

# 2023 ESH Guidelines for the management of arterial hypertension

## *The Task Force for the management of arterial hypertension of the European Society of Hypertension*

Endorsed by the International Society of Hypertension (ISH) and the European Renal Association (ERA)

**Authors/Task Force Members:** Giuseppe Mancia (Chairperson)<sup>a,\*</sup>, Reinhold Kreutz (Co-Chair)<sup>b,\*</sup>, Mattias Brunström<sup>c</sup>, Michel Burnier<sup>d</sup>, Guido Grassi<sup>e</sup>, Andrzej Januszewicz<sup>f</sup>, Maria Lorenza Muiesan<sup>g</sup>, Konstantinos Tsioufis<sup>h</sup>, Enrico Agabiti-Rosei<sup>i</sup>, Engi Abd Elhady Algharably<sup>b</sup>, Michel Azizi<sup>j,k</sup>, Athanase Benetos<sup>l</sup>, Claudio Borghi<sup>m</sup>, Jana Brguljan Hitij<sup>n</sup>, Renata Cifkova<sup>o,p</sup>, Antonio Coca<sup>q</sup>, Veronique Cornelissen<sup>r</sup>, J. Kennedy Cruickshank<sup>s</sup>, Pedro G. Cunha<sup>t,u</sup>, A.H. Jan Danser<sup>v</sup>, Rosa Maria de Pinho<sup>w</sup>, Christian Delles<sup>x</sup>, Anna F. Dominiczak<sup>y</sup>, Maria Dorobantu<sup>z</sup>, Michalis Doumas<sup>aa</sup>, María S. Fernández-Alfonso<sup>bb,cc</sup>, Jean-Michel Halimi<sup>dd,ee,ff</sup>, Zoltán Járjai<sup>gg</sup>, Bojan Jelakovic<sup>hh</sup>, Jens Jordan<sup>ii,jj</sup>, Tatiana Kuznetsova<sup>kk</sup>, Stephane Laurent<sup>ll</sup>, Dragan Lovic<sup>mm</sup>, Empar Lurbe<sup>nn,oo,pp</sup>, Felix Mahfoud<sup>qq,rr</sup>, Athanasios Manolis<sup>ss</sup>, Marius Miglinas<sup>tt,uu</sup>, Krzysztof Narkiewicz<sup>vv</sup>, Teemu Niiranen<sup>www,xx</sup>, Paolo Palatini<sup>yy</sup>, Gianfranco Parati<sup>zz,aaa</sup>, Atul Pathak<sup>bbb</sup>, Alexandre Persu<sup>ccc</sup>, Jorge Polonia<sup>ddd</sup>, Josep Redon<sup>eee,fff</sup>, Pantelis Sarafidis<sup>ggg</sup>, Roland Schmieder<sup>hhh</sup>, Bart Spronck<sup>iii</sup>, Stella Stabouli<sup>jjj</sup>, George Stergiou<sup>kkk</sup>, Stefano Taddei<sup>lll</sup>, Costas Thomopoulos<sup>mmm</sup>, Maciej Tomaszewski<sup>nnn,ooo</sup>, Philippe Van de Borne<sup>ppp</sup>, Christoph Wanner<sup>qqq</sup>, Thomas Weber<sup>rrr</sup>, Bryan Williams<sup>sss</sup>, Zhen-Yu Zhang<sup>ttt</sup>, and Sverre E. Kjeldsen<sup>uuu</sup>

