

Hypertension in Older Women: Illuminating a Bright Spot

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Disclosure

I have no financial interests or relationships to disclose.



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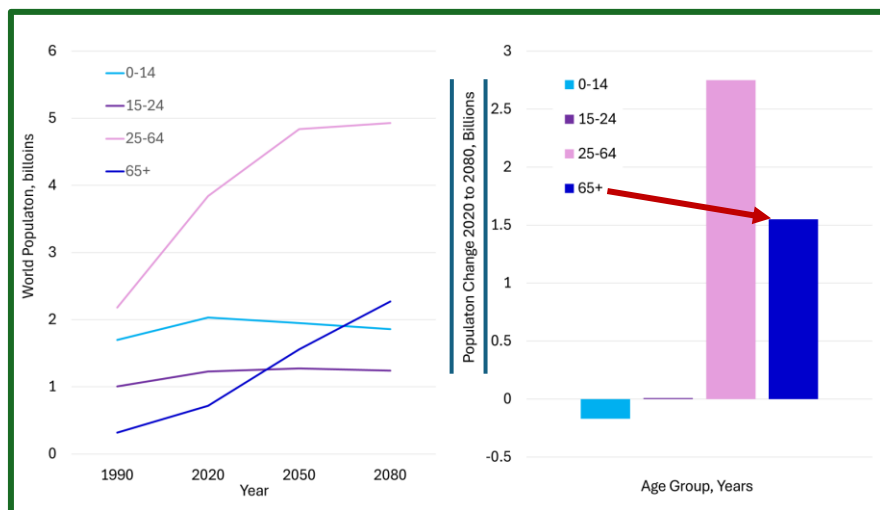
Hypertension in Older Women: Illuminating a Bright Spot

Objectives – Participants in this program will:

1. Describe sex-related differences in the change of systolic BP, pulse pressure (PP), treatment (Rx) effectiveness and BP control between 60-74 and ≥75 years of age
2. List key variables that may explain more adverse changes in women than men with aging in SBP, PP, Rx effectiveness and BP control
3. Identify lifestyle and therapeutic options that may reduce adverse changes in SBP, PP, Rx effectiveness and BP control among women with aging

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The Importance of HTN with Aging is Magnified as Older Populations are Mainly Women and Expanding Rapidly



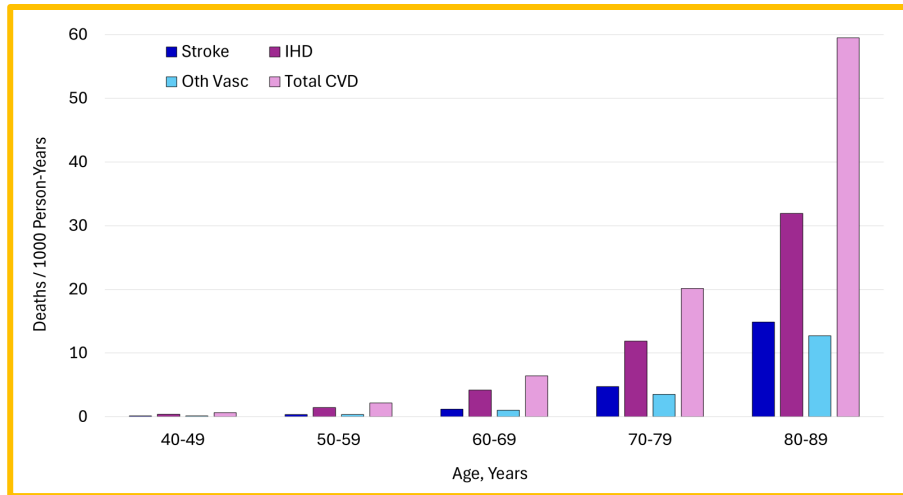
U.S. population ≥65 years could grow from ~56 million (16%) in 2020 to >100 million (23%) in 2080

<https://www.bing.com/search?pglt=297&q=Increase+in+US+population+65+and+older+2020+to+2080>

Egan B, Lackland D, et al. Perspective – The growing global benefits of limiting salt intake: An urgent call from the World Hypertension League. *J Hum Hypertension*. 2025;39:241-245.

