



## REVIEW

# Hypertension management in older adults [version 1; peer review: 5 approved]

Ozlem Bilen <sup>1</sup>, Nanette K. Wenger <sup>1-3</sup>

<sup>1</sup>Division of Cardiology, Department of Medicine, Emory University School of Medicine, Atlanta, GA, USA

<sup>2</sup>Emory Heart and Vascular Center, Atlanta, GA, USA

<sup>3</sup>Emory Women's Heart Center, Atlanta, GA, USA

**V1** First published: 19 Aug 2020, 9(Faculty Rev):1003  
<https://doi.org/10.12688/f1000research.20323.1>

Latest published: 19 Aug 2020, 9(Faculty Rev):1003  
<https://doi.org/10.12688/f1000research.20323.1>

## Abstract

Vascular aging leads to arterial hypertension, which is the leading cause of cardiovascular mortality and morbidity in older adults. Blood pressure reduction is effective in reducing the cardiovascular risk and is safe in ambulatory older adults. It is important to note that blood pressure control in this group of patients is challenging because of comorbidities, polypharmacy, and frailty. Choice of pharmacotherapy is not simple and should be individualized.

## Keywords

hypertension, elderly, blood pressure

## Open Peer Review

Reviewer Status 

	Invited Reviewers				
	1	2	3	4	5
<b>version 1</b>					
19 Aug 2020					

**Faculty Reviews** are review articles written by the prestigious Members of **Faculty Opinions**. The articles are commissioned and peer reviewed before publication to ensure that the final, published version is comprehensive and accessible. The reviewers who approved the final version are listed with their names and affiliations.

1. **George Bakris**, The University of Chicago Medicine, Chicago, USA
2. **Suzanne Oparil**, The University of Alabama at Birmingham, Birmingham, USA
3. **Carl Lavie**, University of Queensland School of Medicine, New Orleans, USA
4. **Michael W Rich**, Washington University School of Medicine, St. Louis, USA
5. **Wilbert Aronow**, Westchester Medical Center and New York Medical College, Valhalla, USA

Any comments on the article can be found at the end of the article.

**Corresponding author:** Nanette K. Wenger ([nwenger@emory.edu](mailto:nwenger@emory.edu))

**Author roles:** **Bilen O:** Writing – Original Draft Preparation; **Wenger NK:** Writing – Original Draft Preparation, Writing – Review & Editing

**Competing interests:** No competing interests were disclosed.

**Grant information:** The author(s) declared that no grants were involved in supporting this work.

**Copyright:** © 2020 Bilen O and Wenger NK. This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**How to cite this article:** Bilen O and Wenger NK. **Hypertension management in older adults [version 1; peer review: 5 approved]** F1000Research 2020, 9(Faculty Rev):1003 <https://doi.org/10.12688/f1000research.20323.1>

**First published:** 19 Aug 2020, 9(Faculty Rev):1003 <https://doi.org/10.12688/f1000research.20323.1>

## What are the burden and mechanism of hypertension in older adults?

Vascular aging involves endothelial dysfunction and vascular remodeling. This process leads to an increase in large artery stiffness and isolated systolic hypertension, the predominant form of hypertension in older adults<sup>1,2</sup>, affecting more than 75% of people older than 75 years in the US<sup>2</sup>.

Hypertension is not a benign age-related phenomenon and indeed remains the leading cause of preventable cardiovascular mortality and morbidity<sup>3-6</sup>. The number of older patients continues to increase dramatically to be 8.5% of the world's current population and this percentage is expected to reach about 17% by 2050<sup>7</sup>. Hence, appropriate management of hypertension in this vulnerable population is crucial.

## Do older adults benefit from blood pressure reduction?

Several randomized controlled trials have demonstrated that blood pressure (BP) lowering in systolic hypertension at an older age is effective in reducing the risk of fatal and non-fatal stroke, cardiovascular events, and death<sup>8-16</sup>.

