

Supplementary Materials

Page Number	Contents
2	Figure S1. Study population of prevalent and incident chronic kidney disease in England (NHSD TRE data for England).
3	Figure S2. Prevalence and co-occurrence of underlying conditions in individuals with prevalent (n=1,934,585) and incident (n=144,969) chronic kidney disease in national data for England (NHS Digital TRE England: 1st March 2020 – 1st March 2021).
4	Figure S3. Underlying conditions by age and sex and CKD stage in individuals with prevalent (n= 1,934,585) and incident (n= 144,969) chronic kidney disease in NHSD TRE England.
5	Figure S4. Prevalence of underlying conditions by age group, CKD stage, and sex, in individuals with prevalent (n= 1,934,585) and incident (n= 144,969) chronic kidney disease during the COVID-19 pandemic.
6	Figure S5. Association between SARS-CoV-2 infection and underlying conditions in individuals with chronic kidney disease in (a) all prevalent CKD (n= 1,934,585), and (b) the non-survival group (i.e. those not surviving to 1 year follow-up during pandemic) (n=172,789).
7	Figure S6. One-year all-cause mortality (%) in individuals with prevalent (n=1,934,585) chronic kidney disease by number of underlying conditions, age, sex, CKD stage, using NHSD TRE data on 1st March 2020.
8	Figure S7: Covariate balance before and after exact matching for prevalent (n=1934585) and incident (n= 144969) chronic kidney disease, using standardized mean difference in all individuals and those with cancer, diabetes, and dialysis/transplantation.
9	Figure S8. Observed age-specific, unadjusted relative risk of mortality and population infection rate during first year of COVID-19 pandemic in individuals with prevalent chronic kidney disease (n=1,934,585).
10	Figure S9. Pre-pandemic one-year all-cause mortality (%) in individuals with prevalent (n= 174,648) chronic kidney disease by number of underlying conditions, age, sex, CKD stage, using CPRD data on 6th April 2014.
11	Figure S10. Proportion of excess COVID-19 deaths in individuals with prevalent chronic kidney disease by age group during one-year of pandemic, predicted by Lancet 2020 model (Population Infection Rate 10%, Relative Risk 3) using pre-pandemic study population in NHSD-TRE (predicted n=28,746) and CPRD (predicted n=24,546), compared with actual excess deaths (observed n=34,265).
12	Table S1. Code list used to identify chronic kidney disease in primary and secondary care including ICD-10 codes, and SNOMED CT concepts.
16	Table S2. Baseline characteristics in individuals with prevalent chronic kidney disease (n= 1,934,585) at the onset of and during COVID-19 pandemic (from 1st March 2020): age, sex, stages of CKD, underlying conditions, and COVID-19-mortality.
17	Table S3. Baseline characteristics of incident (n= 144,969) chronic kidney disease during COVID-19 pandemic (1st March 2020-1st March 2021): age, sex, stages of CKD, underlying conditions, and 28-days COVID-mortality.
18	Table S4. Association between underlying conditions and SARS-CoV-2 infection (compared with non-infected individuals) in individuals with chronic kidney disease in (a) all prevalent (n= 1,934,585) or incident CKD (n= 144969) and (b) the non-survival group (i.e. those not surviving to 1 year follow-up during pandemic) (n=172,789).
19	Table S5. Association between underlying conditions and one-year all-cause mortality for prevalent (n= 1934585) and incident (n= 144969) chronic kidney disease.
20	Table S6. Association between COVID-19 vaccination and 1-year all-cause mortality by underlying condition for prevalent (n= 1934585) and incident (n= 144969) chronic kidney disease.
21	Table S7. Incidence rate of SARS-CoV-2 infection per 10,000 person-weeks in prevalent (n= 1,934,585) and incident (n= 144,969) chronic kidney disease over one year of the COVID-19 pandemic: (a) crude, and (b) adjusted based on first COVID-19 vaccination, underlying conditions and CKD stage.
22	Table S8. Baseline characteristics of pre-pandemic prevalent chronic kidney disease in the NHS Digital Trusted Research Environment (NHSD TRE; n= 1,727,130; 1st Jan 2019) and Clinical Practice Research Datalink (CPRD; n= 174,648; 1st April 2014) by age, sex, stages of CKD, and underlying conditions.

Figure S1. Study population of prevalent and incident chronic kidney disease in England (NHSD TRE data for England).

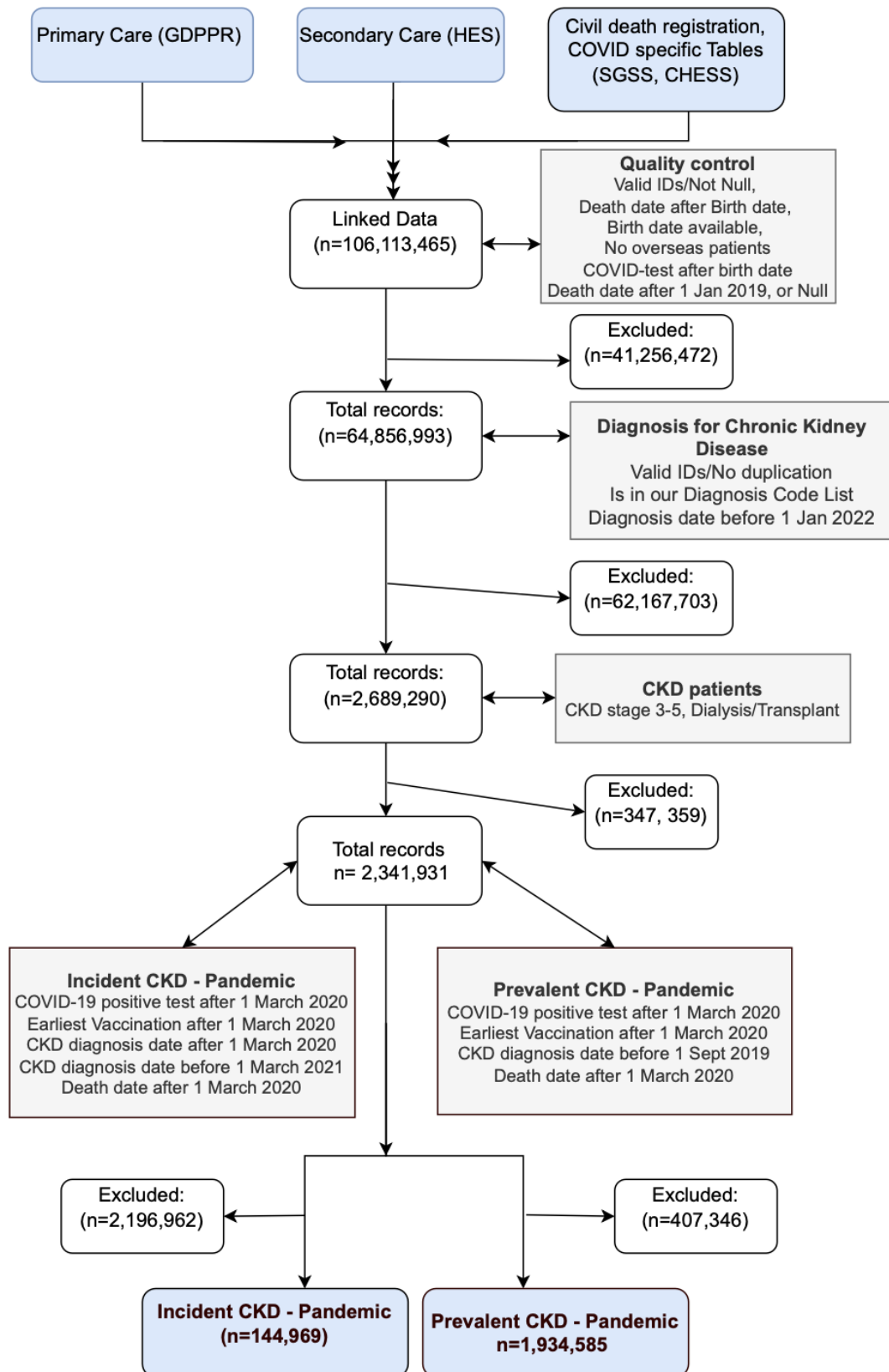
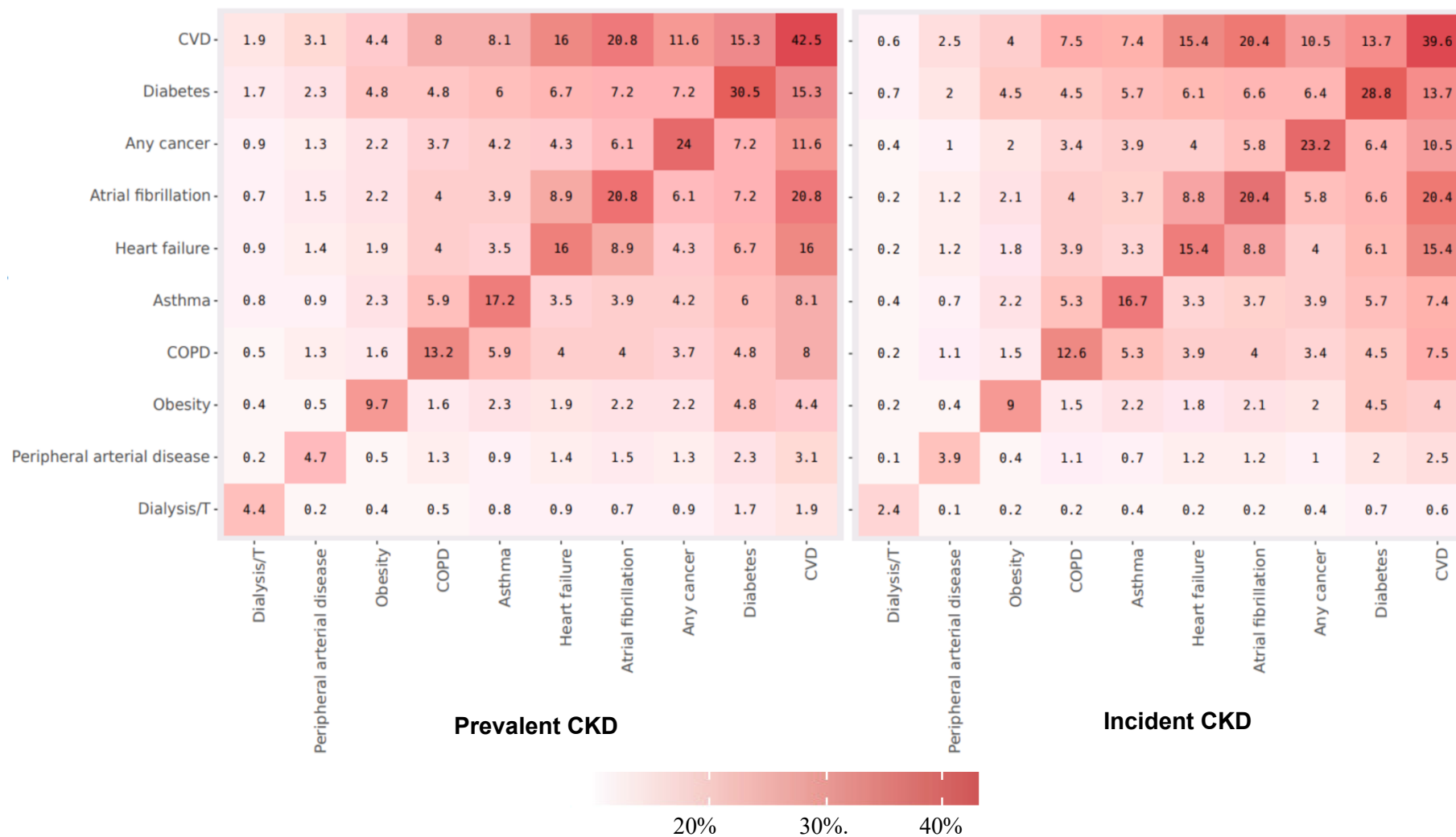