4

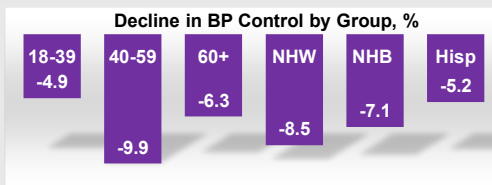
The Importance of HTN with Aging is Magnified as CVD Mortality Triples Every Decade after Age 40–49



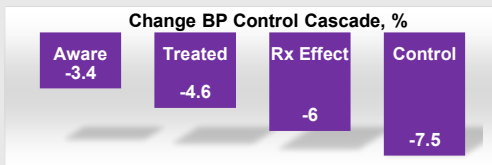
Lewington S, et al. Prospective Studies Collaboration. Age-specific relevance of usual BP to vascular mortality: a meta-analysis of one million adults in 61 prospective studies. *Lancet*. 2002;360:1903-1913.

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Falling BP Control from 2009–2014 to 2015–2018 Was Demographically Agnostic

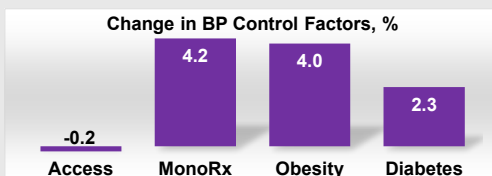


BP control fell across demographic groups – not just those ≥60 years with a hotly debated SBP goal <150



Hypertension control fell 7.5% points because . . .

- fewer adults with HTN were aware (–3.4% points)
- fewer adults with HTN were treated (–4.6% points)
- fewer adults treated for HTN were controlled (–6% points)



Monotherapy rose, despite more obesity and diabetes

Access to care did not change. Thus,

HTN control likely fell in 2015 to 2018 because the quality of care declined.

Egan BM, Li J, Sutherland SE, Rakotz MK, Wozniak GD. *Hypertension*. 2021;78:578–587.

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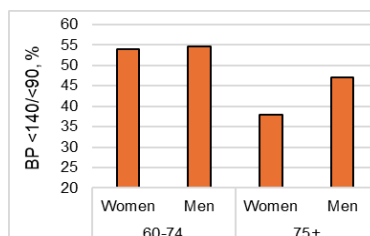
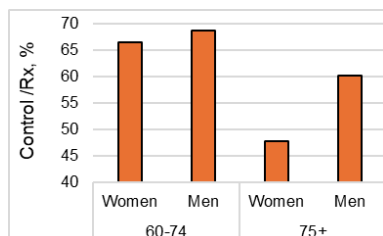
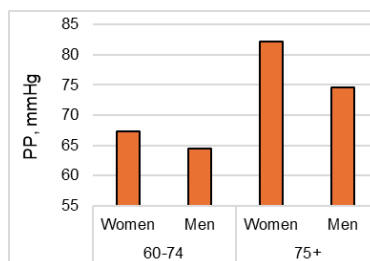
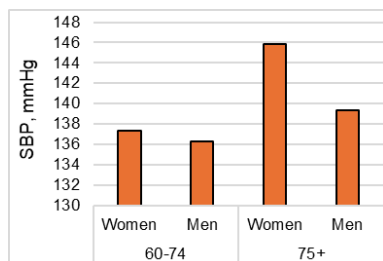
Women and Men ≥75 Years in U.S. with Hypertension 2005-2020.

Variable	Women ≥75	Men ≥75	P-Value
(NHANES) U.S. Pop, n	(1682) 8,068,200	(1468) 5,074,694	
Age, years (80 cap)	79.0	78.7	0.0001
Race, NHW, %	80.8	81.4	0.27
NHB, %	9.1	8.0	
Hispanic, %	5.6	5.7	
Care access, %	95.9	94.5	0.06
Height, meters	1.57	1.71	<.0001
Body Mass Index, kg/m ²	28.0	28.1	0.61
BP Med Classes, n	2.18	2.19	0.74
Diabetes Mellitus, %	23.1	28.5	0.007
Chronic Kidney Dz, %	53.7	48.2	0.005
Cardiovascular Dz, %	31.5	41.5	<.0001
nonHDL-C, mg/dL	135.7	121.3	<.0001
Statins, %	47.1	56.7	<.0001

Egan BM, Li J, Sutherland SE, Riesser BC, Mattix-Kramer H, Rakotz MK. Height may explain sex differences in systolic blood pressure in older adults. *Hypertension*. 2025;82:1857-1865.

