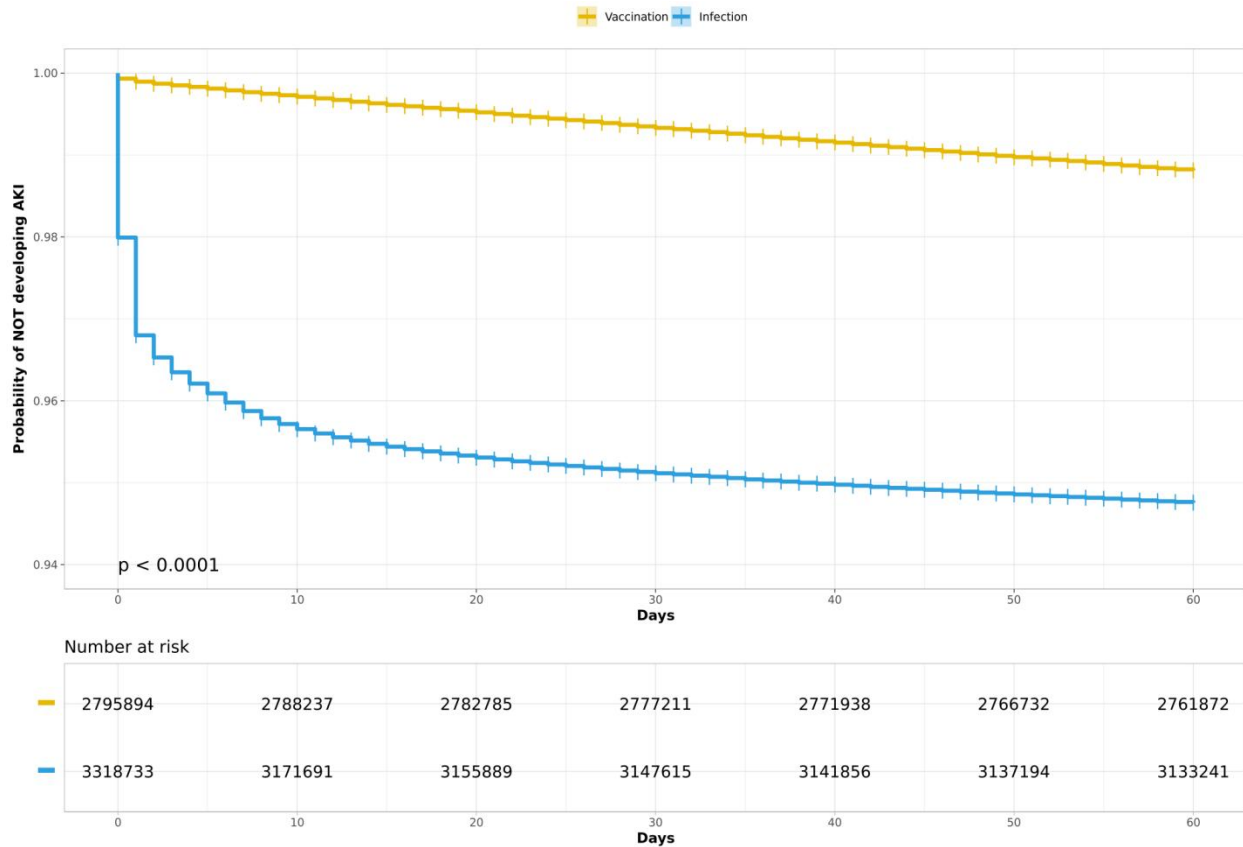
Note: Adults included in the study were categorized in two groups based on their initial exposure to COVID-19 in the phase over December 2020 to August 2023. The vaccine group: those whose first recorded COVID-19 vaccine dose preceded any infection formed the vaccine group; The infection group: those whose first documented COVID-19 infection occurred prior to any vaccination. This figure presents three panels corresponding to study phases aligned with COVID-19 strains. Phase 1 covers the Alpha variant from December 11, 2020, to April 1, 2021 (Fig 2a). Phase 2 spans the Delta variant era from April 1 to November 30, 2021 (Fig 2b). Phase 3 focuses on Omicron and its subvariants from December 1, 2021, to the study's end date (Fig 2c). The probability of developing AKI in the infection group was significantly higher than that in the vaccination group from day 0 to day 30 in every phase. Abbreviation: AKI-acute kidney injury



