Supplementary materials

Table 1. Acute kidney injury (AKI) and chronic kidney disease (CKD) associated with COVID-19 infection: incidence, prevalence, risk factors, clinical pattern and patient outcome.

ACUTE KIDNEY INJURY (AKI)					
Outcome	**Author**	**Number of patients**	**Number of studies**	**Risk estimates**	**Timeline**
Incidence (AKI)	Lin et al. [16]	49,692	79 (Metanalysis)	10.6% (higher than patients without COVD-19)	
Incidence (AKI)	Fabrizi et al. 2020 [17]	25,566	39 (random effect metanalysis)	15% pooled incidence (0.154; 95%CI: 0.107-0.201) $p<0.0001$; $I^2=$ 99.4% 50% in severe COVID-19 (0.53 (95% CI, 0.427; 0.633)	Studies published Dec 1 2019-June 30 2020
Incidence (AKI)	Bennet et al. 2021 [18]	14,358	45 (metanalysis)	12.6% AKI incidence in hospitalized COVID-19 patients	Studies published in 2019-2020
Incidence (AKI)	Zhou et al. 2020 [19]	13,452 patients hospitalized during 3 pandemic waves (SARS-CoV-1, MERS-CoV and SARS-CoV-2	58	12.5% (95% CI: 7.6%–18.3%) pooled incidence in patients with coronavirus infection	Studies published until June 16, 2020
Incidence (AKI)	Fu EL et al. 2020 [20]	49,048	142	28.6% (95%CI: 19.8–39.5) in 20 studies from USA/Europe (8,061 patients and 2,545 AKI events	Studies published until May 29, 2020

				5.5% (95%CI: 4.1–7.4) among 62 studies from Asia (19,378 patients and 884 AKI events:))	
Incidence (AKI)	Passoni et al. 2022 [21]	18,043	28	9.2% (95%CI: 4.6; 13.9) in hospitalized patients 32.6% (95%CI: 8.5-56.6) among ICU patients	COVID-19 patients hospitalized through June 20, 2020
Incidence (AKI)	Mahli et al [22]	420-54,173	42 systematic reviews (38 with metanalysis)	(4.3 - 34.6%) 36% - 50% among COVID-19 dialysis patients (30-69%) among renal transplant recipients	
Incidence (AKI)	Chan et al. 2021 [31]	3,993	Single center (Mount Sinai Health system, New York, USA)	46% (N=1,835) 19% (N=347) patients with AKI requiring dialysis Stage 1 AKI: 39% Stage 2 AKI: 19% Stage 3 AKI: 42%	Patients admitted Feb 27 - May 30, 2020
Clinical Pattern (AKI)	Pei et al. 2020 [29]	467 patients hospitalized 333 with dipstick test at admission	Single center Tonji hospital (Wuhan, China)	41.7% proteinuria (all patients on admission) 33.3% with moderate COVID-19 39.1% with severe COVID-19	COVID-19 patients admitted Jan 28 - Feb 9, 2020

				69.6% with critical COVID-19 65.8% proteinuria (all patients on admission) 43.8% for moderate COVID-19 81.2% for severe COVID-19 85.7% for critical COVID-19	
Clinical Pattern (AKI)	Kormann et al. 2020 [30]	42 patients admitted; 28 entering ICU	Single center (Nancy University Hospital, France)	88% proteinuria 88% of patients with severe Stages 2 and 3 KDIGO AKI experienced proximal tubule injury before AKI	Patients admitted 20 - 29 Mar 2020
Clinical Pattern (AKI)	Chan et al. 2021 [31]	3,993	Single center (Mount Sinai Health system, New York, USA)	84% proteinuria and 81% hematuria	Patients admitted Feb 27 - May 30, 2020
Clinical Pattern AKI)	Cheng et al. 2020 [32]	701	Single center (Tonji hospital, Wuhan, China)	43.9% proteinuria; 26.7% hematuria on admission	Patients admitted until Feb 29, 2020
Risk factors (AKI)	Fu EL et al. 2020 [20]	49,048	142 (metanalysis)	OR=2.15 (1.54–3.00) per mean/median 10-year increase in age OR=1.36 (1.07–1.73) per 10% increase in male sex prevalence	Studies published until May 29, 2020