One of the few interventions shown to reduce mortality risk in older individuals is BP reduction. One of the earlier hypertension trials in this group of individuals was the Hypertension in the Very Elderly Trial (HYVET). Individuals older than 80 years with an initial systolic BP (SBP) greater than 160 mm Hg were assigned to receive either treatment or placebo<sup>10</sup>. Reduction of BP significantly decreased the incidence of fatal stroke, all-cause mortality, any cardiovascular event, and heart failure. Another important study that included older individuals was the Systolic Blood Pressure Intervention Trial (SPRINT). Patients older than 50 years with SBP greater than 130 mm Hg and at least one additional cardiovascular risk factor (presence of clinical or subclinical cardiovascular disease other than stroke, chronic kidney disease, a Framingham Risk Score for 10-year cardiovascular disease risk of at least 15, or age greater than 75 years) were enrolled. Patients were randomly assigned to intensive SBP lowering (<120 mm Hg) or routine SBP management (<140 mm Hg). The trial was concluded early because of overwhelming evidence of benefit. There was significant reduction of the primary outcome (myocardial infarction, acute coronary syndrome, stroke, congestive heart failure, or cardiovascular death) (5.2% versus 6.8%, hazard ratio [HR] 0.75, 95% confidence interval [CI] 0.64–0.89;  $P < 0.0001$ ). Among patients at least 75 years of age ( $n = 2,636$ ), primary outcomes for intensive versus routine BP management were 7.7% versus 11.2% ( $P < 0.05$ ). Rates of all-cause mortality were 5.5% versus 8.1%, respectively ( $P < 0.05$ ). There was a significantly increased risk of hypotensive events and metabolic derangements such as hyponatremia with intensive treatment. It is important to note that generalizability of results was limited as patients with diabetes mellitus, history of stroke, and heart failure within 6 months and residents of nursing homes were excluded and less than 40% of patients were female<sup>17</sup>. The SPRINT trial not only showed the clear benefit of hypertension treatment at an older age but also brought a new perspective to the intensive BP control controversy in this vulnerable population.

Another relevant clinical question when it comes to treating hypertension in older individuals is whether it is beneficial for cognitive function. Longitudinal observational data have shown a strong association between elevated BP and cognitive decline later in life<sup>18</sup>; indeed, midlife hypertension is considered to be a major risk factor for dementia<sup>19</sup>.

Whereas several trials demonstrated a lower incidence of dementia with anti-hypertensive treatment in older individuals<sup>9,20-22</sup>, others failed to show benefit and this was due in part to inadequate duration for follow-up<sup>23-25</sup>. A recently published sub-study of the SPRINT trial (SPRINT-MIND) did not show a significantly reduced risk of probable dementia with intensive BP control<sup>26</sup>. The study was terminated early and thus the cases of dementia were fewer than expected, and the study may have been underpowered for this endpoint. However, intensive BP control did significantly reduce the risk of mild cognitive impairment (14.6 versus 18.3 cases per 1000 person-years; HR 0.81, 95% CI 0.69–0.95) and the combined rate of mild cognitive impairment or probable dementia (20.2 versus 24.1 cases per 1000 person-years; HR 0.85, 95% CI 0.74–0.97), which were predefined secondary endpoints.

## What is the optimal target blood pressure in older adults?

Although the benefit of hypertension treatment in older adults has been clearly demonstrated, several cross-sectional studies have raised questions about the risk of hypotension and related cerebrovascular accidents, falls, and kidney failure<sup>27,28</sup>; thus, the safety of BP reduction at an older age has been a controversial topic.

Recent US guidelines recommended initiation of anti-hypertensive drug therapy in older individuals with a BP greater than 130/80 mm Hg<sup>29</sup>, although the BP target for treatment differed in European guidelines<sup>30</sup>. This recommendation was based on several anti-hypertensive therapy trials that included large numbers of older individuals<sup>31-34</sup>. Some patients with mild frailty were also included but most of these patients were ambulatory and able to travel to a clinic. In these trials, cardiovascular morbidity and mortality were reduced during BP lowering with different BP targets, including when the SBP treatment goal was less than 120 mm Hg. However, the risk of adverse outcomes, including orthostatic hypotension or falls, did not increase<sup>9,10,12,35</sup>. Both HYVET and SPRINT included patients who were frail but still living independently in the community, and both were stopped early for benefit.

Thus, it is fair to say that BP control in ambulatory older patients seems to be safe. However, it is important to recognize that evidence-based recommendations for BP management are lacking in those who are very frail or institutionalized or those with cognitive impairment, several comorbidities, or polypharmacy. There is no evidence in the latter group that anti-hypertensive treatment reduces cardiovascular events or promotes established cognitive dysfunction<sup>36</sup>, and evidence suggests that such treatment may not be safe<sup>37</sup>. These individuals might be at risk for adverse consequences; thus, it is important for the clinician to pursue an individualized approach. Clinicians

should carefully titrate BP lowering in persons with a high comorbidity burden<sup>37–39</sup>.