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<sup>a</sup>University of Milano-Bicocca, Milan, Italy, <sup>b</sup>Charité – Universitätsmedizin Berlin, Corporate Member of Freie Universität Berlin and Humboldt-Universität zu Berlin, Institute of Clinical Pharmacology and Toxicology, Berlin, Germany, <sup>c</sup>Department of Public Health and Clinical Medicine, Umeå University, Umeå, Sweden, <sup>d</sup>Faculty of Biology and Medicine, University of Lausanne, Lausanne, Switzerland, <sup>e</sup>Clinica Medica, University Milano-Bicocca, Milan, Italy, <sup>f</sup>Department of Hypertension, National Institute of Cardiology, Warsaw, Poland, <sup>g</sup>UOC 2 Medicina, ASST Spedali Civili di Brescia, Department of Clinical and Experimental Sciences, University of Brescia, Brescia, Italy, <sup>h</sup>First Department of Cardiology, Medical School, University of Athens, Hippokraton Hospital, Athens, Greece, <sup>i</sup>Department of Clinical and Experimental Sciences, University of Brescia, Italy, <sup>j</sup>Université Paris Cité, Paris, France; AP-HP Hôpital Européen Georges-Pompidou, Hypertension Department and DMU CARTE, <sup>k</sup>INSERM, Paris, <sup>l</sup>Université de Lorraine, CHRU-Nancy, Department of Geriatric Medicine and INSERM DCAC, Nancy, France, <sup>m</sup>Department of Medical and Surgical Sciences-IRCCS AOU S. Orsola di Bologna, Bologna, Italy, <sup>n</sup>University Medical Centre Ljubljana, Department of Hypertension, Medical University Ljubljana, Ljubljana, Slovenia, <sup>o</sup>Center for Cardiovascular Prevention, Thomayer University Hospital, <sup>p</sup>Department of Medicine II, Charles University in Prague, First Faculty of Medicine, Prague, Czech Republic, <sup>q</sup>Hypertension and Vascular Risk Unit, Department of Internal Medicine, Hospital Clinic, University of Barcelona, Spain, <sup>r</sup>Department of Rehabilitation Sciences, KU Leuven, Leuven, Belgium, <sup>s</sup>King's College, London, UK, <sup>t</sup>Center for the Research and Treatment of Arterial Hypertension and Cardiovascular Risk, Internal Medicine Department, Hospital Senhora da Oliveira, Guimaraes/Minho University, <sup>u</sup>Life and Health Science Research Institute (ICVS), School of Medicine, University of Minho; ICVS/3B's – PT Government Associate Laboratory, Braga/Guimaraes, Portugal, <sup>v</sup>Department of Internal Medicine, Erasmus MC, Rotterdam, The Netherlands, <sup>w</sup>Family and general practitioner, Sao Joao da Madeira, Portugal, <sup>x</sup>School of Cardiovascular and Metabolic Health, University of Glasgow, Glasgow, UK, <sup>y</sup>Regius Professor of Medicine, University of Glasgow, Glasgow, UK, <sup>z</sup>University of Medicine and Pharmacy 'Carol Davila', The Romanian Academy, <sup>aa</sup>2nd Prop Department of Internal Medicine, Aristotle University, Thessaloniki, Greece, <sup>bb</sup>Instituto Pluridisciplinar and Facultad de Farmacia, Universidad Complutense de Madrid, <sup>cc</sup>Instituto de Investigación Sanitaria del Hospital Clínico San Carlos (IdISSC), Madrid, Spain, <sup>dd</sup>Service de Néphrologie-Hypertension, Dialyses, Transplantation Rénale, CHRU Tours, <sup>ee</sup>Equipe d'Accueil EA4245, Université de Tours, <sup>ff</sup>INI-CRCT, Tours, France, <sup>gg</sup>South-Buda Center Hospital St. Imre University Hospital, Budapest & Semmelweis University, Budapest, Hungary, <sup>hh</sup>UHC Zagreb, Dept for Nephrology, Hypertension, Dialysis and Transplantation, School of Medicine, University of Zagreb, Zagreb, Croatia, <sup>ii</sup>Institute of Aerospace Medicine, German Aerospace Center, <sup>jj</sup>Medical Faculty, University of Cologne, Cologne, Germany, <sup>kk</sup>Research Unit Hypertension and Cardiovascular Epidemiology, KU Leuven, Department of Cardiovascular Sciences, University of Leuven, Leuven, Belgium, <sup>ll</sup>Paris-Cité University, Paris, France, <sup>mm</sup>Singidunum University, Clinic for internal Disease Intermedica Cardiology Department, Hypertension Centre, Nis, Serbia, <sup>nn</sup>Consorcio Hospital General Universitario de Valencia, Valencia, <sup>oo</sup>Biomedical Research Networking Center for Physiopathology of Obesity and Nutrition (CIBEROBN), Institute of Health Carlos III (ISCIII), Madrid, <sup>pp</sup>University of Valencia, Valencia, Spain, <sup>qq</sup>Cardiology, Angiology and Intensive Care Medicine, Saarland University Hospital and Saarland University, Homburg, Germany, <sup>rr</sup>Institute for Medical Engineering and Science, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA, <sup>ss</sup>Metropolitan Hospital, Piraeus, Greece, <sup>tt</sup>Institute of Clinical Medicine, Faculty of Medicine, Vilnius University, <sup>uu</sup>Vilnius University Hospital Santaros Klinikos, Vilnius, Lithuania, <sup>vv</sup>Department of Hypertension and Diabetology, Medical University of Gdansk, Gdansk, Poland and <sup>www</sup>Department of Internal Medicine, Turku University Hospital and University of Turku, Turku (continued on next page)