				OR=1.53 (1.13–2.08) per 10% increase in CVD prevalence OR=1.48 (1.24–1.77) per 10% increase in diabetes prevalence OR=1.64 (1.40–1.93) per 10% increase in CKD prevalence OR=1.50 (95% CI 1.33–1.69) per 10% increase in hypertension prevalence	
Risk factors (AKI)	Cai et al. 2020 [40]	42,779	38 (metanalysis)	Male sex (OR=1.37; 1.25-1.49; Tau^2=0.02) Smoking (OR=1.23; 1.07- 1.42; Tau^2=0.01) Obesity (OR=1.12; 1.01; 1.25; Tau^2=0.01) Hypertension (OR=1.85; 1.70-2.02; Tau^2=0.01) Diabetes (OR=1.71; 1.59-1.84; Tau^2=0.01)	Studies published Dec 1 2019 - 30 Jan 2021

				Pneumopathy (OR=1.36; 1.16-1.80; Tau^2=0.05) CVD (OR=1.98; 1.74-2.34; Tau^2=0.07) Cancer (OR=1.26; 1.13-1.40; Tau^2=0.01; CKD (OR=4.56; 3.83-5.83; Tau^2=0.012) MV (OR=8.61; 5.83-13.17; Tau^2=0.97) Vasopressors (OR=8.33; 4.31-14.72; Tau^2=1.08)	
Risk factors (AKI)	Lin et al. 2020 [41]	49,692	79 (metanalysis)	aOR=3.53 (95%CI: 2.92–4.25) for age≥ 60 aOR=6.02 (95%CI: 2.53; 14.58) for severe COVID-19	Studies published Jan 1-May 15, 2020
Risk factors (AKI)	Lee et al 2021 [42]	17,876	14 (random effect metanalysis)	increased risk of AKI (OR=1.68; 95%CI: 1.19–2.36) with renin–angiotensin–aldosterone system blockades by either angiotensin-converting-enzyme inhibitor or angiotensin receptor blocker	Studies published Jan 1 - Dec 24, 2020
Mortality	Zhou et al. 2020 [19]	13,452 patients hospitalized	58 (metanalysis)	OR = 5.75 (3.75–8.77; $p < 0.00001$) mortality risk in	Studies published

(associated with AKI)		during 3 pandemic waves (SARS-CoV-1, MERS-CoV and SARS-CoV-2		patients with coronavirus infection	until June 16, 2020
Mortality (with AKI)	Fu et al. 2020 [20]	49,048	142 (metanalysis)	5,152 AKI events Pooled RR= 4.6 (3.3-6.5)	Studies published until May 29, 2020
Mortality (with AKI)	Cheng et al. 2020 [32]	701	Single center (tertiary hospital in Wuhan, China)	stage 1 (HR=1.90; 0.76-4.76) to stage 2 (HR=3.51;1.49-8.26) and stage 3 (HR=4.38; 2.31-8.31)	Patients admitted Jan 28 - Feb 11, 2020
Mortality (with AKI)	Wang et al. 2020 [47]	339 (Hospitalized patients aged >60 years)	Single center (Renmin Hospital, Wuhan)	aHR 1.2 (0.6–2.4) HR adjusted for age and multiple comorbidities	Jan 1 - Feb 6, 2020
Mortality (associated with AKI)	Chang et al. 2020 [58]	12,437 ICU admitted	28 (metanalysis)	Pooled OR= 12.47 (95% CI 1.52–102.7)	Studies published until May 1, 2020
Mortality (associated with AKI)	Chang et al 2020 [60]	12,437 COVID-19 patients ICU admitted	28 (metanalysis)	Pooled OR= 12.47 (1.52–102.7)	Studies published until May 1, 2020
Treatment and outcome (AKI)	Gupta et al. [62]	3,099 critically ill patients admitted to ICU	Multicenter (67 hospitals across USA)	20.6% required KRT	ICU admission March 4 - April 11, 2020
CHRONIC KIDNEY DISEASE (CKD)					