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Differences in SBP, Pulse Pressure, Rx Effectiveness and BP Control Between Women and Men Are Larger at Ages ≥75 Years than 60-74*



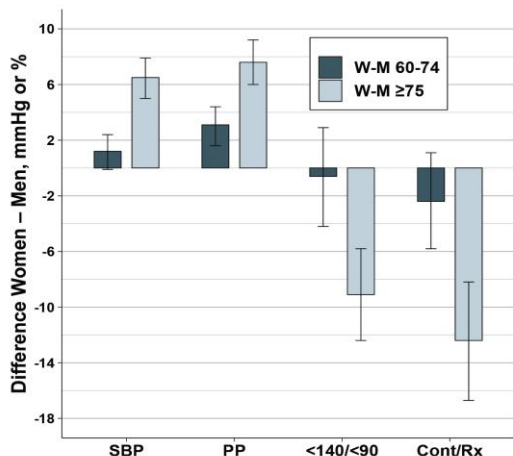
Abbreviations:
 SBP, systolic BP
 PP, pulse pressure
 Control/Rx, proportion of treated patients controlled (treatment effectiveness)
 BP <140/<90, hypertension control

*Analysis used NHANES 2005-2020 data

Egan BM, Li J, Sutherland SE, Riesser BC, Mattix-Kramer H, Rakotz MK. Height may explain sex differences in systolic blood pressure in older adults. *Hypertension*. 2025;82:1857-1865.

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Blood Pressure and Control Diverge with Aging in Women and Men



Differences between women and men in SBP, pulse pressure, control to <140/<90 and treatment effectiveness (control/Rx) are larger at ages ≥75 than 60-74 years ($p < .001$ for all 4 variables)

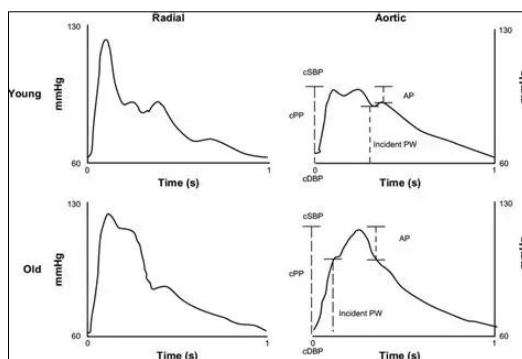
Data shown as mean and 95% confidence interval
 Legend: W, women; M, men; W-M, difference between women and men; SBP, systolic blood pressure; PP, pulse pressure; HTN, hypertension; Rx, pharmacotherapy; Cont/Rx, treated adults controlled, %

Egan BM, et al. *Hypertension*. 2025;82:1857-1865.

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Pathophysiology of Higher SBP and PP in Older Women: It Is a Bit Complex but Probably Worth the Mental Effort !!

- The aortic forward wave mainly accounts for the first and second peaks of SBP, and both increase with age.^{1-3 9,31,32}
- The initial SBP peak is related to pulse wave velocity and stroke volume before the first peak.^{3,432,33}
- The second systolic peak (augmentation pressure) is directly related to stroke volume between the first and second peaks and inversely related to total aortic compliance.
- The latter phase of stroke volume increases with advancing age³ and with the decline in aortic compliance, underlies the age-related rise of PP.



Abbreviations: SBP, systolic BP; PP, pulse pressure.

Ref. 1. Mitchell GF, et al. *Hypertension*. 2008;51:1128-8. 2. Mitchell GF, et al. *Circ*. 2010;122:1379-86. 3. Li Y, et al. *Hypertension*. 2019 73:1018-24. 4. Xing C, et al. *J Hypertension*. 2025;43:615-22.

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Pathophysiology of Higher SBP and PP in Older Women: It Is a Bit Complex but Probably Worth the Mental Effort !!

- Aortic diameter is a key determinant of PP.¹ Aortic diameters are smaller in women (shorter) than men (taller) and may explain higher central PP in women than men.^{1,2}
- In middle-aged women, increasing aortic diameter offsets effects of aortic stiffening on PP. In older women, aortic diameter remains constant and aortic stiffening continues → higher SBP and PP.^{1,2}

Smaller aortic diameters and greater age-related increases of structural aortic stiffness in women than men explain the larger increase of SBP and PP with aging in women.⁴⁻⁶

Abbreviations: SBP, systolic BP; PP, pulse pressure.

Ref. 1. Smiulyan H, et al. *JACC*. 1998;31:1103-1109. 2. Xing C, et al. *J Hypertension*. 2025;43:615-22. 3. Chapman N, et al. *Hypertension*. 2023;80:1140-49. 4. Mitchell GF, et al. *Hypertension*. 2008;51:1128-8. 5. Mitchell GF, et al. *Circ*. 2010;122:1379-86. 6. Li Y, et al. *Hypertension*. 2019 73:1018-24

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Clinical Implications of Height for BP Targets ? ? ?