Correspondence to Giuseppe Mancia, Piazza dei Daini 4, Milan 20126, Italy, E-mail: giuseppe.mancia@unimib.it or Reinhold Kreutz, Charité – Universitätsmedizin Berlin, Institute of Clinical Pharmacology and Toxicology, Berlin, Germany. E-mail: reinhold.kreutz@charite.de

\*Giuseppe Mancia and Reinhold Kreutz contributed equally to the document.

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**Document Reviewers:** Luis Alcocer (Mexico), Christina Antza (Greece), Mustafa Arici (Turkey), Eduardo Barbosa (Brazil), Adel Berbari (Lebanon), Luís Bronze (Portugal), John Chalmers (Australia), Tine De Backer (Belgium), Alejandro de la Sierra (Spain), Kyriakos Dimitriadis (Greece), Dorota Drozd (Poland), Béatrice Duly-Bouhanick (France), Brent M. Egan (USA), Serap Erdine (Turkey), Claudio Ferri (Italy), Slavomira Filipova (Slovak Republic), Anthony Heagerty (UK), Michael Hecht Olsen (Denmark), Dagmara Hering (Poland), Sang Hyun Ihm (South Korea), Uday Jadhav (India), Manolis Kallistratos (Greece), Kazuomi Kario (Japan), Vasilios Kotsis (Greece), Adi Leiba (Israel), Patricia López-Jaramillo (Colombia), Hans-Peter Marti (Norway), Terry McCormack (UK), Paolo Mulatero (Italy), Dike B. Ojji (Nigeria), Sungha Park (South Korea), Priit Pauklin (Estonia), Sabine Perl (Austria), Arman Postadzian (Bulgaria), Aleksander Prejbsiz (Poland), Venkata Ram (India), Ramiro Sanchez (Argentina), Markus Schlaich (Australia), Alta Schutte (Australia), Cristina Sierra (Spain), Sekib Sokolovic (Bosnia and Herzegovina), Jonas Spaak (Sweden), Dimitrios Terentes-Printzios (Greece), Bruno Trimarco (Italy), Thomas Unger (The Netherlands), Bert-Jan van den Born (The Netherlands), Anna Vachulova (Slovak Republic), Agostino Virdis (Italy), Jiguang Wang (China), Ulrich Wenzel (Germany), Paul Whelton (USA), Jiri Widimsky (Czech Republic), Jacek Wolf (Poland), Grégoire Wuerzner (Switzerland), Eugene Yang (USA), Yuqing Zhang (China).