OUTCOME	Author	Number of patients	Number of studies	Risk estimates	Timeline
Prevalence (CKD)	Zhou et al. 2020 [19]	13,452 patients hospitalized during 3 pandemic waves (SARS-CoV-1, MERS-CoV and SARS-CoV-2	58 (metanalysis)	30.9% (4.6%–66.8) prevalence of ESKD 7.7% (4.9%–11.1) incidence of coronavirus infection among dialysis patients	Studies published until June 16, 2020
Prevalence (CKD)	Jdiaa et al. 2020 [74]	Unreported	Overview of 69 systematic reviews and 66 primary studies	0.4 to 49.0% (according to 28 reviews)	
Prevalence (CKD)	Khan et al. 2020 [75]	27,670 Hospitalized COVID-19 patiemts	41 (metanalysis)	4.6%	Studies published through May 1, 2020
Prevalence (CKD)	Bajgain et al. 2021 [76]	22,753	27 (metanalysis)	3.5% in all COVID-19 cases 9.6% in all fatal COVID-19 cases	Studies published until May 15, 2020
Prevalence (CKD)	Kaur et al. 2020 [77]	6,635	50 (metanalysis)	Pooled prevalence 0.99%	Studies published Dec 1, 2019 - April 27, 2020
Prevalence (CKD)	Espinoza et al. 2020 [78]	89,238	39 (metanalysis)	Overall prevalence: 5.5% Among ICU patients: 6.8% Among fatal cases: 3.6%	Studies published until May 15, 2020

Prevalence (CKD)	Baradaran et al. 2020 [79]	9,249 (5,036 males vs. 4,191 females)	33 (metanalysis)	3.6% prevalence	Studies published uniti April 7, 2020

Prevalence (CKD)	Zhou et al. 2020 [19]	13,452 patients hospitalized during 3 pandemic waves (SARS-CoV-1, MERS-CoV and SARS-CoV-2	58 (metanalysis)	30.9% (4.6%–66.8) prevalence of ESKD associated with COVID-19 7.7% (4.9%–11.1) incidence of coronavirus infection among dialysis patients	Studies published until June 16, 2020
Prevalence (CKD)	Kunutsor et al. 2020 [81]	17,391	22 (metanalysis)	5.2% (95%CI: 2.8-8.1) pool 2.3% (95%CI: 1.8-2.8) for ESKD	Paper published until June 13, 2020
Prevalence (CKD)	Dorjee et al. 2020 [82]	38,906 hospitalized COVID-19 patients; 21,468 from US-Europe and 9,740 from China	77 (metanalysis)	13% (95%CI: 11–16%; I^2 = 96%; n = 47)	Studies published Dec 15 2019- Aug 31 2020
Prevalence (CKD)	Tan et al. 2021 [83]	16,561 COVID-19 patients ICU admitted	45 (metanalysis) 17 countries and 4 continents	10.0% (95%CI: 6.2-14.6) pooled prevalence	Studies published until August 1, 2020

