

SUPPLEMENTAL MATERIAL

Table S1. Preferred Reporting Items for Systematic Review and Meta-Analysis **Protocols 2020 Checklist**

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	NA
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	NA
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	4, suppl 2
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	4
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	NA
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	4
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	4-5
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	4-5
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	4-5
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	NA
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	NA
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	NA
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	4-5

Section and Topic	Item #	Checklist item	Location where item is reported
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	4-5
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	NA
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	NA
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	4
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	NA
Study characteristics	17	Cite each included study and present its characteristics.	Suppl 3
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	NA
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	NA
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	NA
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	NA
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	NA
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	5-6

Section and Topic	Item #	Checklist item	Location where item is reported
	23b	Discuss any limitations of the evidence included in the review.	4, 6
	23c	Discuss any limitations of the review processes used.	NA
	23d	Discuss implications of the results for practice, policy, and future research.	6-7
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	NA
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	NA
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	7
Competing interests	26	Declare any competing interests of review authors.	NA
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	NA

NA: Not Applicable

Table S2. Selection criteria of studies.

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none">• Cited in the International Society of Hypertension (2020), Latin American Society of Hypertension (2017), European Society of Cardiology/European Society of Hypertension (2018), Pan-African Society of Cardiology (2020), American College of Cardiology/American Heart Association (2017) or Hypertension Canada (2020) guidelines• Original studies with any of the following study designs: observational studies, randomized controlled trials and systematic reviews• The study was related to antihypertensive medications	<ul style="list-style-type: none">• Commentaries, guidelines• Single sex studies

Table S3. Reference list of included studies which reported the sex of participants.

1. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension. Final results of the Systolic Hypertension in the Elderly Program (SHEP). SHEP Cooperative Research Group. *JAMA*. 1991;265:3255-3264.
2. Agodoa LY, Appel L, Bakris GL, Beck G, Bourgoignie J, Briggs JP, Charleston J, Cheek D, Cleveland W, Douglas JG, et al. Effect of ramipril vs amlodipine on renal outcomes in hypertensive nephrosclerosis: a randomized controlled trial. *JAMA*. 2001;285:2719-2728. doi: 10.1001/jama.285.21.2719
3. Ahmed N, Wahlgren N, Brainin M, Castillo J, Ford GA, Kaste M, Lees KR, Toni D, Investigators S. Relationship of blood pressure, antihypertensive therapy, and outcome in ischemic stroke treated with intravenous thrombolysis: retrospective analysis from Safe Implementation of Thrombolysis in Stroke-International Stroke Thrombolysis Register (SITS-ISTR). *Stroke*. 2009;40:2442-2449. doi: 10.1161/STROKEAHA.109.548602
4. Anderson C, Teo K, Gao P, Arima H, Dans A, Unger T, Commerford P, Dyal L, Schumacher H, Pogue J, et al. Renin-angiotensin system blockade and cognitive function in patients at high risk of cardiovascular disease: analysis of data from the ONTARGET and TRANSCEND studies. *Lancet Neurol*. 2011;10:43-53. doi: 10.1016/S1474-4422(10)70250-7
5. Anderson CS, Heeley E, Huang Y, Wang J, Stapf C, Delcourt C, Lindley R, Robinson T, Lavados P, Neal B, et al. Rapid blood-pressure lowering in patients with acute intracerebral hemorrhage. *N Engl J Med*. 2013;368:2355-2365. doi: 10.1056/NEJMoa1214609
6. Anderson CS, Huang Y, Wang JG, Arima H, Neal B, Peng B, Heeley E, Skulina C, Parsons MW, Kim JS, et al. Intensive blood pressure reduction in acute cerebral haemorrhage trial (INTERACT): a randomised pilot trial. *Lancet Neurol*. 2008;7:391-399. doi: 10.1016/S1474-4422(08)70069-3
7. Andersson C, Merie C, Jorgensen M, Gislason GH, Torp-Pedersen C, Overgaard C, Kober L, Jensen PF, Hlatky MA. Association of beta-blocker therapy with risks of adverse cardiovascular events and deaths in patients with ischemic heart disease undergoing noncardiac surgery: a Danish nationwide cohort study. *JAMA Intern Med*. 2014;174:336-344. doi: 10.1001/jamainternmed.2013.11349
8. Antihypertensive, Lipid-Lowering Treatment to Prevent Heart Attack Trial Collaborative Research G. Diuretic versus alpha-blocker as first-step antihypertensive therapy: final results from the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT). *Hypertension*. 2003;42:239-246. doi: 10.1161/01.HYP.0000086521.95630.5A
9. Antihypertensive Treatment of Acute Cerebral Hemorrhage i. Antihypertensive treatment of acute cerebral hemorrhage. *Crit Care Med*. 2010;38:637-648. doi: 10.1097/CCM.0b013e3181b9e1a5
10. Appel LJ, Wright JT, Jr., Greene T, Agodoa LY, Astor BC, Bakris GL, Cleveland WH, Charleston J, Contreras G, Faulkner ML, et al. Intensive blood-pressure control in hypertensive chronic kidney disease. *N Engl J Med*. 2010;363:918-929. doi: 10.1056/NEJMoa0910975
11. Arima H, Chalmers J, Woodward M, Anderson C, Rodgers A, Davis S, Macmahon S, Neal B, Group PC. Lower target blood pressures are safe and effective for the prevention of recurrent stroke: the PROGRESS trial. *J Hypertens*. 2006;24:1201-1208. doi: 10.1097/01.hjh.0000226212.34055.86
12. Aronow WS, Ahn C, Kronzon I. Effect of propranolol versus no propranolol on total mortality plus nonfatal myocardial infarction in older patients with prior myocardial infarction,