**Keywords:** antihypertensive device interventions, antihypertensive drug therapy, blood pressure, cardiac disease, cardiovascular disease, drug combinations, guidelines, heart failure, hypertension, kidney disease, lifestyle interventions, patient's follow-up, organ damage, secondary hypertension, stroke

**Abbreviations:** AAA, abdominal aortic aneurysm; ABI, ankle-brachial index; ABPM, ambulatory blood pressure monitoring; ACEi, angiotensin-converting-enzyme inhibitor; ACR, albumin-creatinine ratio; ADL, activity daily living; ADR, adverse drug reactions; AGB, adjustable gastric banding; ARB, angiotensin receptor blocker; ARNI, angiotensin receptor neprilysin inhibitor; ARR, aldosterone-renin ratio; ARVD, atherosclerotic renal vascular disease; AS, aortic stenosis; ASCVD, atherosclerotic cardiovascular disease; AV, atrio-ventricular; baPWV, brachial-ankle pulse wave velocity; BB, beta blocker; BNP, brain natriuretic peptide; BP, blood pressure; BSA, body surface area; CAC, coronary arterial calcium; CAD, coronary or ischemic heart disease; CCB, calcium channel blocker; cfPWV, carotid-femoral pulse wave velocity; CKD, chronic kidney disease; CKD-EPI, Chronic Kidney Disease Epidemiology Collaboration Equation; CMR, cardiac magnetic resonance; COPD, chronic obstructive pulmonary disease; CPAP, continuous positive airway pressure; CV, cardiovascular; CVD, cardiovascular disease; DDim, diastolic dimension; DOAC, direct oral anticoagulant; DPP-4, dipeptidyl peptidase 4; eGFR, estimated glomerular filtration rate; EPO, erythropoietin; ESKD, end-stage kidney disease; ET1, endothelin 1; FEV1, forced expiratory volume in 1s; FLAIR-MRI, fluid-attenuated inversion recovery magnetic resonance imaging; FMD, fibromuscular dysplasia; FU, follow-up; GDMT, guideline-directed medical therapy; GFR, glomerular filtration rate; GIP, gastric inhibitory polypeptide; GLP-1, glucagon-like peptide-1; GLP-1 RA, GLP-1 receptor antagonist; GLS, global longitudinal strain; HbA1c, hemoglobinA<sub>1c</sub>; HBPM, home blood pressure monitoring; HDL, high-density lipoprotein; HDP, hypertensive disorders in pregnancy; HELLP, Hemolysis, Elevated liver enzymes, Low platelet count syndrome; HF, heart failure; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; HIV, Human Immuno-deficiency Virus; HMOD, hypertension-mediated organ damage; IDH, isolated diastolic hypertension; IMID, immune-mediated inflammatory diseases; IMT, intima-media thickness; INOCA, Ischemia with non obstructive coronary arteries; ISH, isolated systolic hypertension; ISHY, isolated systolic hypertension of the young; IVT, intravenous thrombolysis; KTR, kidney transplant recipients; KWB, Keith Wagener Barger; LA, left atrium; LAV, left atrial volume; LEAD, lower extremity artery disease; LGE, late gadolinium enhancement; LMIC, low-income and middle-income countries; LV, left ventricle; LVDD, left ventricular diastolic dysfunction; LVDP, left ventricular diastolic pressure; LVEF, left ventricular ejection fraction; LVH, left ventricular hypertrophy; LVM, left ventricular mass; LVSD, left ventricular systolic dysfunction; LVSP, left ventricular systolic pressure; MACE, major adverse cardiovascular events; MAS, middle aortic syndrome; MH, masked hypertension; MI, mitral insufficiency; MINOCA, myocardial infarction with nonobstructive coronary arteries; MMSE, Mini Mental State Examination; MoCA, Montreal Cognitive Assessment; MRA, mineralocorticoid receptor antagonist; MT, mechanical thrombectomy; MUCH, masked uncontrolled hypertension; NASH, nonalcoholic steatohepatitis; NHANES, National Health and Nutrition Examination Study; NOAC, non-Warfarin oral anticoagulants; NRI, Net Reclassification Index; NSAIDS, nonsteroidal antiinflammatory drugs; NT-proBNP, N-Terminal Pro-B-Type Natriuretic Peptide; OBPM, office blood pressure monitoring; OSA, obstructive sleep apnea; PA, primary aldosteronism; PAC, plasma aldosterone concentration; POAG, primary open angle glaucoma; PRA, plasma renin

