Increased risk of acute kidney injury in coronavirus disease patients with renin-angiotensin-aldosterone-system blockade use: A systematic review and meta-analysis

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Supplemental Table 1. Newcastle-Ottawa Scale

	Selection 1)	Selection 2)	Selection 3)	Selection 4)	Comparability 1)	Outcome 1)	Outcome 2)	Outcome 3)	Score
Chaudhri *et al.*[1]	b	a	a	a	a	a	a	a	8
Cheng *et al.*[2]	b	a	a	a	a	a	a	a	8
Dudoignon *et al.*[3]	b	a	d	a	a	a	a	a	7
Hirsch *et al.*[4]	b	a	a	a	a	a	a	a	8
Husain-Syed *et al.*[5]	a	a	a	a	a	a	a	a	8
Kolhe *et al.*[6]	b	a	a	a	a	a	a	a	8
Lim *et al.*[7]	b	a	b	a	a	a	a	a	8
Louis *et al.*[8]	b	a	d	a	a	a	a	a	7
Ng *et al.*[9]	a	a	a	a	a	a	a	a	8
Pelayo *et al.*[10]	b	a	d	a	a	a	a	a	7
Peng *et al.*[11]	a	a	a	a	a	a	a	a	8
Russo *et al.*[12]	b	a	a	a	a	a	a	a	8
Soleimani *et al.*[13]	b	a	a	a	a	a	a	a	8
Taher *et al.*[14]	b	a	a	a	a	a	a	a	8
Tetlow *et al.*[15]	b	a	a	a	a	a	a	a	8
Zahid *et al.*[16]	b	a	a	a	a	a	a	a	8

Reference

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9. Ng, J. H. *et al.* Outcomes Among Patients Hospitalized With COVID-19 and Acute Kidney Injury. *Am J Kidney Dis* (2020).
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16. Zahid, U. *et al.* Acute Kidney Injury in COVID-19 Patients: An Inner City Hospital Experience and Policy Implications. *Am J Nephrol* **51**, 786-796 (2020).

