

# Association of Angiotensin-Converting Enzyme Inhibitors or Angiotensin Receptor Blockers Use and Covid-19 Infection Among Patients with Hypertension

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## Disclosures

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- JA reports grants from Novartis, Vital Strategies, and Merck & Co. outside the submitted work.
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# Background

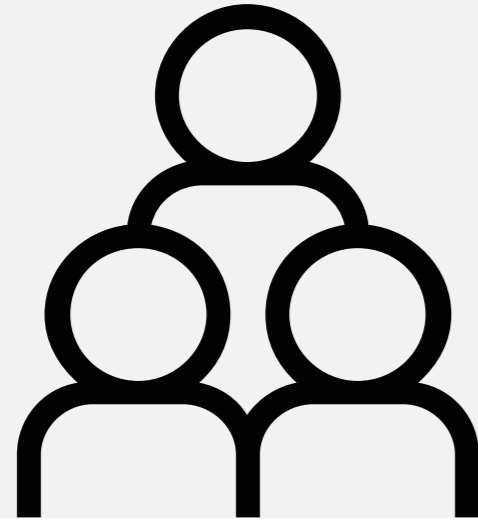
- The Covid-19 pandemic has generated concerns that use of angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs) may be associated with increased risk of Covid-19 infection or disease severity.
  - ACEIs or ARBs may upregulate angiotensin-converting enzyme 2 (ACE2) receptors and increase SARS-CoV-2 infectivity.<sup>1</sup>
  - ACEIs or ARBs may be protective against Covid-19 by upregulating ACE2 and mitigating the inflammatory response in the lungs of infected patients.<sup>2</sup>
- Epidemiologic studies have emerged to address this question, and these reports showed no increased risk of severity of Covid-19 associated with ACEI or ARB exposure.<sup>3-8</sup>
  - Limited information is available on the susceptibility of Covid-19.

## Objective

Determine the risk of Covid-19 infection among patients with hypertension taking ACEIs or ARBs, compared with other frequently used antihypertensive medications\* within a large, diverse hypertension population at Kaiser Permanente Southern California.

\*Calcium channel blockers (CCB), beta-blockers (BB), thiazide or thiazide-like diuretics (TD)

# Methods



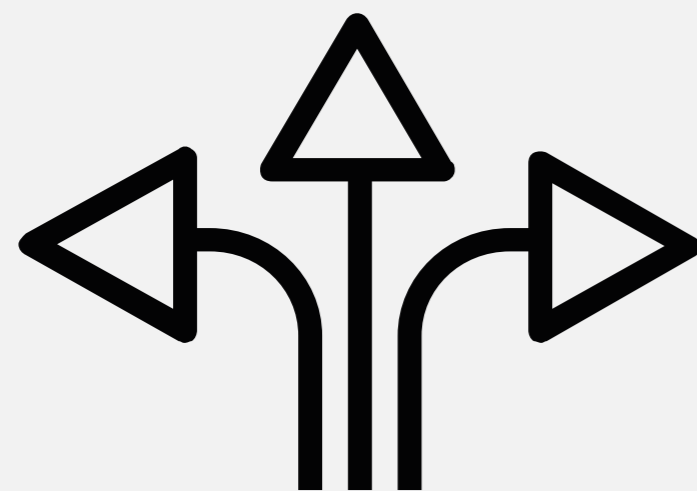
## Retrospective Study Cohort

- Patients with hypertension as of March 1, 2020 (index date) from Kaiser Permanente Southern California
- Had a test for Covid-19 between March 1 – May 6, 2020



## Variables of Interest

- **Exposure:**
  - 1) Any ACEIs
  - 2) Any ARBs
  - 3) CCB/BB/TD (reference group)
  - 4) Other antihypertensives
  - 5) No antihypertensives
- **Outcome:**
  - Positive reverse transcription polymerase chain reaction (RT-PCR) test for Covid-19



## Statistical Analysis

- Propensity score matching based on patient demographics, neighborhood income and education, insurance, body mass index, smoking, blood pressure, baseline comorbidities, and medication use.

# Results

Among 824,650 patients with hypertension, 16,898 (2.0%) were tested for Covid-19.

Table 1. Patient demographic and clinical characteristics by antihypertensive drug exposure

	<b>ACEI 4,878 (29%)</b>	<b>ARB 3,473 (21%)</b>	<b>CCB or BB or TD 4,177 (25%)</b>	<b>Other Antihypertensives 377 (2%)</b>	<b>No Antihypertensives 3,993 (24%)</b>
Age in years, mean	64	66	65	71	61
Male, %	53	40	39	58	45
Race/Ethnicity, %					
Asian	11	20	14	7	12
Black	12	14	18	15	14
Hispanic	36	31	27	28	39
Other/Unknown	2	2	2	2	2
White	39	33	39	48	33
Blood Pressure, %					
<140/90 mm Hg	82	80	82	87	72
<130/80 mm Hg	44	40	43	53	36
Diabetes, %	46	49	29	39	28
Heart failure, %	7	8	10	19	3
Chronic kidney disease, %	10	14	14	18	6