**Fig 1c. Comparative Kaplan-Meier Analysis of AKI Incidence in 30 Days after Exposure to COVID-19 Antigens in P3**

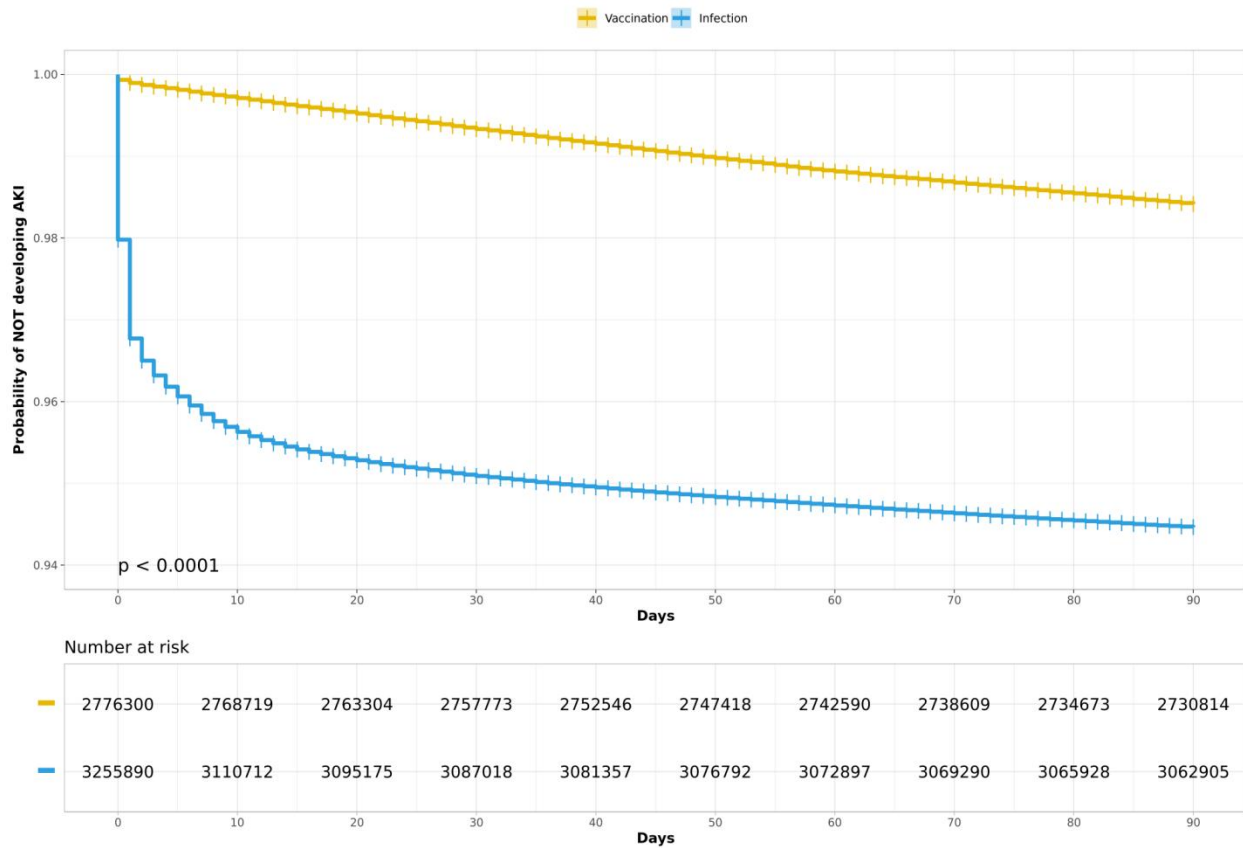
Note: Adults included in the study were categorized in two groups based on their initial exposure to COVID-19 in the phase over December 2020 to August 2023. The vaccine group: those whose first recorded COVID-19 vaccine dose preceded any infection formed the vaccine group; The infection group: those whose first documented COVID-19 infection occurred prior to any vaccination. This figure presents three panels corresponding to study phases aligned with COVID-19 strains. Phase 1 covers the Alpha variant from December 11, 2020, to April 1, 2021 (Fig 2a). Phase 2 spans the Delta variant era from April 1 to November 30, 2021 (Fig 2b). Phase 3 focuses on Omicron and its subvariants from December 1, 2021, to the study's end date (Fig 2c). The probability of developing AKI in the infection group was significantly higher than that in the vaccination group from day 0 to day 30 in every phase. Abbreviation: AKI-acute kidney injury

## Supplement Figure 2 a, b: Comparative Kaplan-Meier Analysis of Acute Kidney Injury Incidence after Exposure to COVID-19 Antigens in 60-day and 90-day Follow-up Periods