Figure S2. Prevalence and co-occurrence of underlying conditions in individuals with prevalent (n=1,934,585) and incident (n=144,969) chronic kidney disease in national data for England (NHS Digital TRE England: 1st March 2020 – 1st March 2021).



The diagonal values in each figure illustrate the prevalence (%) of each condition whilst off-diagonals display the prevalence (%) of pairs of underlying conditions.

Figure S3. Underlying conditions by age and sex and CKD stage in individuals with prevalent (n= 1,934,585) and incident (n= 144,969) chronic kidney disease in NHSD TRE England.

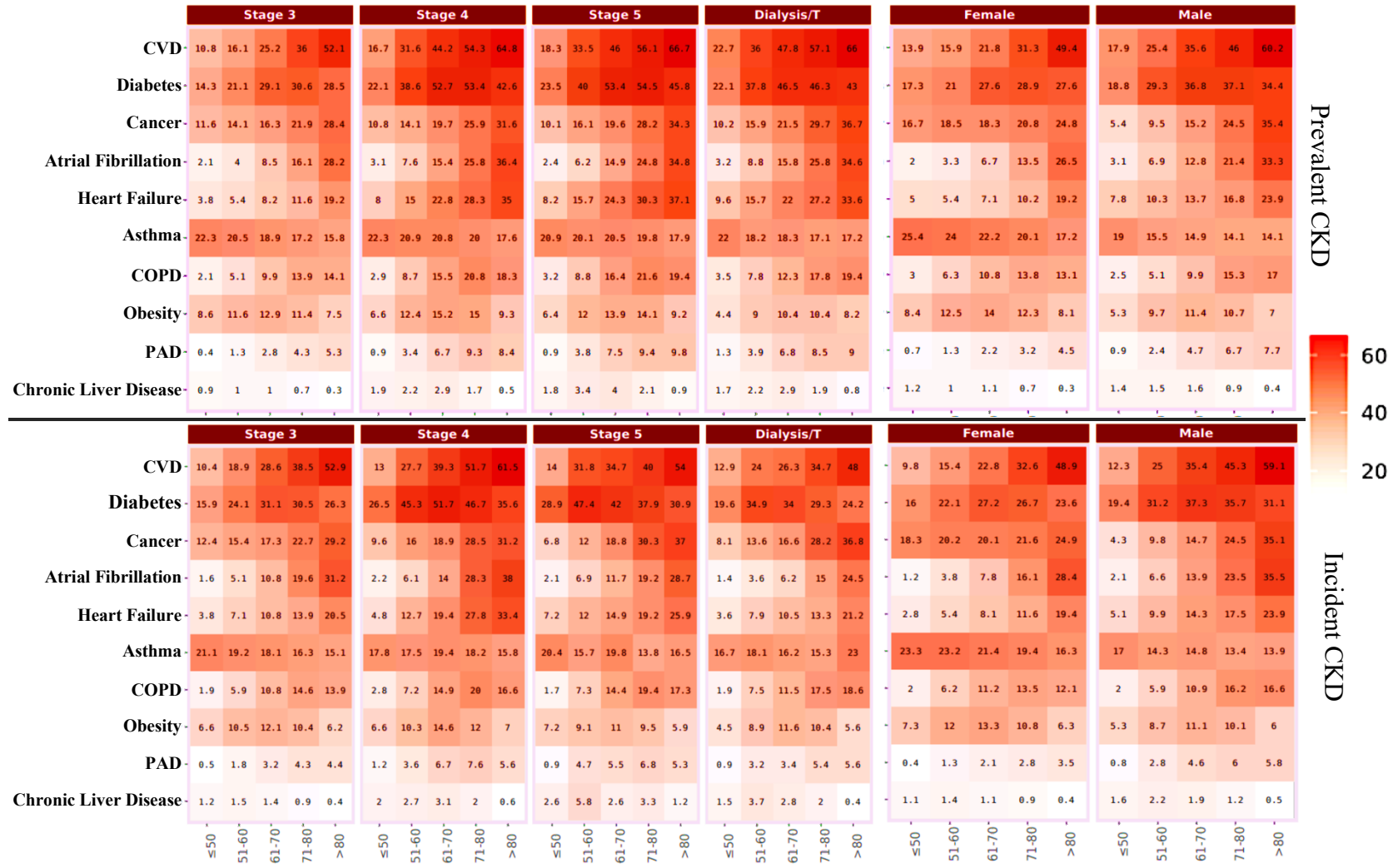


Figure S4. Prevalence of underlying conditions by age group, CKD stage, and sex, in individuals with prevalent (n= 1,934,585) and incident (n= 144,969) chronic kidney disease during the COVID-19 pandemic.

