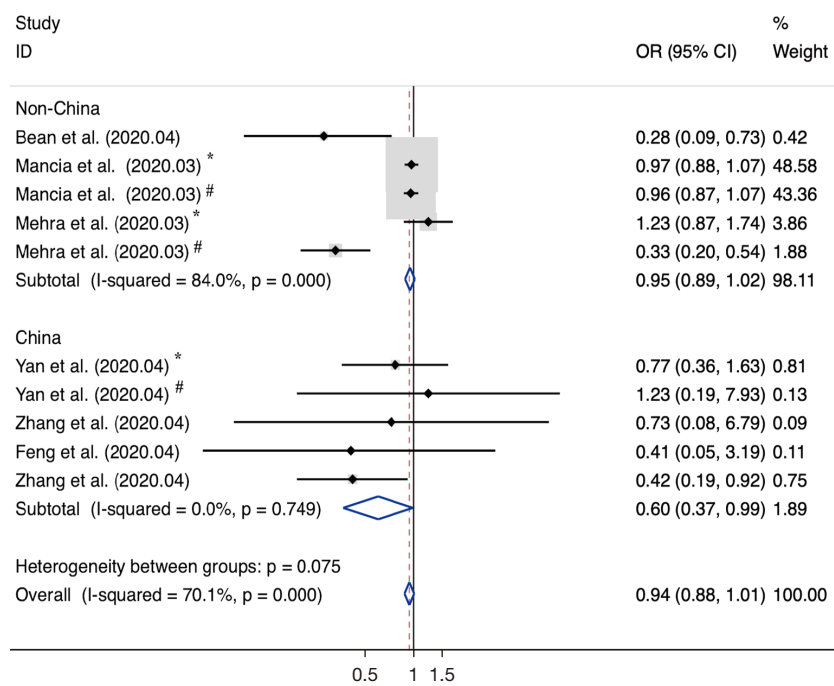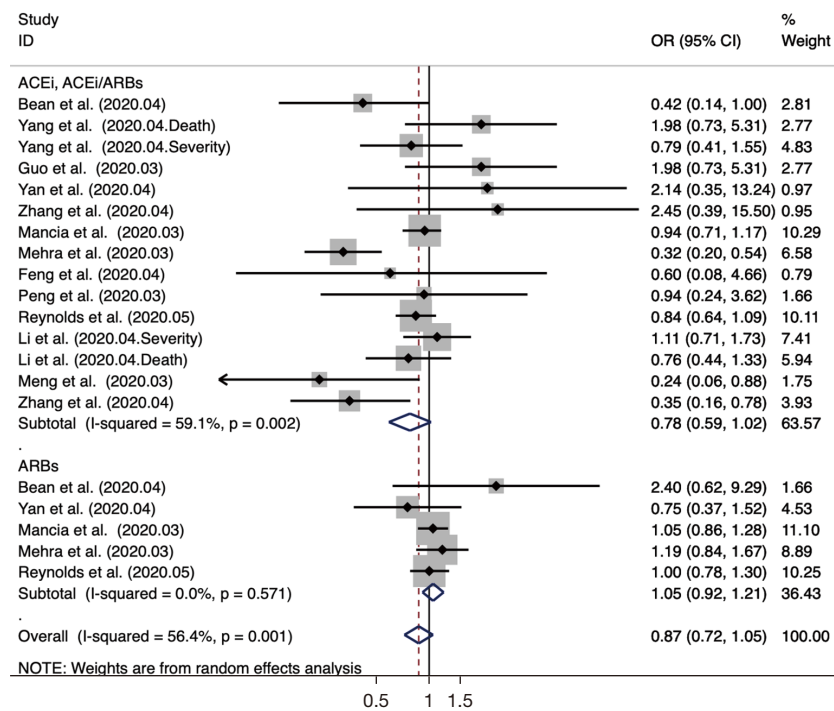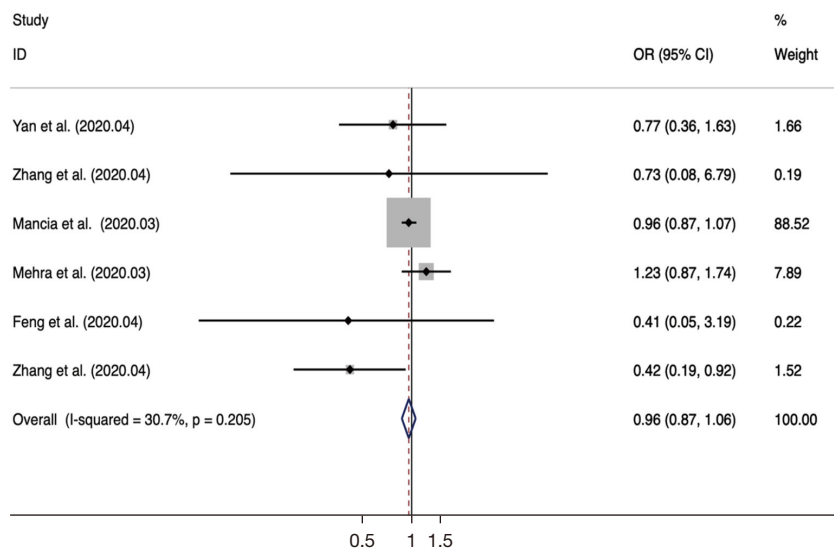**Figure S1** Forest plot showing the effect of medications on the risk of total and different clinical outcomes COVID-19-infected patients by random effects model analysis with crude OR values. In this and subsequent figures, the horizontal lines indicate the lower and upper limits of the 95% CI, the size of the gray squares reflects the relative weight of each study in the meta-analysis. COVID-19, coronavirus disease 2019; OR, odds ratio; CI, confidence interval.
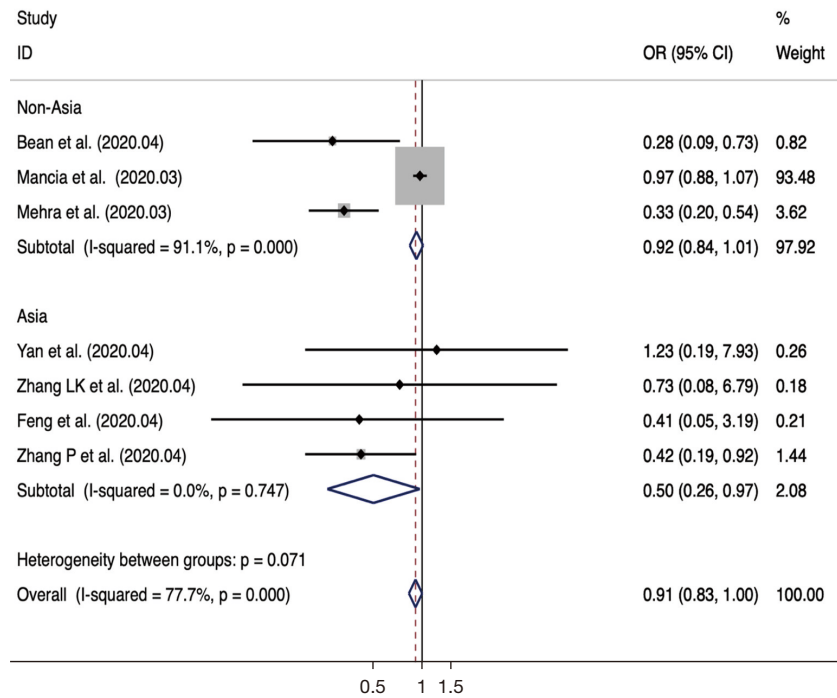
Figure S2 Forest plot showing the effect of study locations on the risk of clinical outcomes SARS-CoV-2-infected patients depending on adjust OR values using fixed effects model analysis. OR, odds ratio; CI, confidence interval; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Figure S3 Forest plot showing the effect of different medications on the risk of COVID-19 patients' clinical outcomes by random effects model analysis with crude OR values. OR, odds ratio; CI, confidence interval; ACEI, angiotensin-converting enzyme inhibitor; ARBs, angiotensin receptor blockers; COVID-19, coronavirus disease 2019.