PRISMA 2009 Checklist

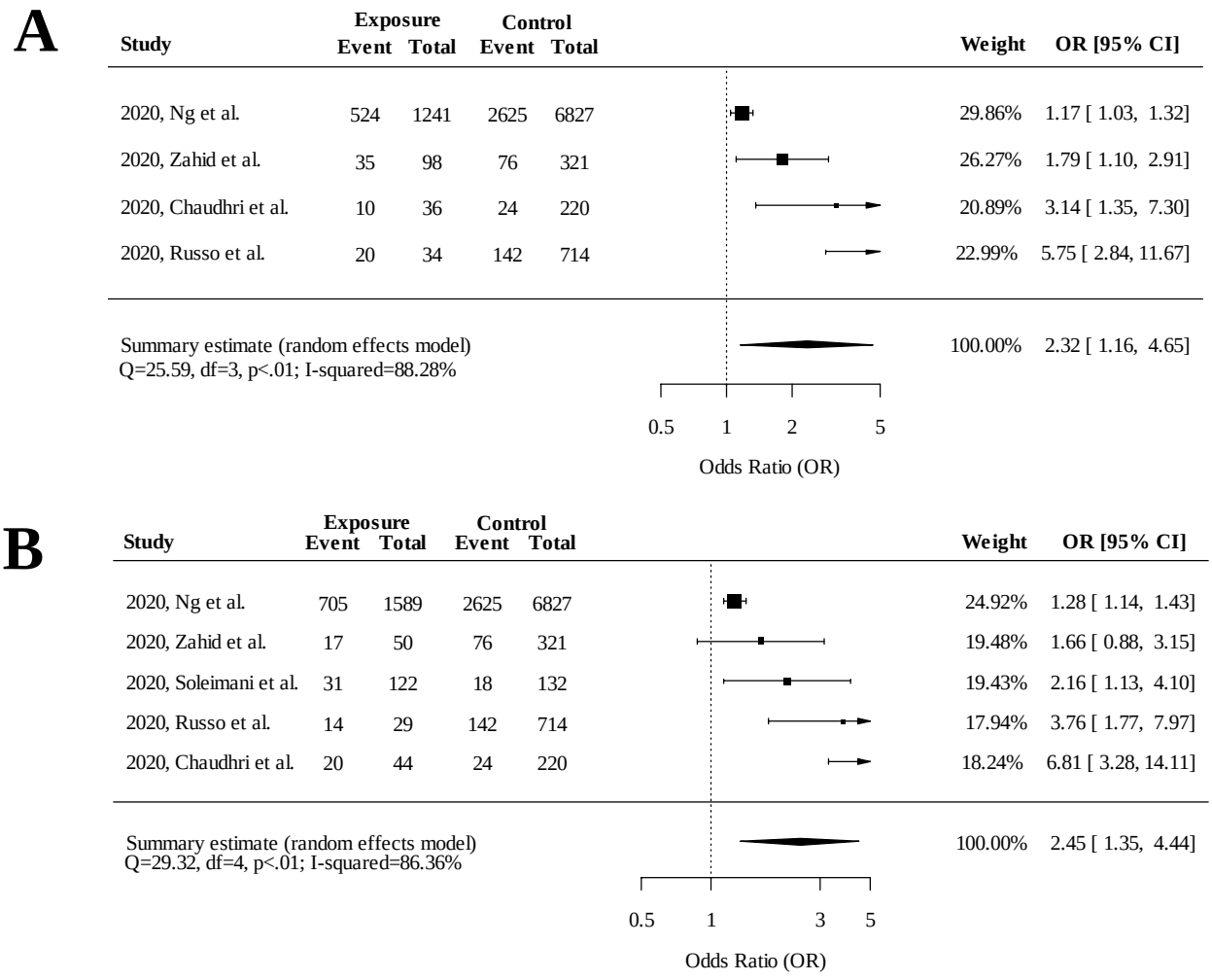
Supplemental Table 2. PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	3-4
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	5-6
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5-6
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	7
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	7
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	7
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	7
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	8
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	8
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	8-9
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	7-8
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	8

PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	8
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	8-9
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	10
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	10-11
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	10-12
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	11-12, Fig.2, Supp. Fig. 1 & 3
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	11-12
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	10-12
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	11-12
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	13
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	15-16
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	16
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	20