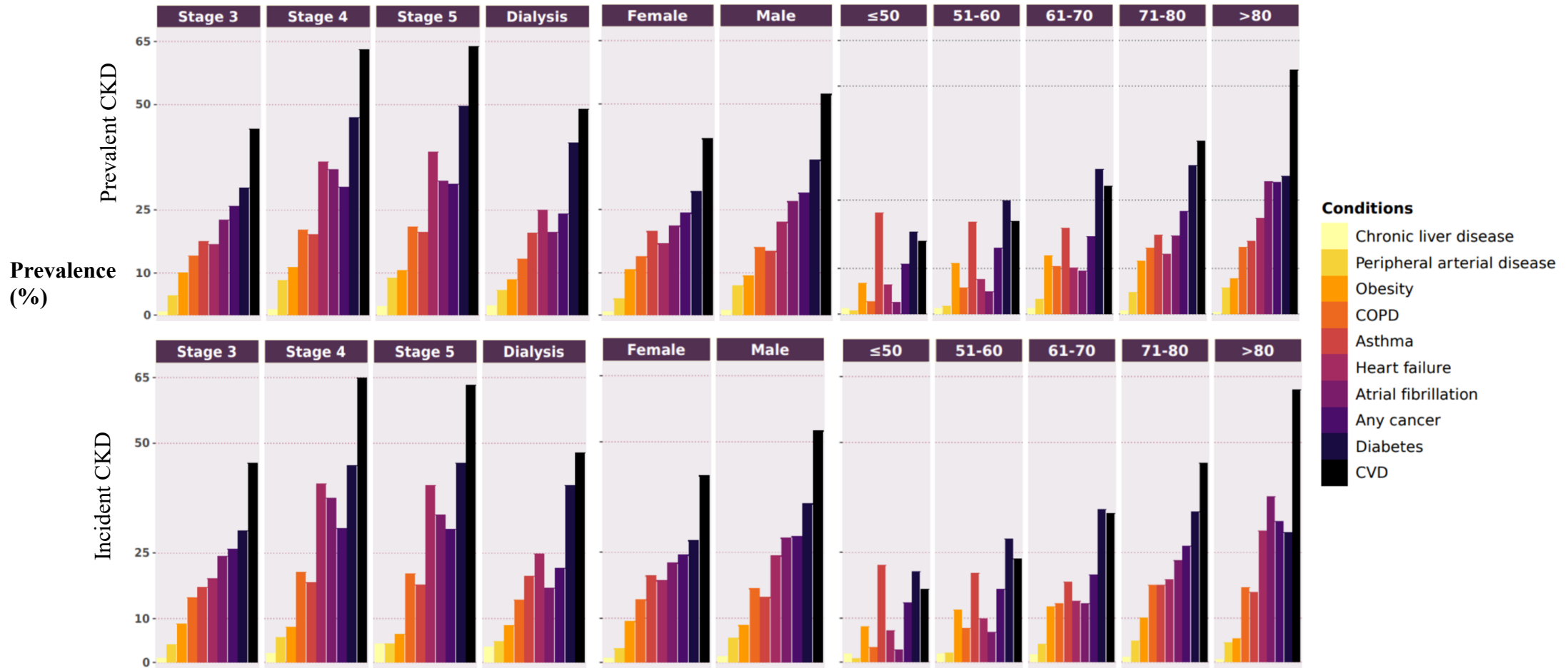


Figure S5. Association between SARS-CoV-2 infection and underlying conditions in individuals with chronic kidney disease in (a) all prevalent CKD (n= 1,934,585), and (b) the non-survival group (i.e. those not surviving to 1 year follow-up during pandemic) (n=172,789).

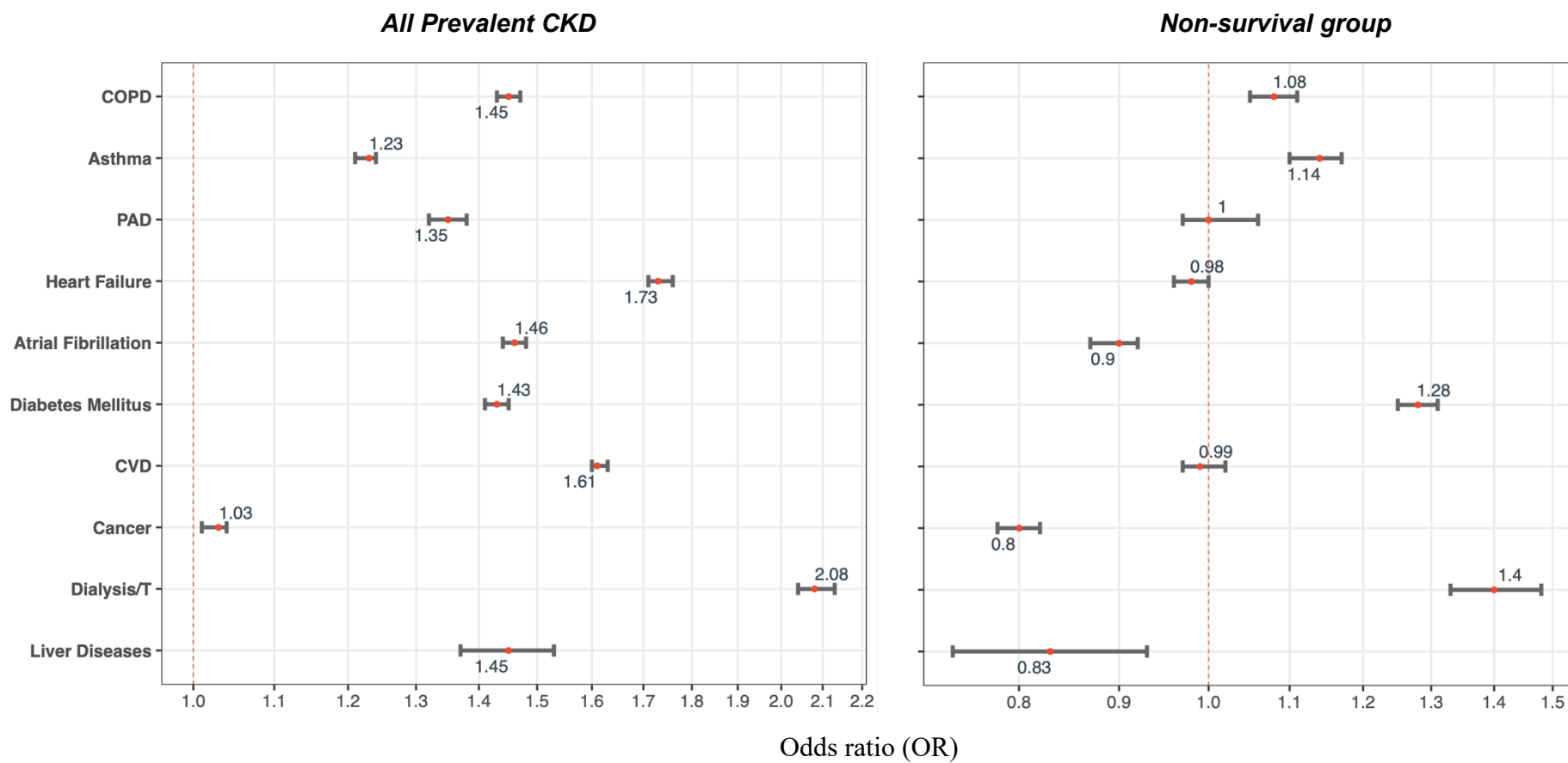


Figure S6. One-year all-cause mortality (%) in individuals with prevalent (n=1,934,585) chronic kidney disease by number of underlying conditions, age, sex, CKD stage, using NHSD TRE data on 1st March 2020.