<sup>xx</sup>Finnish Institute for Health and Welfare, Helsinki, Finland, <sup>yy</sup>Studium Patavinum, Department of Medicine, University of Padova, Padova, Italy, <sup>zz</sup>IRCCS, Istituto Auxologico Italiano, Ospedale San Luca, <sup>aaa</sup>Department of Medicine and Surgery, University of Milano-Bicocca, Milan, Italy, <sup>bbb</sup>Princess Grace Hospital Monaco (Centre Hospitalier Princesse Grace, CHPG), <sup>ccc</sup>Division of Cardiology, Department of Cardiovascular Diseases, Cliniques Universitaires Saint-Luc and Pole of Cardiovascular Research, Institut de Recherche Expérimentale et Clinique, Université Catholique de Louvain, Brussels, Belgium, <sup>ddd</sup>CINTESIS; Faculty of Medicine of Porto, Portugal, <sup>eee</sup>Incliva Research Institute, University of Valencia, <sup>fff</sup>CIBEROBN, Institute of Health Carlos III (ISCIII), Madrid, Spain, <sup>ggg</sup>1st Department of Nephrology, Hippokraton Hospital, Aristotle University of Thessaloniki, Greece, <sup>hhh</sup>University Hospital Erlangen, Friedrich Alexander University Erlangen/Nürnberg, Germany, <sup>iii</sup>Department of Biomedical Engineering, CARIM School for Cardiovascular Diseases, Maastricht University, Maastricht, The Netherlands, <sup>jjj</sup>First Department of Pediatrics, Aristotle University Thessaloniki, Hippokraton Hospital, Thessaloniki, <sup>kkk</sup>Hypertension Center STRIDE-7, School of Medicine, Third Department of Medicine, Sotiria Hospital, National and Kapodistrian University of Athens, Athens, Greece, <sup>lll</sup>Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy, <sup>mmm</sup>Department of Cardiology, Helena Venizelou Hospital, Athens, Greece, <sup>nnn</sup>Division of Cardiovascular Sciences, Faculty of Medicine, Biology and Health, University of Manchester, <sup>ooo</sup>Manchester Royal Infirmary, Manchester Academic Health Science Centre, Manchester University NHS Foundation Trust, Manchester, UK, <sup>ppp</sup>Department of Cardiology, Erasme Hospital-ULB, Brussels, Belgium, <sup>qqq</sup>Division of Nephrology, Wuerzburg University Clinic, Wuerzburg, Germany, <sup>rrr</sup>Cardiology Department, Klinikum Wels-Grieskirchen, Wels, Austria, <sup>sss</sup>Institute of Cardiovascular Sciences, University College London (UCL); National Institute for Health Research UCL Hospitals Biomedical Research Centre, London, UK, <sup>ttt</sup>Hypertension and Cardiovascular Epidemiology, Department of Cardiovascular Sciences, KU Leuven, Leuven, Belgium and <sup>uuu</sup>Departments of Cardiology and Nephrology, Institute for Clinical Medicine, and Ullevål Hospital, University of Oslo, Oslo, Norway

activity; PRC, plasma renin concentration; PTR, percutaneous transluminal renal angioplasty; PTSD, posttraumatic stress disease; PWV, pulse wave velocity; RAS, renin-angiotensin system; RAAS, renin-angiotensin-aldosterone system; RCT, randomized controlled trial; RDN, renal denervation; RTKIs, receptor tyrosine kinase inhibitors; RVH, renovascular hypertension; RWT, relative wall thickness; RYGB, Roux-en-Y gastric bypass; SCr, serum creatinine; SIADH, syndrome of inappropriate antidiuretic hormone; SLE, systemic lupus erythematosus; SNS, sympathetic nervous system; SNV, single nucleotide variant; SGLT2i, sodium-glucose co-transporter-2 inhibitor; T1DM, type 1 diabetes mellitus; T2DM, type 2 diabetes mellitus; TIA, transient ischemic attack; UACR, urinary albumin creatinine ratio; UPCR, urinary protein creatinine ratio; VEGF, vascular endothelium growth factor; VEGFI, vascular endothelium growth factor inhibitor; WCE, white-coat effect; WCH, white-coat hypertension; WML, white matter lesion; WUCH, white-coat uncontrolled hypertension