Prevalence (CKD)	Corbett et al. 2020 [84]	1,530 dialysis-dependent COVID-19 patients by Mar1, 2020	Multicenter study (North-West London, UK)	19.6% incidence of COVID-19 among dialysis patients	COVID-19 cases testing positive Mar 9 - April 19, 2020.
Hospitalization (with pre-existing CKD)	Fernanez-Villalobos 2021 [86]	44,672 (age 33 - 82 years)	75 (metanalysis)	Various pre-existing comorbidities including CKD increased the risk of hospitalization, though study heterogeneity was moderate to high (I^2=50-90%).	Studies published until May 28, 2020
Hospitalization (with pre-existing CKD)	Chishinga et al. 2020 [87]	4,322 hospitalized COVID-19 patients	Single center study (Atlanta Metropolitan area)	aOR=3.6 (95%CI: 2.2–5.8)	Mar 2 - May 31, 2020
Hospitalization (with pre-existing CKD)	Ko et al. 2021 [89]	5,416	Multicenter study (70 counties and 12 US States covered by COVI-NET)	RR=4.0 (95%CI: 3.0-5.2)	Patients testing positive Mar 1–June 23, 2020
Hospitalization (with pre-existing CKD)	Ioannou et al 2020 [90]	10,371	Natiowide study (Department of Veterans Affairs national health care system, USA)	aHR=1.21 (1.11-1.32)	Feb 28 - May 14, 2020
Hospitalization	Oetjens et al. 2020 [91]	1,604	Multicenter study	354 (22.1%) admitted to hospital	COVID-19 patients tested March

(with pre-existing CKD)			(Gesinger Health system; Central/North-East Pennsylvania)	OR = 3.43 (95%CI: 2.36,5.00) for unspecified CKD; OR = 11.07 (95%CI: 4.54-26.97) for ESKD 5; OR = 2.68 (95%CI: 1.76-4.06) for ESKD 3; OR = 3.26 (95%CI: 1.89,5.62) for acute renal failure CKD based on estimated glomerular filtration rate OR=1.03 (95% CI: 0.71-1.48) for stage 3 CKD; OR=2.90 (95%CI: 1.47- 5.74) for stage 4 CKD; OR=8.83 (95%CI: 2.76- 28.27) for stage 5 CKD; OR=14.98 (95%CI: 2.77- 80.8) for kidney transplant	7- May 19, 2020
Hospitalization **(with pre-existing CKD)**	Rossi et al 2020 [92]	2,653 (symptomatic COVID-19 patients)	Multicenter study (Province of Reggio Emilia, Northern Italy)	aHR=1.9 (95%: 1.3-2.9)	COVID-19 patients tested Feb 27 - April 2, 2020

Hospitalization **(with pre-existing CKD)**	Soares et al. 2020 [93]	10,713	Multicenter study (State of Espirito Santo, Brazil)	adjusted OR = 2.41 (1.59–3.66; < 0.001)	Patients testing positive until June 11, 2020,
Hospitalization **(with pre-existing CKD)**	Martos Benites et al. 2021[94]	38,324	Nationwide study (Mexico)	aOR=2.58 (2.08–3.20)	COVID.19 patients tested Jan 1-May 13, 2020
Mortality **Mortality** **(with pre-existing CKD)**	Dorjee et al. 2020 [82]	38,906 hospitalized COVID-19 patients; 21,468 from US-Europe and 9,740 from China	77 (metanalysis)	RR = 2.52 (2.11–3.00); (I^2= 72%) 27% CKD among those died 48% mortality risk among patients with CKD	Studies published Dec 15, 2019- Aug 31, 2020
COVID-19 severity **(with pre-existing CKD**	Pranata et al. 2020 [95]	7,216	19 (metanalysis)	RR=3.47 (95%CI: 1.36-8.86) p=0.009; *I*2 = 14%, p=0.32	Studies published until April 23, 2020
Mortality **(associated with pre-existing CKD)**	Ioannou et al. 2020 [90]	10,371	Nationwide study (Department of Veterans Affairs national health care system, USA)	aHR=1.25 (95%CI: 1.08-1.45)	Patients tested Feb 28 - May 14, 2020
Mortality **(with pre-existing CKD)**	Holman et al. 2020 [96]	37,895	Nationwide study (England)	CKD stage 3A HR=2.07 (1.48- 2.89) CKD stage 3B HR=2.46 (1.72- 3.52)	Until May 11, 2020