Another important consideration is initiation of anti-hypertensive therapy with two agents. These individuals need to be monitored carefully for orthostatic hypotension and history of falls. BP must be measured both sitting and standing. Older persons may present with neurogenic orthostatic hypotension. This is particularly common in neurodegenerative disorders such as Parkinson's disease and hence should be taken into consideration.

### What are the pharmacologic options for hypertension management in older adults?

Lifestyle measures are important in addition to pharmacotherapy. These include sodium restriction—Dietary Approaches to Stop Hypertension (DASH) diet—and physical activity<sup>40</sup>. BP control in older adults is challenging because of the presence of other comorbidities, polypharmacy, and frailty. Physicians should individualize management to weigh the benefits and potential harmful effects of such therapy.

Common anti-hypertensive drugs, including diuretics, angiotensin-converting enzyme (ACE) inhibitors, calcium channel blockers, and even beta-blockers, have been shown to be effective in older adults<sup>41–44</sup>.

It is important to note that each commonly used drug class has additional benefit in the presence of different comorbidities, such as ACE inhibitors in diabetes mellitus and beta-blockers in coronary disease. Decisions should be based on efficacy, tolerability, cost-effectiveness of each drug, and the presence of specific comorbidities and polypharmacy and thus drug interactions.

Beta-blockers should be used cautiously in older patients as these individuals are particularly sensitive to bradycardic effects. The main adverse effects of calcium channel blockers are related to edema and orthostatic hypotension. Also, constipation

might be a significant limitation with diltiazem and verapamil. Nitrates are useful during hypertensive emergencies and angina; however, they are not preferred for long-term BP control at an older age. Owing to their side effect profile, peripheral agents such as hydralazine and minoxidil are not first-line agents. A centrally acting agent, clonidine, can be used for BP management. Owing to reflex hypertension when discontinued, oral clonidine is not advised; clonidine patch averts this problem. It has several side effects, including bradycardia and sedation, both of which are problematic in older and frail individuals. Diuretics should be used with caution as urinary incontinence can be a major concern in older adults.

Another important consideration in the management of hypertension in older individuals is to use ambulatory BP monitoring instead of relying on single office measurements. The development of isolated systolic hypertension (and thus wide pulse pressure), white coat effect, different measurements between ambulatory and clinical BP, prevalence of orthostatic hypotension, and medication interactions are among the reasons that necessitate ambulatory BP monitoring<sup>45</sup>.

Finally, another important consideration is de-escalation of anti-hypertensive medications in patients who are intolerant. The Discontinuation of Anti-hypertensive Treatment in Elderly people (DANTE) study showed that in older individuals with orthostatic hypotension, discontinuation of anti-hypertensives showed significant recovery from orthostasis<sup>46</sup>. Discontinuation of therapy might also be considered in older patients approaching the end of life, in whom the burden of therapy might exceed the purported benefit.

### What are the future considerations?

Randomized clinical trials are needed in frail older individuals with hypertension residing in nursing homes to determine both the benefits and adverse effects of anti-hypertensive drug therapy in this vulnerable population.

## References

- Egan BM, Li J, Hutchison FN, et al.: **Hypertension in the United States, 1999 to 2012: Progress toward Healthy People 2020 goals.** *Circulation*. 2014; **130**(19): 1692–9.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Duprez DA: **Systolic Hypertension in the Elderly: Addressing an Unmet Need.** *Am J Med*. 2008; **121**(3): 179–184.e3.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- den Ouden MEM, Schuurmans MJ, Mueller-Schotte S, et al.: **Do subclinical vascular abnormalities precede impaired physical ability and ADL disability?** *Exp Gerontol*. 2014; **58**: 1–7.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- Ettinger WH, Fried LP, Harris T, et al.: **Self-reported Causes of Physical Disability in Older People: The Cardiovascular Health Study.** *CHS Collaborative Research Group.* *J Am Geriatr Soc*. 1994; **42**(10): 1035–44.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- Ezzati M, Lopez AD, Rodgers A, et al.: **Selected major risk factors and global and regional burden of disease.** *Lancet*. 2002; **360**(9343): 1347–60.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- Ferrucci L, Guralnik JM, Pahor M, et al.: **Hospital diagnoses, Medicare charges, and nursing home admissions in the year when older persons become severely disabled.** *JAMA*. 1997; **277**(9): 728–34.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- <https://www.census.gov/content/dam/Census/library/publications/2016/demo/p95-16-1.pdf>.
- Moraes AAI, Baena CP, Muka T, et al.: **Achieved systolic blood pressure in older people: A systematic review and meta-analysis.** *BMC Geriatr*. 2017; **17**(1): 279.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Faculty Opinions Recommendation](#)
- 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**(24): 3255–64.  
[PubMed Abstract](#) | [Publisher Full Text](#)
- Beckett NS, Peters R, Fletcher AE, et al.: **Treatment of hypertension in patients 80 years of age or older.** *N Engl J Med*. 2008; **358**(18): 1887–98.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)