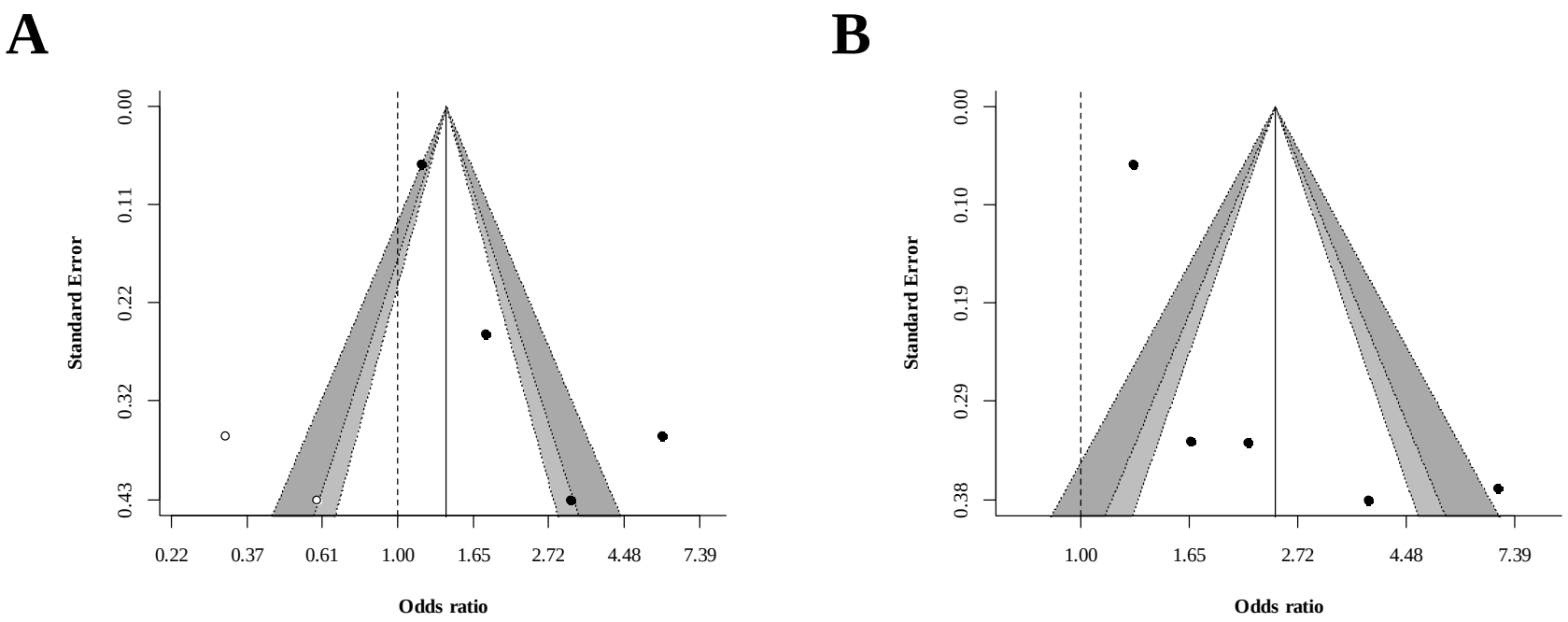
From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097



Supplemental Figure 1. Meta-analysis of pooled odds ratios for incident AKI in hospitalized COVID-19 patients based on exposure to ACEIs or ARBs

Significant association was found between COVID-19-related AKI incidence and recent exposure to (A) ACEIs as well as (B) ARBs.