congestive heart failure, and left ventricular ejection fraction \geq 40% treated with diuretics plus angiotensin-converting enzyme inhibitors. *Am J Cardiol.* 1997;80:207-209. doi: 10.1016/s0002-9149(97)00320-2

13. Aronow WS, Turbow M, Van Camp S, Lurie M, Whittaker K. The effect of timolol vs placebo on angina pectoris. *Circulation.* 1980;61:66-69. doi: 10.1161/01.cir.61.1.66
14. Aronson S, Dyke CM, Stierer KA, Levy JH, Cheung AT, Lumb PD, Kereiakes DJ, Newman MF. The ECLIPSE trials: comparative studies of clevidipine to nitroglycerin, sodium nitroprusside, and nicardipine for acute hypertension treatment in cardiac surgery patients. *Anesth Analg.* 2008;107:1110-1121. doi: 10.1213/ane.0b013e31818240db
15. Ayala DE, Hermida RC, Mojon A, Fernandez JR. Cardiovascular risk of resistant hypertension: dependence on treatment-time regimen of blood pressure-lowering medications. *Chronobiol Int.* 2013;30:340-352. doi: 10.3109/07420528.2012.701455
16. Ayers K, Byrne LM, DeMatteo A, Brown NJ. Differential effects of nebivolol and metoprolol on insulin sensitivity and plasminogen activator inhibitor in the metabolic syndrome. *Hypertension.* 2012;59:893-898. doi: 10.1161/HYPERTENSIONAHA.111.189589
17. Azizi M, Sapoval M, Gosse P, Monge M, Bobrie G, Delsart P, Midulla M, Mounier-Vehier C, Courand PY, Lantelme P, et al. Optimum and stepped care standardised antihypertensive treatment with or without renal denervation for resistant hypertension (DENERHTN): a multicentre, open-label, randomised controlled trial. *Lancet.* 2015;385:1957-1965. doi: 10.1016/S0140-6736(14)61942-5
18. Bakris GL, Fonseca V, Katholi RE, McGill JB, Messerli FH, Phillips RA, Raskin P, Wright JT, Jr., Oakes R, Lukas MA, et al. Metabolic effects of carvedilol vs metoprolol in patients with type 2 diabetes mellitus and hypertension: a randomized controlled trial. *JAMA.* 2004;292:2227-2236. doi: 10.1001/jama.292.18.2227
19. Bakris GL, Lindholm LH, Black HR, Krum H, Linas S, Linseman JV, Arterburn S, Sager P, Weber M. Divergent results using clinic and ambulatory blood pressures: report of a darusentan-resistant hypertension trial. *Hypertension.* 2010;56:824-830. doi: 10.1161/HYPERTENSIONAHA.110.156976
20. Bangalore S, Kumar S, Lobach I, Messerli FH. Blood pressure targets in subjects with type 2 diabetes mellitus/impaired fasting glucose: observations from traditional and bayesian random-effects meta-analyses of randomized trials. *Circulation.* 2011;123:2799-2810, 2799 p following 2810. doi: 10.1161/CIRCULATIONAHA.110.016337
21. Barrett TW, Mori M, De Boer D. Association of ambulatory use of statins and beta-blockers with long-term mortality after vascular surgery. *J Hosp Med.* 2007;2:241-252. doi: 10.1002/jhm.160
22. Bavishi C, Bangalore S, Messerli FH. Outcomes of Intensive Blood Pressure Lowering in Older Hypertensive Patients. *J Am Coll Cardiol.* 2017;69:486-493. doi: 10.1016/j.jacc.2016.10.077
23. Bavry AA, Anderson RD, Gong Y, Denardo SJ, Cooper-Dehoff RM, Handberg EM, Pepine CJ. Outcomes Among hypertensive patients with concomitant peripheral and coronary artery disease: findings from the INternational VErapamil-SR/Trandolapril STudy. *Hypertension.* 2010;55:48-53. doi: 10.1161/HYPERTENSIONAHA.109.142240
24. Beckett N, Peters R, Leonetti G, Duggan J, Fagard R, Thijs L, Narkiewicz K, McCormack T, Banya W, Fletcher A, et al. Subgroup and per-protocol analyses from the Hypertension in the Very Elderly Trial. *J Hypertens.* 2014;32:1478-1487; discussion 1487. doi: 10.1097/HJH.0000000000000195