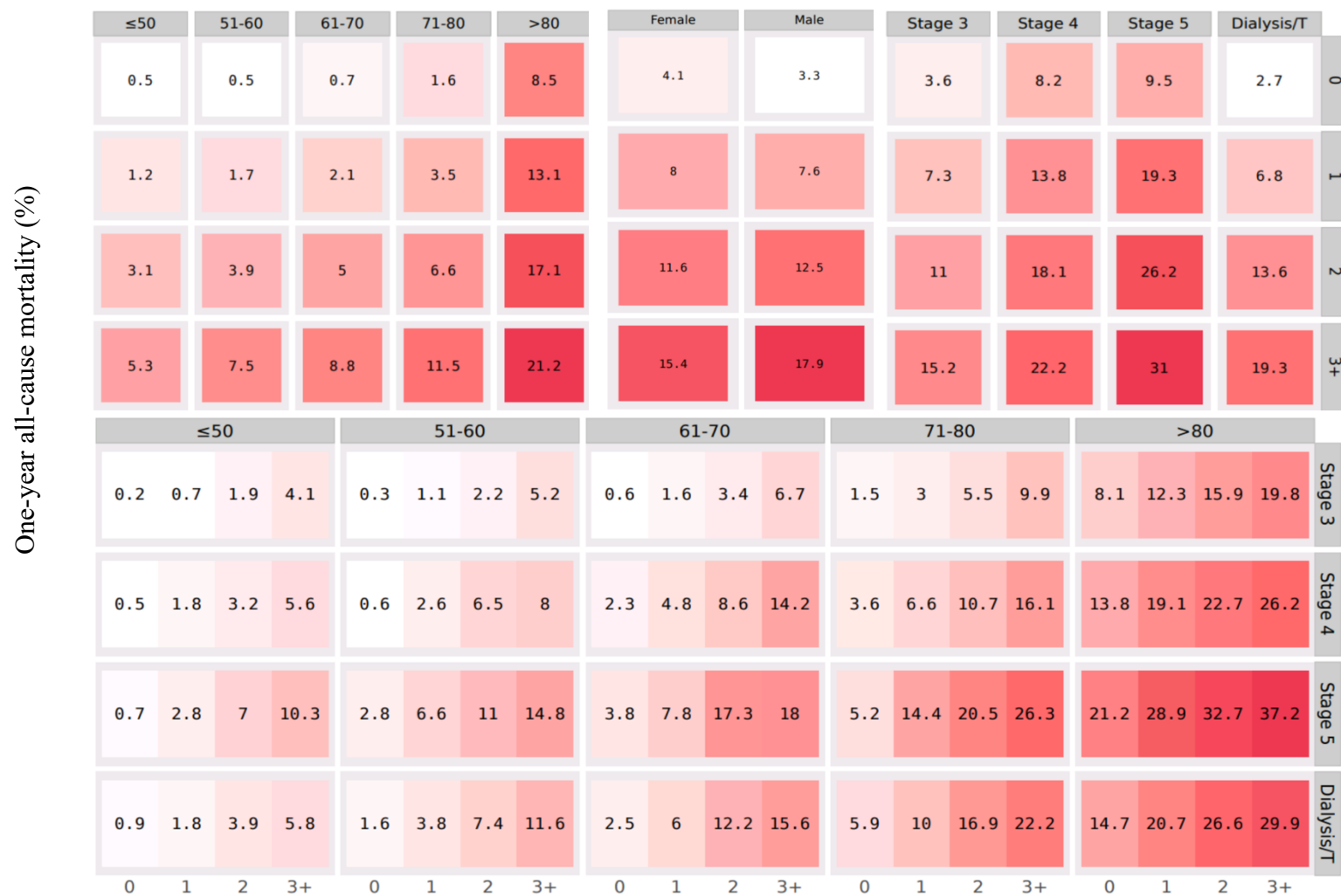


Figure S7. Covariate balance before and after exact matching for prevalent (n=1934585) and incident (n= 144969) chronic kidney disease, using standardized mean difference in all individuals and those with cancer, diabetes, and dialysis/transplantation.

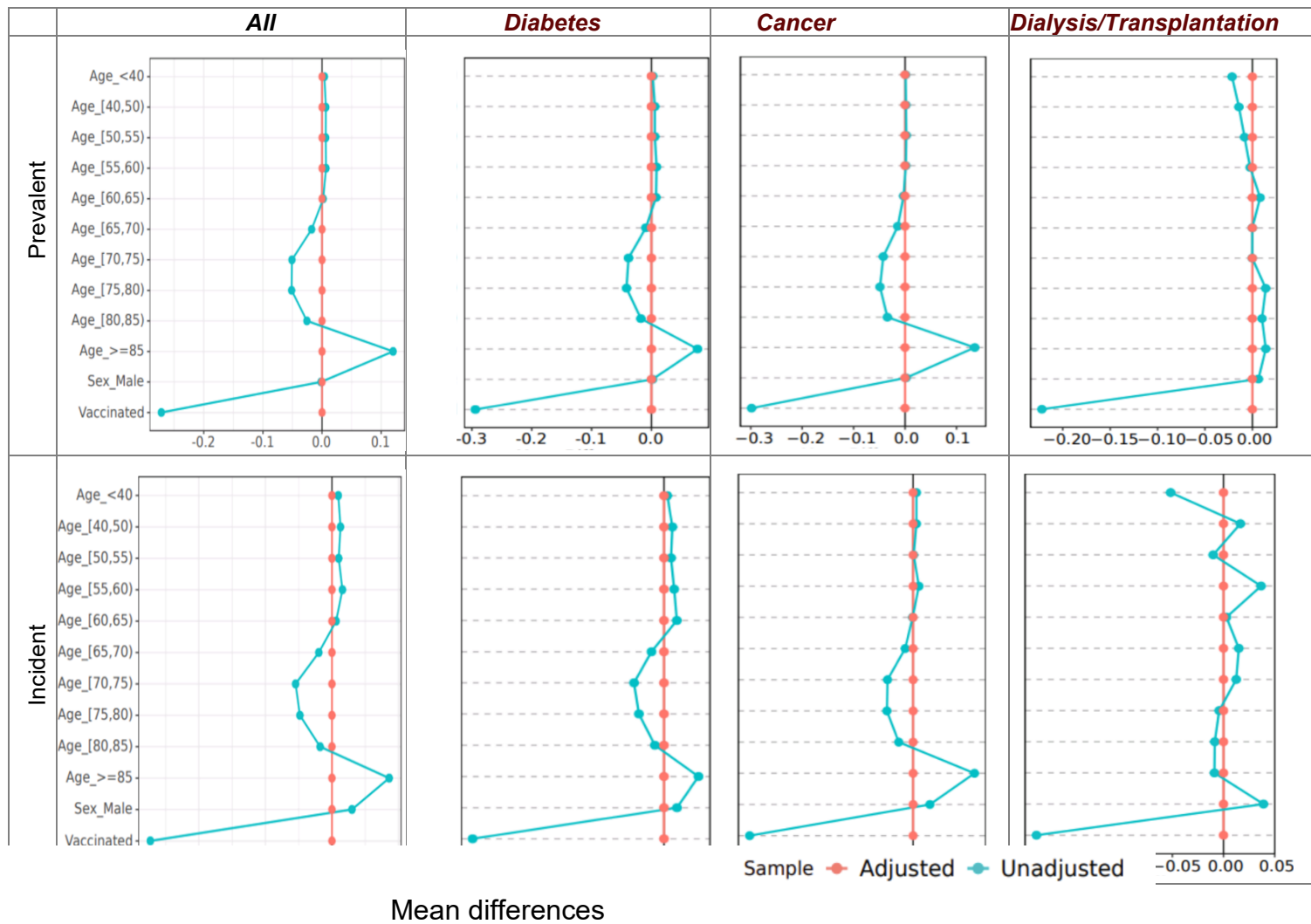


Figure S8. Observed age-specific, unadjusted relative risk of mortality and population infection rate during first year of COVID-19 pandemic in individuals with prevalent chronic kidney disease (n=1,934,585).