11. Liu L, Wang JG, Gong L, et al.: **Comparison of Active Treatment and Placebo in Older Chinese Patients With Isolated Systolic Hypertension.** Systolic Hypertension in China (Syst-China) Collaborative Group. *J Hypertens.* 1998; **16**(12 Pt 1): 1823–9.  
[PubMed Abstract](#) | [Publisher Full Text](#)
12. Staessen JA, Fagard R, Thijs L, et al.: **Randomised Double-Blind Comparison of Placebo and Active Treatment for Older Patients With Isolated Systolic Hypertension.** The Systolic Hypertension in Europe (Syst-Eur) Trial Investigators. *Lancet.* 1997; **350**(9080): 757–64.  
[PubMed Abstract](#) | [Publisher Full Text](#)
13.  Bavishi C, Bangalore S, Messerli FH: **Outcomes of Intensive Blood Pressure Lowering in Older Hypertensive Patients.** *J Am Coll Cardiol.* 2017; **69**(5): 486–93.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)
14. Amery A, Birkenhäger W, Brixko P, et al.: **Mortality and morbidity results from the European Working Party on High Blood Pressure in the Elderly trial.** *Lancet.* 1985; **1**(8442): 1349–54.  
[PubMed Abstract](#) | [Publisher Full Text](#)
15. Dahlöf B, Hansson L, Lindholm LH, et al.: **Morbidity and mortality in the Swedish Trial in Old Patients with Hypertension (STOP-Hypertension).** *Lancet.* 1991; **338**(8778): 1281–5.  
[PubMed Abstract](#) | [Publisher Full Text](#)
16. Ogihara T, Saruta T, Rakugi H, et al.: **Target blood pressure for treatment of isolated systolic hypertension in the elderly: Valsartan in elderly isolated systolic hypertension study.** *Hypertension.* 2010; **56**(2): 196–202.  
[PubMed Abstract](#) | [Publisher Full Text](#)
17.  Williamson JD, Supiano MA, Applegate WB, et al.: **Intensive vs Standard Blood Pressure Control and Cardiovascular Disease Outcomes in Adults Aged ≥75 Years: A Randomized Clinical Trial.** *JAMA.* 2016; **315**(24): 2673–82.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Faculty Opinions Recommendation](#)
18.  Gottesman RF, Albert MS, Alonso A, et al.: **Associations Between Midlife Vascular Risk Factors and 25-Year Incident Dementia in the Atherosclerosis Risk in Communities (ARIC) Cohort.** *JAMA Neurol.* 2017; **74**(10): 1246–54.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Faculty Opinions Recommendation](#)
19.  Supiano MA, Williamson JD: **Applying the Systolic Blood Pressure Intervention Trial Results to Older Adults.** *J Am Geriatr Soc.* 2017; **65**(1): 16–21.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)
20. Tzourio C, Anderson C, Chapman N, et al.: **Effects of blood pressure lowering with perindopril and indapamide therapy on dementia and cognitive decline in patients with cerebrovascular disease.** *Arch Intern Med.* 2003; **163**(9): 1069–75.  
[PubMed Abstract](#) | [Publisher Full Text](#)
21. Forette F, Seux ML, Staessen JA, et al.: **The prevention of dementia with antihypertensive treatment: New evidence from the Systolic Hypertension in Europe (Syst-Eur) study.** *Arch Intern Med.* 2002; **162**(18): 2046–52.  
[PubMed Abstract](#) | [Publisher Full Text](#)
22. Forette F, Seux ML, Staessen JA, et al.: **Prevention of dementia in randomised double-blind placebo-controlled Systolic Hypertension in Europe (Syst-Eur) trial.** *Lancet.* 1998; **352**(9137): 1347–51.  
[PubMed Abstract](#) | [Publisher Full Text](#)
23.  van Charante EPM, Richard E, Eurelings LS, et al.: **Effectiveness of a 6-year multidomain vascular care intervention to prevent dementia (preDIVA): A cluster-randomised controlled trial.** *Lancet.* 2016; **388**(10046): 797–805.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)
24.  Williamson JD, Launer LJ, Bryan RN, et al.: **Cognitive function and brain structure in persons with type 2 diabetes mellitus after intensive lowering of blood pressure and lipid levels: A randomized clinical trial.** *JAMA Intern Med.* 2014; **174**(3): 324–33.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Faculty Opinions Recommendation](#)
25. Prince MJ, Bird AS, Blizard RA, et al.: **Is the cognitive function of older patients affected by antihypertensive treatment? Results from 54 months of the Medical Research Council's treatment trial of hypertension in older adults.** *BMJ.* 1996; **312**(7034): 801–5.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
26.  SPRINT MIND Investigators for the SPRINT Research Group, Williamson JD, Pajewski NM, et al.: **Effect of Intensive vs Standard Blood Pressure Control on Probable Dementia: A Randomized Clinical Trial.** *JAMA.* 2019; **321**(6): 553–61.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Faculty Opinions Recommendation](#)
27.  Divisón-Garrote JA, Ruilope LM, de La Sierra A, et al.: **Magnitude of Hypotension Based on Office and Ambulatory Blood Pressure Monitoring: Results From a Cohort of 5066 Treated Hypertensive Patients Aged 80 Years and Older.** *J Am Med Dir Assoc.* 2017; **18**(5): 452.e1–452.e6.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)