**Acronyms of trials, observational studies, medical associations etc.:** AASK, African American study on kidney disease; ACC, American College of Cardiology; ACCOMPLISH, Avoiding Cardiovascular Events through Combination Therapy in Patients Living with Systolic Hypertension; ACCORD, Action to control cardiovascular risk in diabetes; ADVANCE, Action in Diabetes and Vascular Disease – PreterAx and DiamicroN Controlled Evaluation; AHA, American Heart Association; ALLHAT, Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial; ALTITUDE, Aliskiren Trial in Type 2 Diabetes Using Cardiorenal Endpoints; AMBER, Spironolactone With Patiromer in the Treatment of Resistant Hypertension in Chronic Kidney Disease; AMI, US Association for Advance in Medical Instrumentation; ANBP-2, Second Australian National Blood Pressure Study; ASCOT, Anglo-Scandinavian Cardiac Outcomes Trial; ATTACH-2, Antihypertensive Treatment of Acute Cerebral Hemorrhage II; BUMP-1, Blood Pressure Monitoring in High Risk Pregnancy to Improve the Detection and Monitoring of Hypertension-1; BUMP-2, Blood Pressure Monitoring in High Risk Pregnancy to Improve the Detection and Monitoring of Hypertension-2; CALM-FIM, Controlling and Lowering Blood Pressure With the MobiusHD – First in Man; CAPP, The Captopril Prevention Project Study; CARDIA, Coronary Artery Risk Development in Young Adults; CHAP, Chronic Hypertension and Pregnancy; CHIPS, Control of Hypertension in Pregnancy Study; CLICK, Chlorthalidone in Chronic Kidney disease trial; COLM, Combination of OLMesartan and a calcium channel blocker or diuretic in Japanese elderly patients trial; CONVINCE, Controlled ONset Verapamil INvestigation of Cardiovascular Endpoints; COPE, Combination Therapy of Hypertension to Prevent Cardiovascular Events; CREDESCENCE, Canagliflozin and Renal Events in Diabetes with Established Nephropathy Clinical Evaluation; CREOLE, Comparison of Three Combination Therapies in Lowering Blood Pressure in Black Africans; DAPA-CKD, Dapagliflozin and Prevention of Adverse Outcomes in Chronic Kidney Disease; DASH, Dietary Approaches to Stop Hypertension; DCP, Diuretic Comparison Project; EASD, European Association for the Study of Diabetes; ELSA, European Lacidipine Study on Atherosclerosis; EMPA KIDNEY TRIAL, The Study of Heart and Kidney Protection With Empagliflozin trial; ESC, European Society of Cardiology; ESH, European Society of Hypertension; EUCLID, EURODIAB Controlled Trial of Lisinopril in Insulin-dependent Diabetes Mellitus; EUROPA, Efficacy of perindopril in reduction of cardiovascular events among patients with stable coronary artery disease; FEVER, Felodipine Event Reduction; FIDELIO DKD, Finerenone in Reducing Kidney Failure and Disease Progression in Diabetic Kidney Disease; FIDELITY, The Finerenone in chronic kidney disease and type 2 diabetes: Combined FIDELIO-DKD and FIGARO-DKD Trial programme analysis; FIGARO DKD, Finerenone in Reducing Cardiovascular Mortality and Morbidity in Diabetic Kidney Disease; GATEWAY, Gastric Bypass to Treat Obese Patients With Steady Hypertension; GRADE, Grade of Recommendation, Assessment, Development and Evaluation; HAS-BLED, Hypertension, Abnormal Renal/Liver Function, Stroke, Bleeding History or Predisposition, Labile INR, Elderly, Drugs/Alcohol Concomitantly; HOPE-3, Heart Outcomes Prevention Evaluation-3; HOT, Hypertension Optimal Treatment; HYVET, Hypertension in the Very Elderly Trial; IDACO, International Database of Ambulatory blood pressure in relation to Cardiovascular Outcome.; IDNT, Irbesartan diabetic nephropathy trial; INTERACT-2, Second Intensive Blood Pressure Reduction in Acute Cerebral Haemorrhage Trial; INVEST, INternational Verapamil SR TRandolapril STudy; ISO, International Organization for Standardization; LEGEND, Large-scale Evidence Generation and Evaluation across a Network of Databases; LIFE, Losartan Intervention For Endpoint reduction in hypertension; MATCH, Is Metomidate PET-CT superior to Adrenal vein sampling in predicting ouTCome from adrenalectomy in patients with primary Hyperaldosteronism; MDRD, Modification of diet in renal disease; MODERATO I, Moderato System in Patients With Hypertension I; MODERATO II, Moderato System in Patients With Hypertension II; NORDIL, Nordic Diltiazem; ONTARGET, Ongoing Telmisartan Alone and in Combination with Ramipril Global Endpoint Trial; OSCAR, The OlmeSartan and Calcium Antagonists Randomized study; PAMELA, Pressioni Arteriose Monitorate e Loro Associazioni; PATHWAY-1, Optimum Treatment for Drug-Resistant Hypertension -1; PATHWAY-2, Optimum Treatment for Drug-Resistant Hypertension -2; PATS, Post-stroke Antihypertensive Treatment Study; PEACE, Prevention of Events with Angiotensin Converting Enzyme Inhibition; PHYLLIS, Plaque Hypertension Lipid Lowering Italian Study; PRAISE, Prospective Randomized Amlodipine Survival Evaluation study; PREDIVA, Prevention of dementia by intensive vascular care; PROGRESS, perindopril protection against recurrent stroke study; PROSIT, Project on Stroke Services in Italy; RADIANCE HTN SOLO, A Study of the ReCor Medical Paradise System in Clinical Hypertension – SOLO; RADIANCE HTN-TRIO, A Study of the ReCor Medical Paradise System in Clinical Hypertension -TRIO; RE-HOT, Resistant Hypertension Optimal Treatment; RENAAL, Reduction of endpoints in NIDDM with angiotensin II antagonist losartan; REQUIRE, Renal Denervation on Quality of 24-hr BP Control by Ultrasound In Resistant Hypertension; ROX CONTROL HTN, ROX Coupler in Patients With Resistant Hypertension study; SCOPE, Study on Cognition and Prognosis in the Elderly; SCORE-2, Systemic coronary risk evaluation; SCORE-2-OP, Systemic coronary risk evaluation – Older Persons; SHEP, Systolic Hypertension in the Elderly Program; SOS, Swedish obese individual study; SPRINT, Systolic Blood Pressure Intervention Trial; SPRINT-MIND, Systolic Blood Pressure Intervention Trial – Memory and Cognition in Decreased Hypertension; SPYRAL HTN Off Med, catheter-based renal denervation