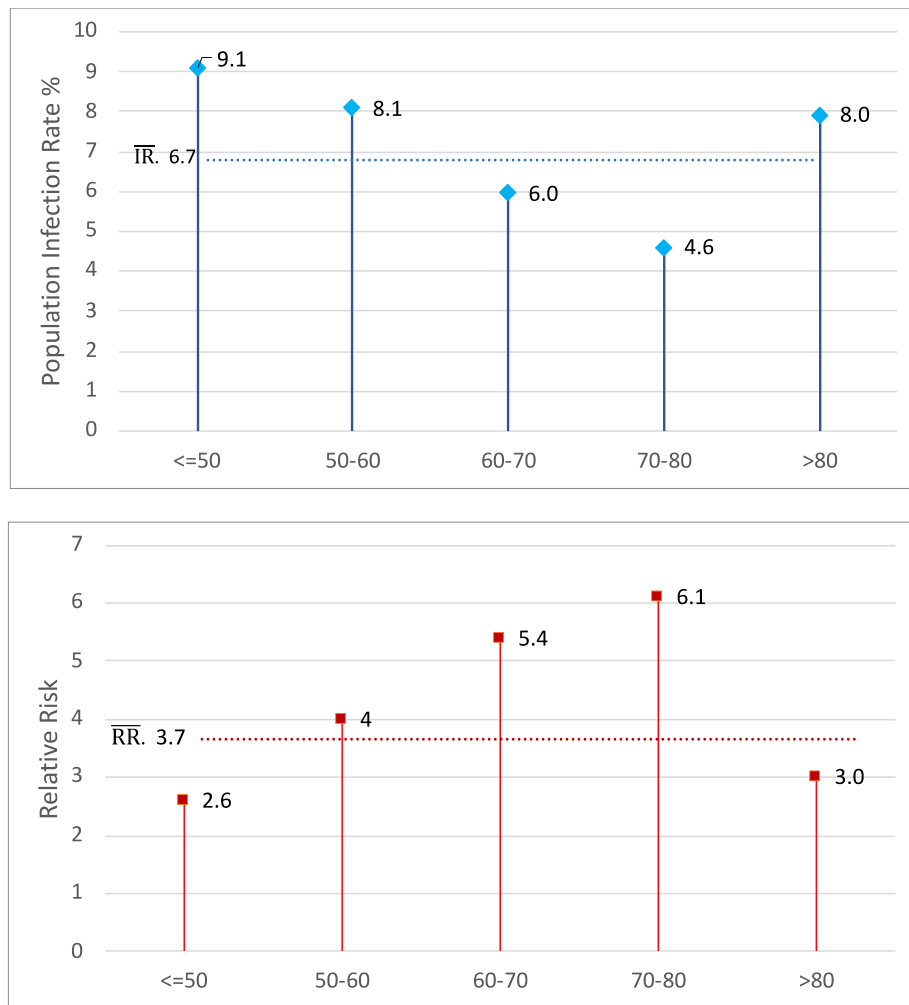
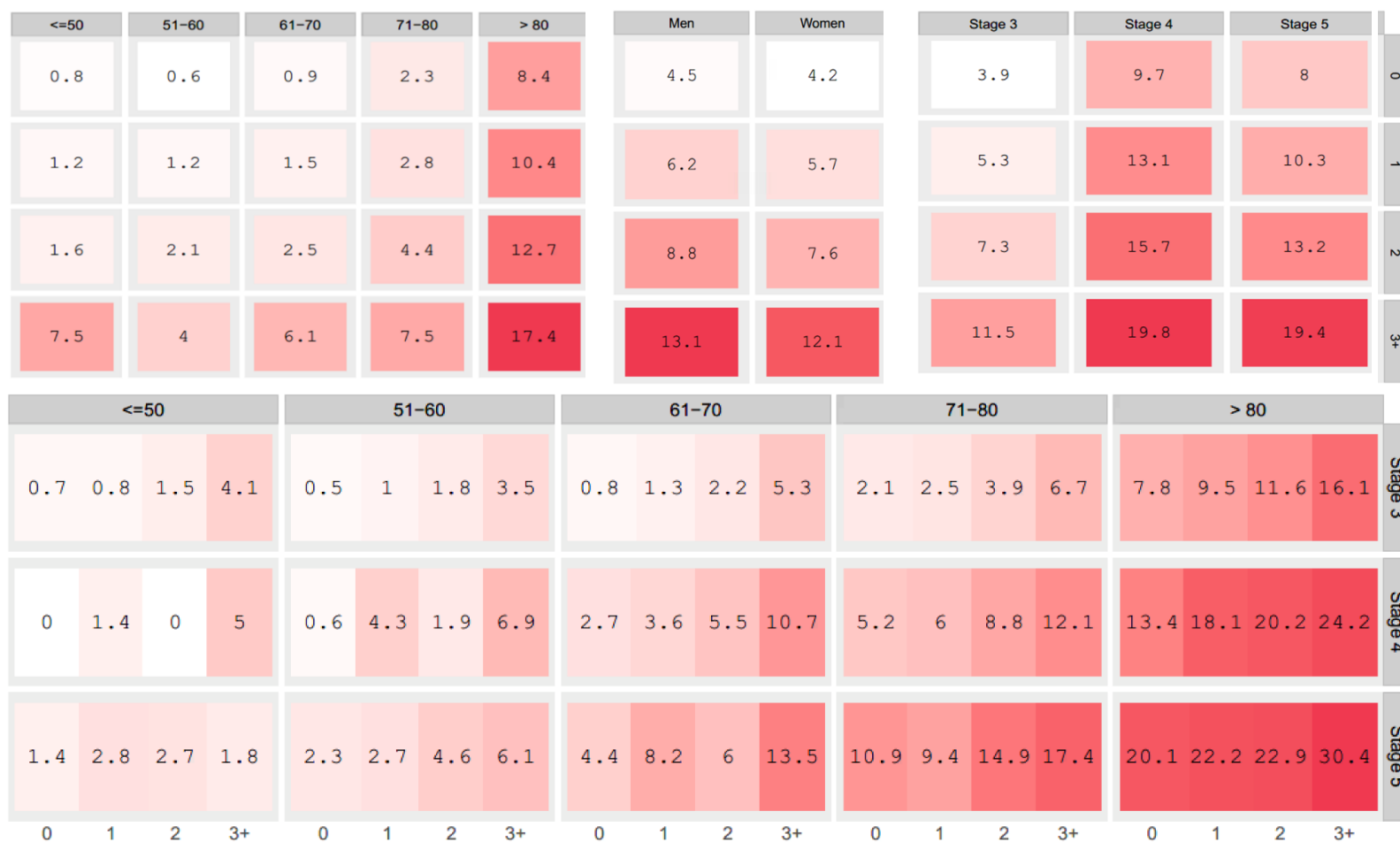


Figure S9. Pre-pandemic one-year all-cause mortality (%) in individuals with prevalent (n= 174,648) chronic kidney disease by number of underlying conditions, age, sex, CKD stage, using CPRD data on 6th April 2014.



* CKD Stage 5 included all End Stage Renal Disease including on-dialysis and transplant patients.

Figure S10. Proportion of excess COVID-19 deaths in individuals with prevalent chronic kidney disease by age group during one-year of pandemic, predicted by Lancet 2020 model (Population Infection Rate 10%, Relative Risk 3) using pre-pandemic study population in NHSD-TRE (predicted n=28,746) and CPRD (predicted n=24,546), compared with actual excess deaths (observed n=34,265).

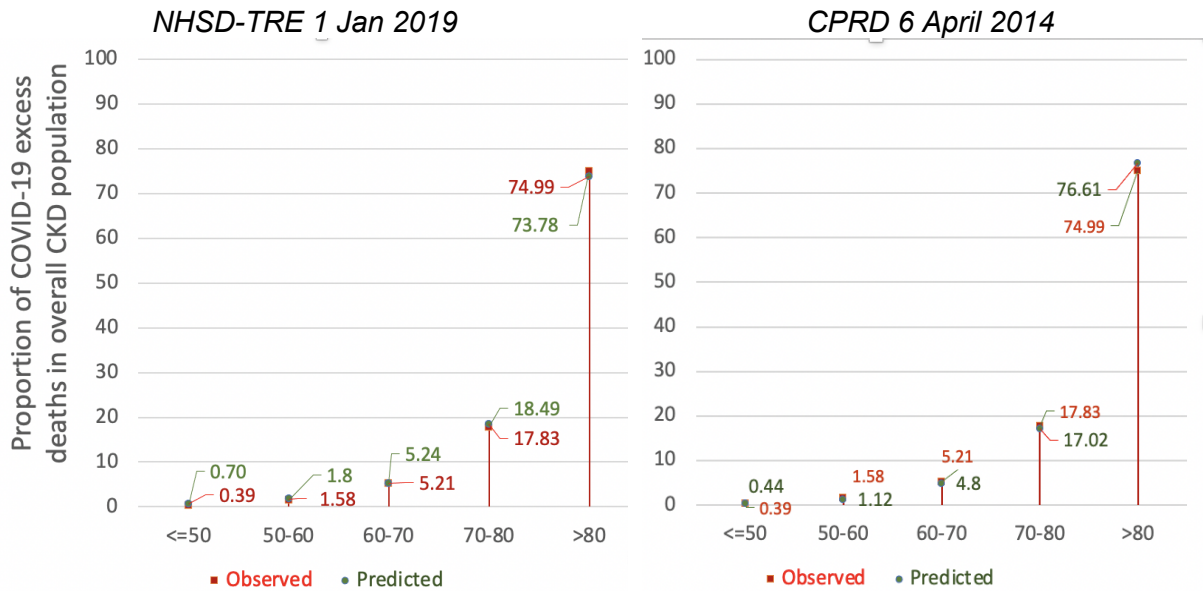


Table S1. Code list used to identify chronic kidney disease in primary and secondary care including ICD-10 codes, and SNOMED CT concepts.