				CKD stage 3 HR= 3.71 (95%CI: 2.47-5.58) CKD stage 4 HR = 8.35 (95%CI: 5.50-12.72)	
Mortality **(with pre-existing CKD)**	Williamson et al. 2020 [97]	206,714	Natiowide study (UK)	10,926 COVID-19-related deaths HR=3.69 (95%: 3.09–4.39)	COVID-19 patients tested until May 6, 2021
Mortality **(with pre-existing CKD)**	De Souza et al. 2020 [98]	9,807 (age >60 years)	Multicenter study (Atate of Alagoas, Brazil)	OR=2.02 (95%CI: 1.27- 3.20)	2020 (early months)
Mortality **(with pre-existing CKD)**	Iman et al. 2020 [99]	1,305 hospitalized COVID-19 patients	Multicenter study (8 hospitals from Beaumont Health's, South Michigan, USA)	OR=1.86 (95% CI: 1.30–2.64) among 1,305	COVID-19 Patients hospitalized during Mar 1 2020-April 17, 2020
Mortality **(with pre-existing CKD)**	Kim et al. 2020 [100]	9,148 (3,556 males vs. 5,592 females)	Nationwide study using data from Korea Centers for Disease Control and Prevention (KCDC)	Overall crude mortality ratio: - Males: 1.88% - Females: 1.13% - aOR=3.07 (95%CI: 1.43–6.61) for renal failure	COVID-19 patients tested by PCR up to Mar 26, 2020

Mortality **(with pre-existing CKD)**	Ng et al. 2020 [101]	10,482	Multicenter study (13 New York hospitals)	OR=1.37 (95%CI: 1.09- 1.73) in 419 patients with ESKD	COVID-19 patients tested 1 Mar- 27 April 2020
Mortality **(with pre-existing CKD)**	Jager et al. 2020 [102]	4,298	Multicenter study (7 European countries)	21.1 (95%CI: 18,6-23.9) higher death risk at 28 days compared to propensity-score matched controls	COVID-19 patients tested Feb 1, 2020-April 30, 2020
Mortality **(with pre-existing CKD)**	Flythe et al. 2020 [103]	4,264 critically ill COVID-19 patients admitted to ICU	Multicenter study (68 USA hospitals)	Mortality risk at 28 days since ICU admission: aHR=1.41 (95% CI, 1.09-1.81) among 143 patients with pre-existing dialysis dependent CKD aHR, 1.25 [(5% CI, 1.08-1.44) among 521 patients with pre-existing dialysis non-dialysis dependent CKD	Critically COVID-19 patients admitted to ICU Mar 4 - May 10 2020
COVID-19 severity **(with pre-existing CKD**	Zhou et al. 2020 [19]	13,452 patients hospitalized during 3 pandemic waves (SARS-CoV-1, MERS-CoV and SARS-CoV-2	58 (metanalysis)	OR = 1.97; 1.56–2.49 ($p < 0.00001$)	Studies published until June 16, 2020
COVID-19 severity	Dorjee et al 2020 [82]	38,906 hospitalized COVID-19	77 (metanalysis)	28% (95%CI: 24–33%) $I^2 = 98\%$	Studies published

(with pre-existing CKD		patients (21,468 from US-Europe and 9,740 from China)		prevalence of severe disease RR = 2.52 (2.11–3.00); (I^2= 72%) for CKD 27% CKD among those died 48% mortality risk among patients with CKD	Dec 15 2019- Aug 31 2020
COVID-19 severity **(with pre-existing CKD**	Ji et al 2020 [84]	7,341	Nationwide study (South Korea, using insurance claims database of HIRA)	13.0% patients with severe COVID-19 OR=2.052–2.178 for CKD or ESKD	Ji 2020 84
COVID-19 severity **(with pre-existing CKD**	Chishinga et al. 2020 [87]	4,322	Multicenter study (Atlanta metropolitan area, USA)	31.5% COVID-19 patients hospitalized OR=3.6 (95%CI: 2.2–5.8) for CKD	COVID-19 patients hospitalized March 2 - May 31, 2020
COVID-19 severity **(with pre-existing CKD**	Pranata et al. 2020 [95]	7,216	19 (metanalysis)	RR=3.47 (95%CI: 1.36-8.86) p=0.009; $I2$ = 14%, p=0.32	Studies published until April 23, 2020
COVID-19 severity **(with pre-existing CKD**	Luo et al. 2020 [104]	unreported (patients aged 40-84 years)	124 (metanalysis)	OR=2.20 (95%CI: 1.27-3.80) risk of severe COVID-19 with CKD	Studies published until July 2020
COVID-19 severity	Henry et al. 2020 [105]	1,389	4 (metanalysis)	19.7% patients with severe disease	Studies published