# Results

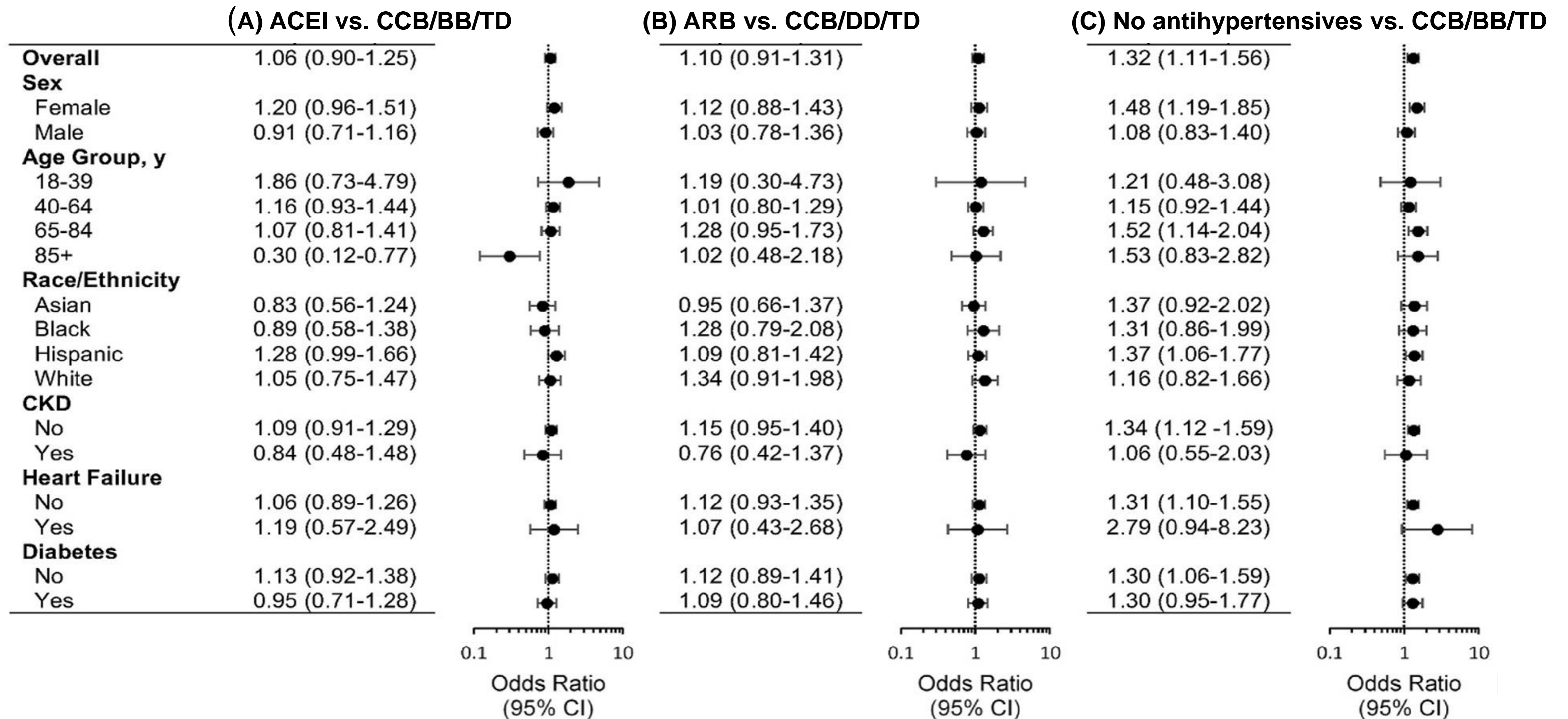
Table 2. Incidence of Covid-19 Infection per 1000 Patients by Antihypertensive Drug Exposure

	ACEI	ARB	CCB or BB or TD	Other Anti- hypertensives	No Anti- hypertensives
Covid-19 Infection per 1000 tested patients	107.6	102.8	81.9	58.4	137.2
(95% CI)	(98.8-117.2)	(92.7-114.0)	(73.6-91.0)	(38.4-88.6)	(126.2-149.2)

ACEI = angiotensin-converting enzyme inhibitors; ARB = angiotensin receptor blockers; BB = beta-blockers; CCB = calcium channel blockers; TD = thiazide diuretics

# Results

Figure 1. Odds Ratio (95% CI) of Covid-19 Infection Associated with Antihypertensive Drug Exposure Stratified by Sex, Age, and Race/ethnicity After Propensity Score Matching





## Summary of Findings/Discussion

- In our racially and ethnically diverse cohort, neither ACEI nor ARB use was associated with increased likelihood of Covid-19 infection.
- The decreased odds of Covid-19 infection among adults  $\geq 85$  years using ACEIs warrants further investigation.
- This study showed an increased likelihood of Covid-19 infection for those without antihypertensive medications compared to those with CCB/BB/TD.
- These results reinforce that patients with hypertension should continue their ACEIs or ARBs as recommended by scientific communities.
- Study has limitations from unmeasured confounding and changes in testing criteria for Covid-19.

# References

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