Concept ID	CKD Stage	Dialysis/ Transplantation	Clinical Term	Coding System
T82.4	0	1	ICD-10 mechanical complication of vascular dialysis catheter	ICD-10
T86.1	0	1	ICD-10 kidney transplant failure and rejection	ICD-10
Y60.2	0	1	ICD-10 during kidney dialysis or other perfusion	ICD-10
Y61.2	0	1	ICD-10 during kidney dialysis or other perfusion	ICD-10
Y62.2	0	1	ICD-10 during kidney dialysis or other perfusion	ICD-10
Y84.1	0	1	ICD-10 kidney dialysis	ICD-10
Z49	0	1	ICD-10 care involving dialysis	ICD-10
Z49.0	0	1	ICD-10 preparatory care for dialysis	ICD-10
Z49.1	0	1	ICD-10 extracorporeal dialysis	ICD-10
Z49.2	0	1	ICD-10 other dialysis	ICD-10
Z94.0	0	1	ICD-10 kidney transplant status	ICD-10
Z99.2	0	1	ICD-10 dependence on renal dialysis//on dialysis treatment	ICD-10
N18.6	0	1	ICD-10 patients with CKD requiring dialysis	ICD-10
I77.0	0	1	ICD-10 arteriovenous fistula	ICD-10
N16.5	0	1	ICD-10 renal tubulo-interstitial disorders in transplant rejection	ICD-10
N18.5	5	0	ICD-10 chronic kidney disease stage 5	ICD-10
N18.4	4	0	ICD-10 chronic kidney disease stage 4	ICD-10
N18.3	3	0	ICD-10 chronic kidney disease stage 3	ICD-10
N18.2	2	0	ICD-10 chronic kidney disease stage 2	ICD-10
N18.1	1	0	ICD-10 chronic kidney disease stage 1	ICD-10
216933008	0	1	Failure of sterile precautions during kidney dialysis	SNOMED CT
238318009	0	1	Continuous ambulatory peritoneal dialysis	SNOMED CT
423062001	0	1	Stenosis of arteriovenous dialysis fistula	SNOMED CT
438546008	0	1	Ligation of arteriovenous dialysis fistula	SNOMED CT
180272001	0	1	Placement ambulatory dialysis apparatus - compens renal fail	SNOMED CT
385971003	0	1	[V]Preparatory care for dialysis	SNOMED CT
426361000000104	0	1	[V]Unspecified aftercare involving intermittent dialysis	SNOMED CT
302497006	0	1	Haemodialysis	SNOMED CT
251859005	0	1	Dialysis finding	SNOMED CT
108241001	0	1	Dialysis procedure	SNOMED CT
398471000000102	0	1	[V]Aftercare involving intermittent dialysis	SNOMED CT
180273006	0	1	Removal of ambulatory peritoneal dialysis catheter	SNOMED CT
426340003	0	1	Creation of graft fistula for dialysis	SNOMED CT
410511000000103	0	1	[V]Aftercare involving renal dialysis NOS	SNOMED CT
426351000000102	0	1	[V]Aftercare involving peritoneal dialysis	SNOMED CT
71192002	0	1	Peritoneal dialysis NEC	SNOMED CT
116223007	0	1	Kidney dialysis with complication without blame	SNOMED CT

428648006	0	1	Automated peritoneal dialysis	SNOMED CT
991521000000102	0	1	Dialysis fluid glucose level	SNOMED CT
161693006	0	1	H/O: renal dialysis	SNOMED CT
17778006	0	1	Mechanical complication of dialysis catheter	SNOMED CT
216878005	0	1	Accidental cut puncture perforation or haemorrhage during kidney dialysis	SNOMED CT
276883000	0	1	Peritoneal dialysis-associated peritonitis	SNOMED CT
265764009	0	1	Renal dialysis	SNOMED CT
180277007	0	1	Insertion of temporary peritoneal dialysis catheter	SNOMED CT
79827002	0	1	cadaveric renal transplant	SNOMED CT
269698004	0	1	failure of sterile precautions during kidney dialysis	SNOMED CT
269691005	0	1	very mild acute rejection of renal transplant	SNOMED CT
216904007	0	1	acute rejection of renal transplant - grade i	SNOMED CT
70536003	0	1	Renal transplant stage 5	SNOMED CT
427053002	0	1	Extracorporeal albumin haemodialysis stage 5	SNOMED CT
225283000	0	1	Priming haemodialysis lines stage 5	SNOMED CT
420106004	0	1	Renal transplant venogram stage 5	SNOMED CT
708932005	0	1	Emergency haemodialysis stage 5	SNOMED CT
5571000001109	0	1	solution haemodialysis stage 5	SNOMED CT
366961000000102	0	1	Renal transplant recipient stage 5	SNOMED CT
57274006	0	1	Initial haemodialysis stage 5	SNOMED CT
233575001	0	1	Intermittent haemodialysis stage 5	SNOMED CT
85223007	0	1	Complication of haemodialysis stage 5	SNOMED CT
96701000119107	0	1	Hypertensive heart AND Chronic kidney disease on dialysis (disorder)	SNOMED CT
285841000119104	0	1	Malignant Hypertensive end stage renal disease (disorder)	SNOMED CT
286371000119107	0	1	Malignant Hypertensive end stage renal disease on dialysis (disorder)	SNOMED CT
324541000000105	5	0	chronic kidney disease stage 5 without proteinuria	SNOMED CT
994441000006100	5	0	chronic kidney disease stage 5	SNOMED CT
950291000000103	5	0	chronic kidney disease with glomerular filtration rate category g5 and albuminuria category a2	SNOMED CT
714153000	5	0	chronic kidney disease 5t	SNOMED CT
714152005	5	0	ckd (chronic kidney disease) stage 5d	SNOMED CT
433146000	5	0	chronic kidney disease stage 5	SNOMED CT
950251000000106	5	0	ckd g5a1 - chronic kidney disease with glomerular filtration rate category g5 and albuminuria category a1	SNOMED CT
324501000000107	5	0	ckd (chronic kidney disease) stage 5 with proteinuria	SNOMED CT
950311000000102	5	0	ckd g5a3 - chronic kidney disease with glomerular filtration rate category g5 and albuminuria category a3	SNOMED CT
285011000119108	5	0	Chronic kidney disease stage 5 due to benign hypertension (disorder)	SNOMED CT
368461000119103	5	0	Chronic kidney disease stage 5 due to drug induced diabetes mellitus (disorder)	SNOMED CT
129161000119100	5	0	Chronic kidney disease stage 5 due to hypertension (disorder)	SNOMED CT

90761000119106	5	0	Chronic kidney disease stage 5 due to type 1 diabetes mellitus (disorder)	SNOMED CT
711000119100	5	0	Chronic kidney disease stage 5 due to type 2 diabetes mellitus (disorder)	SNOMED CT
96711000119105	5	0	Hypertensive heart AND Chronic kidney disease stage 5 (disorder)	SNOMED CT
153851000119106	5	0	Malignant Hypertensive Chronic kidney disease stage 5 (disorder)	SNOMED CT
950211000000107	4	0	chronic kidney disease with glomerular filtration rate category g4 and albuminuria category a2	SNOMED CT
324441000000106	4	0	ckd (chronic kidney disease) stage 4 with proteinuria	SNOMED CT
950181000000106	4	0	ckd g4a1 - chronic kidney disease with glomerular filtration rate category g4 and albuminuria category a1	SNOMED CT
950231000000104	4	0	ckd g4a3 - chronic kidney disease with glomerular filtration rate category g4 and albuminuria category a3	SNOMED CT
431857002	4	0	chronic kidney disease stage 4	SNOMED CT
324471000000100	4	0	chronic kidney disease stage 4 without proteinuria	SNOMED CT
994431000006105	4	0	chronic kidney disease stage 4	SNOMED CT
285001000119105	4	0	Chronic kidney disease stage 4 due to benign hypertension (disorder)	SNOMED CT
368451000119100	4	0	Chronic kidney disease stage 4 due to drug induced diabetes mellitus (disorder)	SNOMED CT
90751000119109	4	0	Chronic kidney disease stage 4 due to type 1 diabetes mellitus (disorder)	SNOMED CT
721000119107	4	0	Chronic kidney disease stage 4 due to type 2 diabetes mellitus (disorder)	SNOMED CT
96721000119103	4	0	Hypertensive heart AND Chronic kidney disease stage 4 (disorder)	SNOMED CT
285881000119109	4	0	Malignant Hypertensive Chronic kidney disease stage 4 (disorder)	SNOMED CT
700379002	3	0	chronic kidney disease stage 3b	SNOMED CT
324251000000105	3	0	chronic kidney disease stage 3 with proteinuria	SNOMED CT
324311000000101	3	0	chronic kidney disease stage 3a with proteinuria	SNOMED CT
949881000000106	3	0	chronic kidney disease with glomerular filtration rate category g3a and albuminuria category a1	SNOMED CT
324341000000100	3	0	ckd (chronic kidney disease) stage 3a without proteinuria	SNOMED CT
949901000000109	3	0	ckd g3aa2 - chronic kidney disease with glomerular filtration rate category g3a and albuminuria category a2	SNOMED CT
949921000000100	3	0	ckd g3aa3 - chronic kidney disease with glomerular filtration rate category g3a and albuminuria category a3	SNOMED CT
950061000000103	3	0	ckd g3ba1 - chronic kidney disease with glomerular filtration rate category g3b and albuminuria category a1	SNOMED CT
950101000000101	3	0	ckd g3ba3 - chronic kidney disease with glomerular filtration rate category g3b and albuminuria category a3	SNOMED CT
433144002	3	0	chronic kidney disease stage 3	SNOMED CT
324411000000105	3	0	chronic kidney disease stage 3b without proteinuria	SNOMED CT
324281000000104	3	0	ckd (chronic kidney disease) stage 3 without proteinuria	SNOMED CT