28.  Tinetti ME, Han L, Lee DSH, et al.: **Antihypertensive medications and serious fall injuries in a nationally representative sample of older adults.** *JAMA Intern Med.* 2014; **174**(4): 588–95.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Faculty Opinions Recommendation](#)
29.  Whelton PK, Carey RM, Aronow WS, et al.: **2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines.** *J Am Coll Cardiol.* 2018; **71**(19): e127–e248.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)
30.  Bakris G, Ali W, Parati G: **ACC/AHA Versus ESC/ESH on Hypertension Guidelines: JACC Guideline Comparison.** *J Am Coll Cardiol.* 2019; **73**(23): 3018–26.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)
31.  **Correction: Benefits and Harms of Intensive Blood Pressure Treatment in Adults Aged 60 Years or Older.** *Ann Intern Med.* 2018; **168**(7): 529.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)
32. Hansson L, Zanchetti A, Carruthers SG, et al.: **Effects of Intensive Blood-Pressure Lowering and Low-Dose Aspirin in Patients With Hypertension: Principal Results of the Hypertension Optimal Treatment (HOT) Randomised Trial.** HOT Study Group. *Lancet.* 1998; **351**(9118): 1755–62.  
[PubMed Abstract](#) | [Publisher Full Text](#)
33. Wei Y, Jin Z, Shen G, et al.: **Effects of intensive antihypertensive treatment on Chinese hypertensive patients older than 70 years.** *J Clin Hypertens (Greenwich).* 2013; **15**(6): 420–7.  
[PubMed Abstract](#) | [Publisher Full Text](#)
34. Weiss J, Freeman M, Low A, et al.: **Benefits and Harms of Intensive Blood Pressure Treatment in Adults Aged 60 Years or Older: A Systematic Review and Meta-analysis.** *Ann Intern Med.* 2017; **166**(6): 419–429.  
[PubMed Abstract](#) | [Publisher Full Text](#)
35. Warwick J, Falaschetti E, Rockwood K, et al.: **No evidence that frailty modifies the positive impact of antihypertensive treatment in very elderly people: An investigation of the impact of frailty upon treatment effect in the Hypertension in the Very Elderly Trial (HYVET) study, a double-blind, placebo-controlled study of antihypertensives in people with hypertension aged 80 and over.** *BMC Med.* 2015; **13**: 78.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
36.  Materson BJ, García-Estrada M, Preston RA: **Hypertension in the frail elderly.** *J Am Soc Hypertens.* 2016; **10**(6): 536–41.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)
37. Muller M, Smulders YM, de Leeuw PW, et al.: **Treatment of hypertension in the oldest old: A critical role for frailty?** *Hypertension.* 2014; **63**(3): 433–41.  
[PubMed Abstract](#) | [Publisher Full Text](#)
38. Benetos A, Bulpitt CJ, Petrovic M, et al.: **An Expert Opinion From the European Society of Hypertension-European Union Geriatric Medicine Society Working Group on the Management of Hypertension in Very Old Frail Subjects.** *Hypertension.* 2016; **67**(5): 820–5.  
[PubMed Abstract](#) | [Publisher Full Text](#)
39. Onder G, Landi F, Fusco D, et al.: **Recommendations to prescribe in complex older adults: Results of the CRITERIA to assess appropriate Medication use among Elderly complex patients (CRIME) project.** *Drugs Aging.* 2014; **31**(1): 33–45.  
[PubMed Abstract](#) | [Publisher Full Text](#)
40.  Rostami H, Khayatzadeh SS, Tavakoli H, et al.: **The relationship between adherence to a Dietary Approach to Stop Hypertension (DASH) dietary pattern and insomnia.** *BMC Psychiatry.* 2019; **19**(1): 57.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#) | [Faculty Opinions Recommendation](#)
41.  Thomopoulos C, Parati G, Zanchetti A: **Effects of blood pressure lowering on outcome incidence in hypertension: 4. Effects of various classes of antihypertensive drugs—overview and meta-analyses.** *J Hypertens.* 2015; **33**(2): 195–211.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)
42. Yusuf S, Sleight P, Pogue J, et al.: **Effects of an angiotensin-converting-enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients.** *N Engl J Med.* 2000; **342**(3): 145–53.  
[PubMed Abstract](#) | [Publisher Full Text](#)
43. Lithell H, Hansson L, Skoog I, et al.: **The Study on Cognition and Prognosis in the Elderly (SCOPE): Principal results of a randomized double-blind intervention trial.** *J Hypertens.* 2003; **21**(5): 875–86.  
[PubMed Abstract](#) | [Publisher Full Text](#)
44. Aronow WS, Fleg JL, Pepine CJ, et al.: **ACCF/AHA 2011 Expert Consensus Document on Hypertension in the Elderly: A Report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents Developed in Collaboration With the American Academy of Neurology, American Geriatrics Society, American Society for Preventive Cardiology, American Society of Hypertension, American Society of Nephrology, Association of Black Cardiologists, and European Society of**