in the absence of antihypertensive medications, multicentre, randomised, sham-controlled trial; SPYRAL HTN – On Med, catheter-based renal denervation in the presence of antihypertensive medications, multicentre, randomised, sham-controlled trial; Ssa, Sub-Saharan Africa; STOP-1, Swedish Trial in Old Patients-1; STOP-2, Swedish Trial in Old Patients-2; STRIDE BP, Science and Technology for Regional Innovation and Development in Europe – Blood Pressure; SYMPPLICITY-3 HTN, Renal Denervation in Patients With Uncontrolled Hypertension trial; SYST-CHINA, Systolic Hypertension in China; SYST-EUR, Systolic Hypertension in Europe; TAIM, Trial on antihypertensive intervention and management; TIME, Treatment in Morning vs Evening study; TOMHS, Treatment of Mild Hypertension Study; TONE, Trial on nonpharmacological intervention in the elderly; TOPCAT, Treatment of Preserved Cardiac Function Heart Failure With an Aldosterone Antagonist; TOPH, Trials of Hypertension Prevention; TRANSCEND, Telmisartan Randomized Assessment Study in ACE intolerant subjects with cardiovascular Disease; UKPDS, United Kingdom prospective diabetes study; VALISH, Valsartan in elderly isolated systolic hypertension study; VALUE, Valsartan Antihypertensive Long-Term Use Evaluation; WHL, World Heart Federation; WHO, World Health Organization

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