324371000000106	3	0	chronic kidney disease stage 3b with proteinuria	SNOMED CT
950081000000107	3	0	ckd g3ba2 - chronic kidney disease with glomerular filtration rate category g3b and albuminuria category a2	SNOMED CT
994421000006107	3	0	chronic kidney disease stage 3	SNOMED CT
700378005	3	0	chronic kidney disease stage 3a	SNOMED CT
284991000119104	3	0	Chronic kidney disease stage 3 due to benign hypertension (disorder)	SNOMED CT
368441000119102	3	0	Chronic kidney disease stage 3 due to drug induced diabetes mellitus (disorder)	SNOMED CT
129171000119106	3	0	Chronic kidney disease stage 3 due to hypertension (disorder)	SNOMED CT
90741000119107	3	0	Chronic kidney disease stage 3 due to type 1 diabetes mellitus (disorder)	SNOMED CT
731000119105	3	0	Chronic kidney disease stage 3 due to type 2 diabetes mellitus (disorder)	SNOMED CT
96731000119100	3	0	Hypertensive heart AND Chronic kidney disease stage 3 (disorder)	SNOMED CT
285871000119106	3	0	Malignant Hypertensive Chronic kidney disease stage 3 (disorder)	SNOMED CT
324181000000105	2	0	chronic kidney disease stage 2 with proteinuria	SNOMED CT
994411000006104	2	0	chronic kidney disease stage 2	SNOMED CT
431856006	2	0	chronic kidney disease stage 2	SNOMED CT
949521000000108	2	0	chronic kidney disease with glomerular filtration rate category g2 and albuminuria category a1	SNOMED CT
949621000000109	2	0	ckd g2a3 - chronic kidney disease with glomerular filtration rate category g2 and albuminuria category a3	SNOMED CT
949561000000100	2	0	chronic kidney disease with glomerular filtration rate category g2 and albuminuria category a2	SNOMED CT
96741000119109	2	0	Hypertensive heart AND Chronic kidney disease stage 2 (disorder)	SNOMED CT
285861000119100	2	0	Malignant Hypertensive Chronic kidney disease stage 2 (disorder)	SNOMED CT
324121000000109	1	0	chronic kidney disease stage 1 with proteinuria	SNOMED CT
994401000006102	1	0	chronic kidney disease stage 1	SNOMED CT
431855005	1	0	chronic kidney disease stage 1	SNOMED CT
949421000000107	1	0	ckd g1a2 - chronic kidney disease with glomerular filtration rate category g1 and albuminuria category a2	SNOMED CT
949481000000108	1	0	chronic kidney disease with glomerular filtration rate category g1 and albuminuria category a3	SNOMED CT
96751000119106	1	0	Hypertensive heart AND Chronic kidney disease stage 1 (disorder)	SNOMED CT
285851000119102	1	0	Malignant Hypertensive Chronic kidney disease stage 1 (disorder)	SNOMED CT

Table S2. Baseline characteristics in individuals with prevalent chronic kidney disease (n= 1,934,585) at the onset of and during COVID-19 pandemic (from 1st March 2020): age, sex, stages of CKD, underlying conditions, and COVID-19-mortality.

	Age group (years)					Overall (%)
	≤50	51-60	61-70	71-80	>80	
Stage 3	28097	86886	218766	533632	822126	87.3
Stage 4	2980	5109	11535	32437	83185	7.00
Stage 5	1270	1666	2925	5996	12278	1.3
Dialysis/Transplantation	20769	17717	18838	17971	10402	4.4
Total (n)	53116	111378	252064	590036	927991	1934585
Overall (%)	2.8	5.8	13.0	30.5	48.0	100

	Underlying conditions (n)				
	Age (years; mean±sd)	Female (%)	≥1	0	≥3
Stage 3	77.98±11.1	59.4	72.3	27.7	12.2
Stage 4	80.47±11.6	54.1	85.7	14.3	22.3
Stage 5	76.77±13.9	48	84.7	15.3	23.2
Dialysis/Transplantation	60.75±16.2	40	76.3	23.7	15.0
Overall	77.37±12.0	58.0	73.5	26.5	13.2

COVID-19 mortality

	Age group (years)					Overall (%)
	≤50	51-60	61-70	71-80	>80	
Stage 3	27	230	1036	4430	21001	78.0
Stage 4	9	52	209	746	3486	13.1
Stage 5	7	28	85	238	638	2.9
Dialysis/Transplantation	90	233	456	695	569	6.0
Overall (%)	0.4	1.6	5.2	17.8	75.0	100

Table S3. Baseline characteristics of incident (n= 144,969) chronic kidney disease during COVID-19 pandemic (1st March 2020-1st March 2021): age, sex, stages of CKD, underlying conditions, and 28-days COVID-mortality.

	Age group					Overall %
	<=50	51-60	61-70	71-80	>80	
Stage 3	5032	10819	22806	44927	48119	90.85
Stage 4	501	667	1128	2091	3391	5.37
Stage 5	235	274	383	515	606	1.39
Dialysis/Transplantation	1069	751	741	645	269	2.4
Total (n)	6837	12511	25058	48178	52385	144969
Overall (%)	4.7	8.6	17.3	33.2	36.1	100

	Age (years; mean±sd)	Female (%)	Underlying condition (n)		
			≥1	0	≥3
Stage 3	74.41± 12.2	52.8	70.9	29.1	11.6
Stage 4	74.85 ± 14.5	45.8	80	20.0	18.5
Stage 5	69.53± 15.9	40	73.6	26.4	15.6
Dialysis/Transplantation	57.23± 16.8	36.9	59.4	40.6	9.1
Overall	73.95± 12.8	51.87	71.2	28.8	11.9

COVID-19 mortality

	≤50	51-60	61-70	71-80	>80	Overall %
Stage 3	7	47	124	434	1270	77.7
Stage 4	5	14	33	88	188	13.5
Stage 5	8	14	19	32	43	4.8
Dialysis/Transplantation	8	11	26	36	15	4.0
Overall (%)	1.2	3.6	8.3	24.4	62.6	100

Table S4. Association between underlying conditions and SARS-CoV-2 infection (compared with non-infected individuals) in individuals with chronic kidney disease in (a) all prevalent (n= 1,934,585) or incident CKD (n= 144969) and (b) the non-survival group (i.e. those not surviving to 1 year follow-up during pandemic) (n=172,789).

	Odds ratio (OR), 95% CI			
	All patients		Non-survival	
	Prevalent	Incident	Prevalent	Incident
COPD	1.45(1.43-1.47)	1.32(1.25-1.39)	1.08(1.05-1.11)	1.05(0.94-1.17)
Asthma	1.23(1.21-1.24)	1.18(1.12-1.24)	1.14(1.10-1.17)	1.14(1.02-1.29)
PAD	1.35(1.32-1.38)	1.25(1.14-1.37)	1.00(0.97-1.06)	1.13(0.94-1.37)
Heart Failure	1.73(1.71-1.76)	1.49(1.42-1.56)	0.98(0.96-1.0)	0.96(0.87-1.07)
Atrial Fibrillation	1.46(1.44-1.48)	1.28(1.22-1.34)	0.90(0.87-0.92)	1.10(0.91-1.11)
Diabetes Mellitus	1.43(1.41-1.45)	1.39(1.33-1.45)	1.28(1.25-1.31)	1.35(1.22-1.48)
CVD	1.61(1.60-1.63)	1.34(1.29-1.39)	0.99(0.97-1.02)	0.98(0.90-1.08)
Cancer	1.03(1.01-1.04)	0.97(0.99-1.01)	0.80(0.78-0.82)	0.75(0.67-0.83)
Chronic Liver Diseases	1.45(1.37-1.53)	1.52(1.29-1.80)	0.83(0.74-0.93)	0.48(0.32-0.70)
Dialysis/Transplantation	2.08(2.04-2.13)	3.18(2.92-3.46)	1.40(1.33-1.48)	1.18(0.93-1.50)

Table S5. Association between underlying conditions and one-year all-cause mortality for prevalent (n= 1934585) and incident (n= 144969) chronic kidney disease.