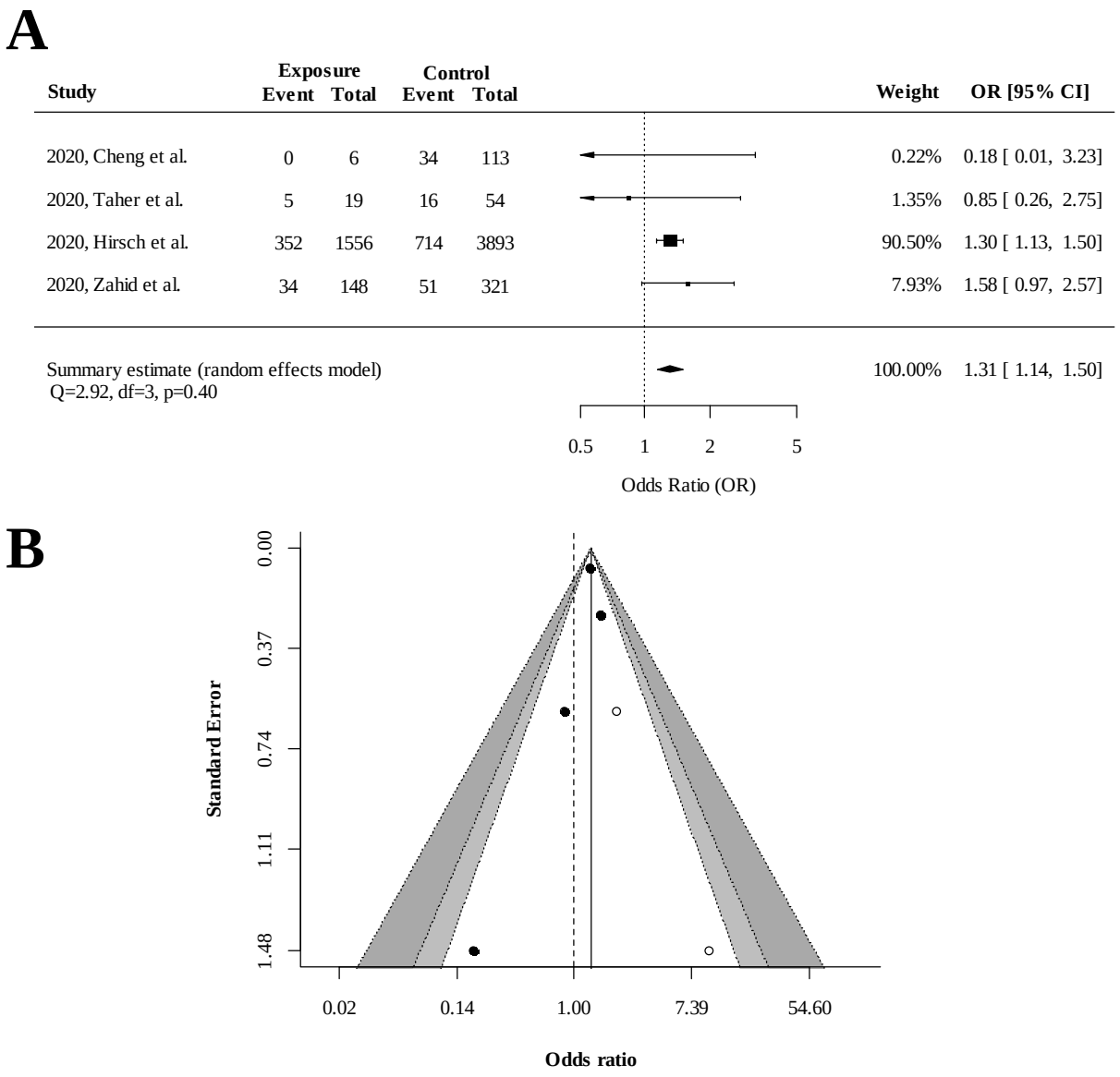
Abbreviations: AKI, acute kidney injury; ACEI, angiotensin-converting-enzyme inhibitor; ARB, angiotensin receptor blocker; OR, odds ratio; CI, confidence interval.



Supplemental Figure 2. Contour-enhanced funnel plot of meta-analysis of the association between ACEI/ARB use and incident AKI in COVID-19 patients

(A) The funnel plot indicates potential publication bias in the meta-analysis regarding the association between ACEI use and COVID-19-related AKI. (B) No publication bias was found in the meta-analysis of the association of ARB use with COVID-19-related AKI. Inner white zone indicates p-value > 0.1, gray zone indicates 0.05 < p-value < 0.1, dark gray zone indicates 0.01 < p-value < 0.05, and outer white zone indicates p-value < 0.01.

Abbreviations: ACEI, angiotensin-converting-enzyme inhibitor; ARB, angiotensin receptor blocker; AKI, acute kidney injury



Supplemental Figure 3. Meta-analysis of pooled odds ratios for moderate-to-severe vs. no/mild AKI in hospitalized COVID-19 patients based on RAAS blockade use

(A) RAAS blockade exposure was significantly associated with the incidence of moderate-to-severe AKI compared to no/mild AKI in hospitalized COVID-19 patients. (B) The funnel plot indicates no potential publication bias in the association of RAAS blockade use on incident moderate-to-severe AKI compared to no/mild AKI in COVID-19 patients requiring hospitalization. Inner white zone indicates p-value > 0.1, gray zone indicates 0.05 < p-value < 0.1, dark gray zone indicates 0.01 < p-value < 0.05, and outer white zone indicates p-value < 0.01

Abbreviations: RAAS, renin-angiotensin-aldosterone-system; AKI, acute kidney injury