**Fig 2a. Comparative Kaplan-Meier Analysis of AKI Incidence after Exposure to COVID-19 Antigens in 60-day Follow-up Period**

Note: Adults included in the study were categorized in two groups based on their initial exposure to COVID-19 in the period from December 2020 to August 2023. The vaccine group: those whose first recorded COVID-19 vaccine dose preceded any infection formed the vaccine group; The infection group: those whose first documented COVID-19 infection occurred prior to any vaccination. The follow-up period was extended to 60 days for a secondary analysis. The probability of developing AKI in the infection group was significantly higher than that in the vaccination group from day 0 to day 60 (Log-Rank test,  $P < 0.001$ ). Abbreviation: AKI-acute kidney injury



**Fig 2b. Comparative Kaplan-Meier Analysis of AKI Incidence after Exposure to COVID-19 Antigens in 90-day Follow-up Period**

Note: Adults included in the study were categorized in two groups based on their initial exposure to COVID-19 in the period from December 2020 to August 2023. The vaccine group: those whose first recorded COVID-19 vaccine dose preceded any infection formed the vaccine group; The infection group: those whose first documented COVID-19 infection occurred prior to any vaccination. The follow-up period was extended to 90 days for a secondary analysis. The probability of developing AKI in the infection group was significantly higher than that in the vaccination group from day 0 to day 90 (Log-Rank test,  $P < 0.001$ ). Abbreviation: AKI-acute kidney injury

### Supplement Figure 3: Association of COVID-19 Vaccination and Infection with AKI Outcomes: Multivariable-Adjusted Cox Model Results by Follow-up Periods, AKI Measurements, and Dominant COVID-19 Strains Phases

Outcomes	Vaccination Group AKI Patients(N)	Vaccination Group Not AKI Patients(N)	Infection Group AKI Patients(N)	Infection Group Not AKI Patients(N)	Harzad Ratio
30-Day Follow-up Period	19,621	2,933,598	176,731	3,440,071	*
60-Day Follow-up Period	8,270	2,944,949	91,358	3,525,444	*
90-Day Follow-up Period	16,103	2,937,116	153,783	3,463,019	*
Defined by Diagnostic Codes	4,752	2,948,467	68,410	3,548,392	**
Defined by Diagnostic Codes and Serum Creatinine Change	33,240	2,762,654	174,007	3,144,726	*
Defined by Serum Creatinine Change	44,000	2,732,300	180,092	3,075,798	**
Phase 1: Alpha	5,304	997,664	33,881	679,466	**
Phase 2: Delta	9,852	1,607,247	65,215	1,215,690	**
Phase 3: Omicron	4,465	328,687	77,635	1,544,915	*

Note: Adults included in the study were categorized in two groups based on their initial exposure to COVID-19 in the period from December 2020 to August 2023. The vaccine group: those whose first recorded COVID-19 vaccine dose preceded any infection formed the vaccine group; The infection group: those whose first documented COVID-19 infection occurred prior to any vaccination. Each row is an independent outcome. The primary outcome of a 30-day follow-up period, and (1) dividing study period into three phases aligned with predominant strains during the pandemic era.<sup>31</sup> Alpha (Phase 1) covered December 11, 2020, to April 1, 2021; Delta (Phase 2) covered April 1, 2021, to November 30, 2021; Omicron and its subvariants (Phase 3) covered December 1, 2021, to the end date of study period; (2) extending follow-up period from 30 days to 60 and 90 days after the index date; (3) adopting different outcome measurements, including only defined by diagnostic codes, only defined by changes in serum creatinine, and a combination of both. All HR results favor COVID-19 vaccination. Abbreviation: AKI-acute kidney injury; Scr-Serum creatinine.



# STROBE<sup>1</sup> statement Checklist

	Item No.	Recommendation	Page No.
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
<b>Introduction</b>			
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	7,8
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	NA
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7, 10
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	4,10
Bias	9	Describe any efforts to address potential sources of bias	7,10,11
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	10,11
		(b) Describe any methods used to examine subgroups and interactions	
		(c) Explain how missing data were addressed	
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	
<b>Results</b>			
Participants	13	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the	12,13,9

		study, completing follow-up, and analyzed	
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12,13
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	12,13
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13,14,15
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	14,15
<b>Discussion</b>			
Key results	18	Summarize key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17-20
Generalisability	21	Discuss the generalisability (external validity) of the study results	20-21
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	22

1. von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (STROBE Initiative). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Med.* **4**, e296 (2007).