		Relative risk (RR), 95% CI									
		Underlying conditions									
Method		COPD	Asthma	PAD	Heart Failure	Atrial Fibrillation	Diabetes Mellitus	CVD	Cancer	Dialysis/Transplantation	Chronic Liver Disease
Prevalent	A	2.67 (2.60-2.72)	3.08 (3.0-3.16)	2.71 (2.61-2.82)	2.28 (2.24-2.32)	2.38 (2.34-2.42)	3.19 (3.14-3.25)	2.64 (2.60-2.67)	2.73 (2.67-2.79)	2.40 (2.29-2.52)	2.12 (1.91-2.36)
	M	1.15 (1.13-1.17)	1.27 (1.24-1.30)	1.16 (1.12-1.19)	1.14 (1.12-1.16)	1.12 (1.10-1.13)	1.32 (1.30-1.33)	1.19 (1.17-1.20)	1.13 (1.11-1.15)	1.18 (1.13-1.22)	1.07 (0.99-1.17)
Incident	A	3.12 (2.84-3.42)	3.75 (3.37-4.17)	3.67 (3.08-4.34)	2.73 (2.52-2.96)	3.09 (2.86-3.33)	3.82 (3.55-4.10)	3.19 (3.08-3.38)	3.14 (2.89-3.41)	1.56 (1.25-1.93)	1.35 (0.93-1.89)
	M	1.13 (1.04-1.21)	1.31 (1.21-1.42)	1.25 (1.10-1.42)	1.14 (1.07-1.21)	1.15 (1.09-1.22)	1.38 (1.30-1.45)	1.20 (1.15-1.23)	1.15 (1.07-1.22)	0.90 (0.75-1.07)	0.85 (0.62-1.15)

***“A” denotes for adjusting only for age, “M” indicates adjusting for age, sex, tested positive for SARS-CoV-2 infection, and vaccination using exact matching. COPD=chronic obstructive pulmonary disease, CVD=cardiovascular disease, PAD = Peripheral arterial disease.*

Table S6. Association between COVID-19 vaccination and 1-year all-cause mortality by underlying condition for prevalent (n= 1934585) and incident (n= 144969) chronic kidney disease.

Incident risk ratio (IRR), 95% CI										
Underlying conditions										
Method	COPD	Asthma	Peripheral arterial disease	Heart Failure	Atrial Fibrillation	Diabetes Mellitus	Cardiovascular disease	Cancer	Dialysis/ Transplantation	Chronic Liver Disease
Prevalent	0.019 (.013-.024)	0.019 (.019-.020)	0.025 (.024-.027)	0.030 (.029-.031)	0.026 (.025-.027)	0.022 (.022-.023)	0.024 (.024-.025)	0.020 (.020-.021)	0.016 (.015-.017)	0.023 (.019-.027)
Incident	0.029 (.025-.032)	0.025 (.021-.028)	0.036 (.029-.044)	0.034 (.030-.037)	0.028 (.026-.031)	0.025 (.023-.028)	0.028 (.026-.030)	0.024 (.022-.026)	0.028 (.018-.040)	0.023 (.011-.035)

*Analyses were done after adjusting for age, sex, and being tested positive for SARS-CoV-2 infection.

Table S7. Incidence rate of SARS-CoV-2 infection per 10,000 person-weeks in prevalent (n= 1,934,585) and incident (n= 144,969) chronic kidney disease over one year of the COVID-19 pandemic: (a) crude, and (b) adjusted based on first COVID-19 vaccination, underlying conditions and CKD stage.

	Crude		Adjusted	
	Prevalent	Incident	Prevalent	Incident
COPD	19.0(18.8-19.2)	25.2(23.6-26.9)	20.9(20.6-21.2)	27.9(26.1-29.7)
Asthma	16.1(15.9-16.3)	22.4(21.1-23.7)	16.1(15.9-16.2)	22.7(21.4-24.0)
PAD	18.5(18.1-18.9)	24.4(21.7-27.3)	17.5(17.3-17.7)	26.8(23.8-30.1)
Heart Failure	21.9(21.6-22.1)	28.8(27.2-30.4)	24.1(23.8-24.3)	31.7(30.0-33.4)
Atrial Fibrillation	18.7(18.5-18.9)	24.8(23.6-26.1)	20.7(20.5-20.9)	28.4(27.1-30.0)
Diabetes Mellitus	17.3(17.2-17.4)	26.3(25.2-7.4)	18.9(18.8-19.1)	25.1(24.0-26.2)
CVD	17.8(17.6-17.9)	24.1(23.1-25.1)	19.7(19.5-19.8)	26.7(25.7-27.7)
Cancer	14.2(14.1-14.4)	20.1(19.1-21.2)	15.7(15.5-15.9)	22.2(21.2-23.4)
Chronic Liver Disease	20.1(19.0-21.2)	28.8(22.9-35.8)	21.6(20.3-22.8)	27.6(21.9-34.3)
CKD Stage 3	12.5(12.4-12.6)	18.3(17.8-18.8)	13.7(13.6-13.8)	18.9(18.4-19.4)
CKD Stage 4	19.6(19.3-20.0)	34.6(31.7-37.6)	21.5(21.2-21.9)	33.9(31.1-36.8)
CKD Stage 5	23.8(22.9-24.8)	41.7(35.2-49.2)	25.8(24.8-26.8)	37.9(31.9-44.6)
Dialysis/Transplantation	26.3(25.8-26.8)	45.7(40.1-50.8)	28.1(27.6-28.6)	39.2(35.2-43.6)
Non-dialysis/transplantation	13.1(13.0-13.2)	19.4(18.9-19.9)	14.4(14.3-14.5)	20.0(19.5-20.5)
Overall	13.7(13.6-13.8)	20.1(19.5-20.5)	15.0(14.9-15.1)	20.5(20.0-21.0)

Table S8. Baseline characteristics of pre-pandemic prevalent chronic kidney disease in the NHS Digital Trusted Research Environment (NHSD TRE; n= 1,727,130; 1st Jan 2019) and Clinical Practice Research Datalink (CPRD; n= 174,648; 1st April 2014) by age, sex, stages of CKD, and underlying conditions.

NHSD TRE

	Age group					Overall %
	≤50	51-60	61-70	71-80	>80	
Stage 3	28462	84457	217530	493782	657287	85.78
Stage 4	2932	5144	12554	35737	77503	7.75
Stage 5	1253	1583	3123	6888	12716	1.48
Dialysis/T	21856	17946	18656	18191	9530	4.99
Total	54503	109130	251863	554598	757036	1727130
Overall %	3.2	6.3	14.6	32.1	43.8	100

	Age	Female %	Underlying condition %		
			≥1	0	≥3
Stage 3	77.6±11.0	60	70.9	29.1	11.1
Stage 4	80.3±11.2	54.4	84.6	15.4	20.4
Stage 5	77.4±13.2	48.2	84.1	15.9	21.56
Dialysis/T	61.0±16.2	39.9	73	27	13.7
Overall	77.0±12.0	58.4	72.3	27.7	12.1

CPRD

	Age group					Overall (%)
	≤50	51-60	61-70	71-80	>80	
Stage 3	2545	8410	26178	52330	69644	91.1
Stage 4	202	371	946	2680	7197	6.5
Stage 5	609	689	842	911	1094	2.4
Total	3356	9470	27966	55921	77935	174648
Overall (%)	1.9	5.4	16.0	32.0	44.6	100

	Age (years)	Female (%)	Underlying condition %		
			≥1	0	≥3
Stage 3	76.9 ±10.7	61.8	60.3	39.8	8
Stage 4	81.2 ±10.9	59.8	69.6	30.4	14.3
Stage 5	67.8 ±15.2	45.0	63.3	36.7	9.7
Overall	77.0 ±11.9	61.2	60.9	39.1	8.4