(with pre-existing CKD				OR=3.03 (95%CI: 1.09–8.47) risk of severe disease with CKD	until March 9, 2020
COVID-19 severity **(with pre-existing CKD**	Degarege et al. 2022[106]	216,834	34 (metanalysis)	(OR=1.44 (95%CI: 0.94–1.94) Low certainty (I^2=53.1%)	Studies published until 18 May 18, 2021
COVID-19 severity **(with pre-existing CKD**	Plasensia 2020 [107]	99,187	13 (metanalysis)	5.60 (95%CI: 4.13-7.60) risk of severe disease with CKD	Studies published until Mar 20, 2020

COVID-19 severity **(with pre-existing CKD**	Lee et al. 2020 [108]	7,339 COVID-19 patients (mean age 47.1 years)	Nationwide study (South Korea)	3.40 (95%CI: 1.67–6.92) for CKD	COVID-19 patients testing positive until May 15, 2020
COVID-19 severity **(with pre-existing CKD**	Liu et al. 2020 [109]	2,387	Multicenter study (Wuhan, China)	4.28 (95%CI: 1.31–13.92) for CKD	Consecutive patients testing positive for COVID-19 between Jan 27 and Mar 21, 2020
ICU admission **(with pre-existing CKD)**	Jdiaa et al. 2020 [74]	unreported	Overview of 69 systematic reviews and 66 primary studies	OR=2.68; 95%CI: 0.65; 11.07) for CKD and ICU	
ICU admission	Chishinga et al. 2020 [87]	4,322	Multicenter study	OR=1.7 (95%CI: 1.2-2.3)	COVID-19 patients hospitalized between

(with pre-existing CKD)			(Atlanta metropolitan area, USA)		March 2 and May 31, 2020
ICU admission **(with pre-existing CKD)**	Degarege et al. [106]	216,834	34 (Metanalysis)	OR=1.44, 95%CI 0.94–1.94; I^2= 53.1%) for CKD	Studies published until 18 May 18, 2021
ICU admission **(with pre-existing CKD)**	Munblit et al. 2021[110]	4,261	Single center study (Sechenov University Hospital Network, Moscow City, Russian federation)	aOR=2.99 (95%CI: 1.89-4.64) for CKD	Patients hospitalized for suspected COVID-19 in Moscow between 8 April 8 and 28 May 2020
ICU admission **(with pre-existing CKD)**	Omrani et al. 2020[111]	5,000 consecutive patients testing positive for COVID-19	Nationwide (Qatar)	aOR=3.6 (95%CI 1.57-8.08) for CKD	Consecutive patients diagnosed with COVID-19 between Feb 28 - April 17, 2020
Mechanical ventilation **(with pre-existing CKD)**	Ioannou et al. 2020 [90]	10,371	Natiowide study (Department of Veterans Affairs national health care system, USA)	aHR=1.16; 95%CI: 0.96- 1.41) No evidence of increased risk of mechanical ventilation with CKD	Patients tested between Feb 28 - May 14, 2020
Mechanical ventilation **(with pre-existing CKD)**	Martos Benitez et al.[94]	38,324	Nationwide study (Mexico)	and 1.44 (95%CI: 1.07-1.94) in 38,324 SARS-CoV-2 positive patients diagnosed in Mexico from January 1 to May 12, 2020	COVID-19 patients testing positive Jan 1 to May 12, 2020