Figure S4 Forest plot showing the effect of ARBs, ACEI/ARBs medications on the risk of clinical outcomes SARS-CoV-2-infected patients depending on adjust OR values using random effects model analysis by fixed effects modle analysis. OR, odds ratio; CI, confidence interval; ARBs, angiotensin receptor blockers; ACEI, angiotensin-converting enzyme inhibitor; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Figure S5 Forest plot showing the effect of ACEI, ACEI/ARBs medication on the risk of clinical outcomes SARS-CoV-2-infected patients depending on adjust OR values using random effects model analysis. OR, odds ratio; CI, confidence interval; ACEI, angiotensin-converting enzyme inhibitor; ARBs, angiotensin receptor blockers; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

Table S1 Risk of bias in studies providing relative risk estimates

First author	Adjusted confounders				Risk of bias
	Year	Age	Sex	Other confounders	
Bean	2020	Yes	Yes	Hypertension, diabetes mellitus, ischaemic heart disease, heart failure	Low risk
Yang	2020	Yes	Yes	None	Moderate risk
Guo	2020	None	None	None	High risk
Yan	2020	Yes	Yes	BMI	Low risk
Zhang	2020	Yes	Yes	The delay from symptom onset to hospital admission, and therapies administration	Low risk
Mancia	2020	Yes	Yes	Drugs and coexisting conditions	Low risk
Mehra	2020	Yes	Yes	None	Moderate risk
Feng	2020	Yes	Yes	None	Moderate risk
Peng	2020	None	None	None	High risk
Reynolds	2020	Yes	Yes	Race; ethnic group; BMI; smoking history; history of hypertension, myocardial infarction, heart failure, diabetes, chronic kidney disease, and obstructive lung disease	Low risk
Li	2020	Yes	Yes	None	Moderate risk
Meng	2020	None	None	None	High risk
Zhang	2020	Yes	Yes	Conditions	Low risk

Risk of bias assessed by level of adjustment. Low risk, adjustment of age, sex, and at least one other covariate; Moderate risk, adjustment of at least age and sex; High risk, no adjustment. BMI, body mass index.