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26. Bhatt DL, Kandzari DE, O'Neill WW, D'Agostino R, Flack JM, Katzen BT, Leon MB, Liu M, Mauri L, Negoita M, et al. A controlled trial of renal denervation for resistant hypertension. *N Engl J Med*. 2014;370:1393-1401. doi: 10.1056/NEJMoa1402670
27. Bisognano JD, Bakris G, Nadim MK, Sanchez L, Kroon AA, Schafer J, de Leeuw PW, Sica DA. Baroreflex activation therapy lowers blood pressure in patients with resistant hypertension: results from the double-blind, randomized, placebo-controlled reos pivotal trial. *J Am Coll Cardiol*. 2011;58:765-773. doi: 10.1016/j.jacc.2011.06.008
28. Black HR, Davis B, Barzilay J, Nwachuku C, Baimbridge C, Marginean H, Wright JT, Jr., Basile J, Wong ND, Whelton P, et al. Metabolic and clinical outcomes in nondiabetic individuals with the metabolic syndrome assigned to chlorthalidone, amlodipine, or lisinopril as initial treatment for hypertension: a report from the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT). *Diabetes Care*. 2008;31:353-360. doi: 10.2337/dc07-1452
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30. Blood Pressure Lowering Treatment Trialists C. Blood pressure-lowering treatment based on cardiovascular risk: a meta-analysis of individual patient data. *Lancet*. 2014;384:591-598. doi: 10.1016/S0140-6736(14)61212-5
31. Blood Pressure Lowering Treatment Trialists C, Ninomiya T, Perkovic V, Turnbull F, Neal B, Barzi F, Cass A, Baigent C, Chalmers J, Li N, et al. Blood pressure lowering and major cardiovascular events in people with and without chronic kidney disease: meta-analysis of randomised controlled trials. *BMJ*. 2013;347:f5680. doi: 10.1136/bmj.f5680
32. Blood Pressure Lowering Treatment Trialists C, Turnbull F, Neal B, Ninomiya T, Algert C, Arima H, Barzi F, Bulpitt C, Chalmers J, Fagard R, et al. Effects of different regimens to lower blood pressure on major cardiovascular events in older and younger adults: meta-analysis of randomised trials. *BMJ*. 2008;336:1121-1123. doi: 10.1136/bmj.39548.738368.BE
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35. Bohm M, Young R, Jhund PS, Solomon SD, Gong J, Lefkowitz MP, Rizkala AR, Rouleau JL, Shi VC, Swedberg K, et al. Systolic blood pressure, cardiovascular outcomes and efficacy and safety of sacubitril/valsartan (LCZ696) in patients with chronic heart failure and reduced ejection fraction: results from PARADIGM-HF. *Eur Heart J*. 2017;38:1132-1143. doi: 10.1093/eurheartj/ehw570
36. Bress AP, King JB, Kreider KE, Beddhu S, Simmons DL, Cheung AK, Zhang Y, Dumas M, Nord J, Sweeney ME, et al. Effect of Intensive Versus Standard Blood Pressure Treatment

According to Baseline Prediabetes Status: A Post Hoc Analysis of a Randomized Trial. *Diabetes Care*. 2017;40:1401-1408. doi: 10.2337/dc17-0885

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Myocardial Infarction Database Initiative. *Eur J Heart Fail.* 2017;19:271-279. doi: 10.1002/ejhf.647

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Figure S1. Flowchart of sex - based analysis and reporting in antihypertensive medication studies informing clinical hypertension guidelines after 2015.