Mechanical ventilation **(with pre-existing CKD)**	Pranata et al. 2020 [95]	7,216	19 (metanalysis)	RR= 34.39; (95%CI: 4.63-255.51)	Studies published until April 23, 2020
Mechanical ventilation **(with pre-existing CKD)**	Ng et al. 2020 [101]	10,482	Multicenter study (13 New York hospitals)	419 patients with ESKD more likely to die (aOR=1.37, 95%CI: 1.09 - 1.73; p=0.003) but not to receive mechanical ventilation (aOR=0.84; 95%CI: 0.84-1.38; p=0.56)	COVID-19 patients tested between May 1 - April 27, 2020
Mechanical ventilation **(with pre-existing CKD)**	Fried et al. 2020 [112]	11,721	Multicentre study (245 hospitals across 38 US states)	1.22 (95%CI: 1.05-1.43)	COVID-19 patients admitted between Feb 15-April 20 2020
Composite outcome **(with pre-existing CKD)**	Martos Benitez et al. 2020 [94]	38,324	Natiowide study (Mexico)	increased risk of hospital admission (OR=4.65; 95%CI3.61–5.98, pneumonia (OR=2.14; 95%CI: 1.69–2.72) and death (OR=2.23; 95%CI: 1.50–3.31) in patients with CKD	COVID-19 patients testing positive to SARS-CoV-2 between Jan 01-May 12, 2020
Composite outcome **(with pre-existing CKD)**	Pranata et al. 2020 [95]	7,216	19 (metanalysis)	2.63 (95%CI: 1.33-5.17; p=0.03; I^2=51%) for a composite poor outcome including mortality, severe COVID-19, ARDS, ICU admission, and mechanical ventilation	Studies published until April 23, 2020
Composite outcome **(with pre-existing CKD)**	Ng et al. 2020 [101]	10,842	Multicenter study (13 New York hospitals)	419 patients with ESKD more likely to die (aOR=1.37, 95%CI: 1.09 - 1.73; p=0.003) and stay in hospital for	COVID-19 patients tested between May 1, 2020-

				7+ days (aOR=1.57 (95%CI:1.22-2.02)	April 27, 2020
Composite outcome **(with pre-existing CKD)**	Nandy et al. 2020 [113]	3,994	16 (metanalysis)	OR=5.32 (95%C: 1.86 - 15.19) for CKD Multiple outcome including ICU admission, acute respiratory distress syndrome (ARDS), mechanical ventilation, pneumonia or mortality	Studies published until April 28, 2020
Composite outcome **(with pre-existing CKD)**	Xiao et al. 2021 [114]	12,999	13 (metanalysis)	pooled RR=1.64 (95%CI: 1.28- 2.09) for CKD composite outcome including severe illness, critical illness or death	Studies published until July 15, 2020

ESKD, end stage kidney disease; CVD, Cardiovascular Disease; MV, Mechanical Ventilation.

Table 2. Renal complications following COVID-19 vaccination.

Disease	Incidence Rate	Typical Onset Time	Symptoms	Diagnostic Methods	Treatment	Prognosis
Minimal Change Disease (MCD)	Most common complication post COVID-19 vaccination 94 cases (59 new, 44 relapses) [122]	Within 3 weeks post-initial vaccination	Edema, AKI	Kidney biopsy, urine tests, serum electrolytes	Steroids; Rituximab if steroids ineffective; hemodialysis in severe cases	Favorable; most patients achieve complete or partial remission within three months

	55 after Comirnaty 19 after Spikevax 13 after Vaxzevria 3 after Jannsen 1 after CoronaVac 52 after 1st dose 37 after 2nd dose 2 after 3rd dose					
	Second most common complication post COVID-19 vaccination	Varies, often post second vaccination	Gross hematuria	Kidney biopsy, serum IgA levels, urinalysis	Conservative management or steroids; over 80% achieve complete remission	Generally good; over 80% achieve remission
IgA Nephropathy (IgAN)	15 IgAN cases after mRNA COVID-19 vaccines [131-132, 137-142]: - 1 newly developed after Spikevax, 14 relapses:					