*Hypertension. J Am Coll Cardiol.* 2011; **57**(20): 2037–114.

[PubMed Abstract](#) | [Publisher Full Text](#)

45. Mediavilla García JD, Jaén Águila F, Fernández Torres C, *et al.*: **Ambulatory blood pressure monitoring in the elderly.** *Int J Hypertens.* 2012; **2012**: 548286.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)

46.  Moonen JEF, Foster-Dingley JC, de Ruijter W, *et al.*: **Effect of discontinuation of antihypertensive medication on orthostatic hypotension in older persons with mild cognitive impairment: The DANTE Study Leiden.** *Age Ageing.* 2016; **45**(2): 249–55.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Faculty Opinions Recommendation](#)

# Open Peer Review

Current Peer Review Status: 

---

## Editorial Note on the Review Process

**Faculty Reviews** are review articles written by the prestigious Members of **Faculty Opinions**. The articles are commissioned and peer reviewed before publication to ensure that the final, published version is comprehensive and accessible. The reviewers who approved the final version are listed with their names and affiliations.

---

## The reviewers who approved this article are:

### Version 1

1. **Wilbert Aronow**

Department of Cardiology, Westchester Medical Center and New York Medical College, Valhalla, NY, 10595, USA

**Competing Interests:** No competing interests were disclosed.

2. **Michael W Rich**

Cardiovascular Division, Washington University School of Medicine, St. Louis, MO, USA

**Competing Interests:** No competing interests were disclosed.

3. **Carl Lavie**

Department of Cardiovascular Diseases, John Ochsner Heart and Vascular Institute, Ochsner Clinical School, University of Queensland School of Medicine, New Orleans, LA, USA

**Competing Interests:** No competing interests were disclosed.

4. **Suzanne Oparil**

Vascular Biology and Hypertension Program, Division of Cardiovascular Disease, Department of Medicine, School of Medicine, The University of Alabama at Birmingham, Birmingham, AL, USA

**Competing Interests:** No competing interests were disclosed.

5. **George Bakris**

Department of Medicine, Am. Heart Assoc. Comprehensive Hypertension Center, Section of Endocrinology, Diabetes and Metabolism, The University of Chicago Medicine, Chicago, IL, USA

**Competing Interests:** No competing interests were disclosed.

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact [research@f1000.com](mailto:research@f1000.com)

**F1000Research**