Table S2 Sensitivity analyses to evaluate the contribution of each study to the pooled estimation by excluding each of the studies one after the others

Study author	Atrial fibrillation OR with 95% CI after removing the study
Bean	0.83 (0.68–1.02)
Yang	0.79 (0.62–0.99)
Yan	0.78 (0.62–0.98)
Zhang	0.79 (0.63–0.98)
Mancia	0.65 (0.44–0.97)
	0.65 (0.44–0.97)
Mehra	0.72 (0.57–0.92)
	0.94 (0.82–1.08)
Feng	0.79 (0.64–0.99)
Zhang	0.83 (0.67–1.02)

OR, odds ratio; CI, confidence interval.

Table S3 Meta regression estimate outcomes of between-study variance

Group	Covariates	Exp (B)	Std. Err	t	P value	95% CI	
By crude OR	Study location	−0.073	0.143	−0.51	0.620	−0.376	0.230
	Journal	−0.458	0.748	−0.61	0.549	−2.036	1.121
	Medications	0.177	0.216	0.82	0.424	−0.278	0.631
	Article risk	−0.150	0.298	−0.50	0.622	−0.779	0.479
	Total case number	−0.053	0.054	0.095	0.355	−0.064	0.016
By adjust OR	Study location	−0.057	0.289	−0.20	0.85	−0.763	0.845
	Journal	−0.353	0.953	−0.37	0.724	−2.685	1.980
	Medications	0.052	0.324	0.16	0.877	−0.740	0.845
	Article risk	−0.353	0.953	−0.37	0.724	−2.685	1.980
	Total case number	−0.646	0.860	−0.75	0.468	−2.586	1.564

Exp (B), exponential (B); Std. Err, standard error; CI, confidence interval; OR, odds ratio.

Table S4 Egger's test for small-study effects

Group	Std_Eff	Coef.	Std. Err.	t	P value	95% CI	
By crude OR	Slope	0.019	0.124	0.15	0.883	−0.240	0.277
	Bias	−0.539	0.532	−1.01	0.324	−1.649	0.572
By adjust OR	Slope	0.025	0.074	0.35	0.735	−0.145	0.197
	Bias	−1.222	0.673	−1.82	0.107	−2.775	0.330

Std_Eff, standard effects; Coef., coefficient; Std. Err, standard error; CI, confidence interval; OR, odds ratio.

Table S5 Begg's test for small-study effects

Group	Adj. Kendall's score	Std. Dev. of score	Number of studies	z	P value	z continuity corrected	P continuity corrected
By crude OR	−8	35.46	22	−0.23	0.822	0.20	0.844
By adjust OR	−11	11.18	10	−0.98	0.325	0.89	0.371

Adj., adjust; Std. Dev., standard deviation; OR, odds ratio.

Appendix: search criteria

PubMed

#1. (((((((((((COVID19[Title/Abstract]) OR COVID-19[Title/Abstract]) OR 2019 novel coronavirus disease[Title/Abstract]) OR SARS-CoV-2[Title/Abstract]) OR COVID-19 virus disease[Title/Abstract]) OR 2019 novel coronavirus infection[Title/Abstract]) OR 2019-nCoV infection[Title/Abstract]) OR 2019-nCoV infection[Title/Abstract]) OR coronavirus disease 2019[Title/Abstract]) OR 2019-nCoV disease[Title/Abstract]) OR COVID-19 virus infection[Title/Abstract]

#2. (Renin–angiotensin–aldosterone System[Title/Abstract]) OR RAAS[Title/Abstract]

#3. (((angiotensin converting enzyme inhibitors[Title/Abstract]) OR ACEIs[Title/Abstract]) OR ACEis[Title/Abstract]) OR ACEi[Title/Abstract]

#4. ((angiotensin receptor blockers[Title/Abstract]) OR ARBs[Title/Abstract]) OR ARB[Title/Abstract]

#5. #3 OR #4

#6. #2 OR #5

#7. #1 AND #6

Embase

1. COVID19. ab. ti.

2. SARS-CoV-2. ab. ti.

3. 2019-nCoV disease. ab. ti.

4. 2019-nCoV. ab. ti.

5. coronavirus disease 2019. ab. ti.

6. 1or 2or 3or 4or 5or

7. Renin–angiotensin–aldosterone System. ab. ti.

8. RAAS. ab. ti.

9. angiotensin converting enzyme inhibitors. ab. ti.

10. ACEIs. ab. ti.

11. ACEis. ab. ti.

12. ACEi. ab. ti.

13. angiotensin receptor blockers. ab. ti.

14. ARBs. ab. ti.

15. ARB. ab. ti.

16. 7 or 8

17. 9 or 10 or 11 or 12

18. 13 or 14 or 15

19. 16 or 17 or 18

20. 6 and 19