	- 7 relapses after Comirnaty - 7 relapses after Spikevax 127 IgAN cases [143]					
Membranous Nephropathy (MN)	66 year old woman after 1st dose of Sinovac [149]	2 weeks	edema	Kidney biopsy, serum anti-PLA2R antibodies	Conservative management; steroid, cyclosporine, lisinopril	Poor in some cases; creatinine may not return to baseline
IgG4-RD Nephritis	Relapse 2 weeks after 2nd dose of Comirnaty in a 66 year old male [157] A novel case in a 69 year old Japanese male after 2nd dose of Comirnaty [158]	Variable (1 day-2 weeks)	AKI, edema, nephrotic syndrome, asthenia, myalgia, arthralgia,	Kidney biopsy, serum IgG4 levels	Systemic corticosteroids; rituximab perfusion	Variable; ongoing management and further investigation needed
IgA Vasculitis (HSP)	3 novel cases following m-RNA vaccines (1 after Comirnaty, [166]	Often post second dose	Rash, abdominal pain, joint pain	Kidney biopsy, serum IgA levels, urinalysis	Supportive care; steroids in severe cases; management of underlying condition	Generally good; may require specific management based on severity

	2 after Spikevax) [138, 167]					
	2 relapses after Spikevax [11, 138]					
Anti-GBM Nephritis	1 novel case 1 day after 2nd dose of Comirnaty [142]	Within 2 weeks post-COVID-19 vaccination	Hematuria, hemoptysis, hypertension, anorexia, nausea, fever	Kidney biopsy, serum anti-GBM antibodies	Mycophenolate, Cyclophosphamide (CyC), steroids, plasma exchange (PLEX)	Poor; 75% patients with suboptimal outcomes, 25% requiring hemodialysis
	1 case 2 weeks after 2nd dose of Spikevax [170]					
ANCA Vasculitis	1 novel case 2 days after 2nd dose of Comirnaty [176]	Symptoms presented within 1-4 weeks since vaccination	Asthenia, anorexia, headache, hematuria, proteinuria, AKI, kidney failure	Kidney biopsy, serum ANCA levels	Steroids pulse therapy; rituximab i.v.; dialysis	Favorable for MPO-ANCA and ANCA-negative patients; variable for PR3-ANCA
	Case reported following 1st or 2nd dose of Spikevax [167,177]					
	1st, 2nd or 3rd dose of Comirnaty [182- 186]					
	and first fose of Vaxzevria [187]					

Thrombotic micro-angiopathy	5 reported cases following 1st dose of Vaxzevria [190]	1 week since 1st dose	Thrombosis, severe thrombocytopenia, cerebral hemorrhage	Kidney biopsy, D-dimer, IgG antibodies to PF4–polyanion complexes	Anti-coagulants, methylprednisolone	Variable, early recognition and treatment critical for a favorable prognosis
Acute Tubulo-interstitial Nephritis (ATIN)	Several cases after different COVID-19 vaccines[195]	1-3 weeks after 1s, 2nd, 3rd dose of different COVID-19 vaccines	creatinine rise, renal failure, fever, skin rash, pyuria, electrolyte imbalance	Kidney biopsy, urine tests, imaging studies	Discontinuation of offending agents; corticosteroids	Variable; depends on underlying cause, timely diagnosis and treatment
Scleroderma Renal Crisis (SRC)	Case reported following mRNA vaccination [201,202]	1-2 days after	Severe hypertension, hypertensive retinopathy, thrombotic glomerular microangiopathy, AKI. Edema, proteinuria, elevated creatinine	Kidney biopsy, imaging studies, clinical assessment	Antihypertensive therapy, management of underlying systemic sclerosis	Poor if not promptly managed; requires careful monitoring
Granulomatous interstitial nephritis	Case report after 1st dose of Vaxzevria [206]	4 weeks after vaccination	Fever, sweating, anorexia, diffuse interstitial edema in kidney	Kidney biopsy	methylprednisolone	Depending on timely diagnosis and treatment