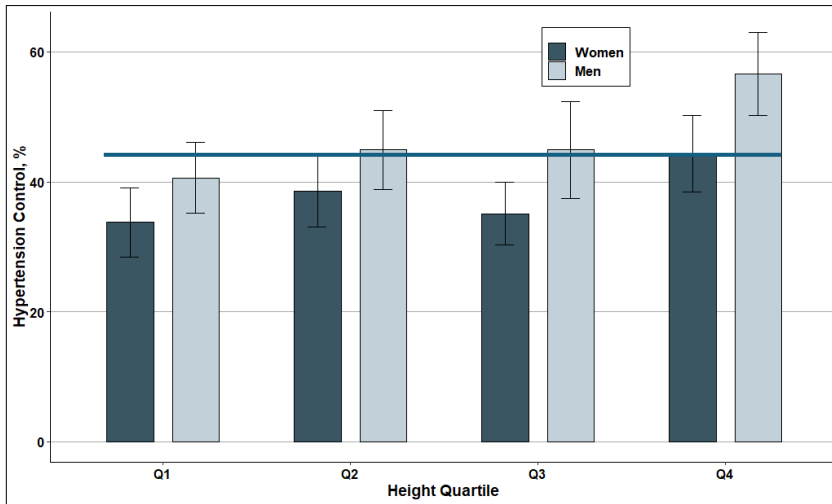
- At any given cuff SBP, central SBP is higher in women (shorter) than men.^{1,2}
- Height is inversely associated with CVD risk (except atrial fibrillation).³⁻⁵
 - In the Finnmark Study, each 5 cm increment in height was associated with an 25% lower risk of stroke in women and 18% lower risk in men after adjustment for other CVD risk factors.
 - In the Physicians' Health Study, men ≥73 inches tall (upper quintile) had a 35% lower risk of MI than men ≤67 inches tall (shortest quintile) after adjusting for other CV risk factors.

Thus, it may be reasonable to aim for lower cuff SBP in shorter than taller people.

1. Chapman N, et al. *Hypertension*. 2023;80:1140-49.
2. Cochran JM, et al. *Cardiology*. 2021;146:345-350.
3. Hebert PR, et al. *Circulation*. 1993;88 [part 1]:1437-43.
4. Njolstad I, et al. *Circulation*. 1996;94:2877-82.
5. Rosenbuhay SW, Parker JM. *Rev Cardio Med*. 2014;15:102-8.

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Height and BP Control in Women and Men ≥75 Years Old



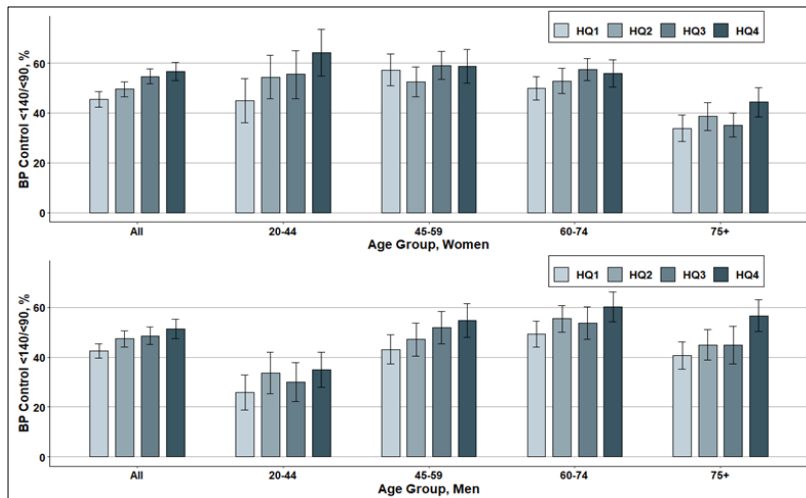
Note: BP control for women in the 4th height quartile is similar to men in the 2nd and 3rd quartiles and higher than men in the 1st quartile.

Height Quartiles (inches)		
Q	Women	Men
1	≤61	<67
2	61-63.5	67-69
3	63.6-65.6	69-71
4	>65.6	>71

Egan BM, Li J, Sutherland SE, Riesser BC, Mattix-Kramer H, Rakotz MK. Height may explain sex differences in systolic blood pressure in older adults. *Hypertension*. 2025;82:1857-1865

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Height Is Related to BP Control in Women and Men Across Age Groups



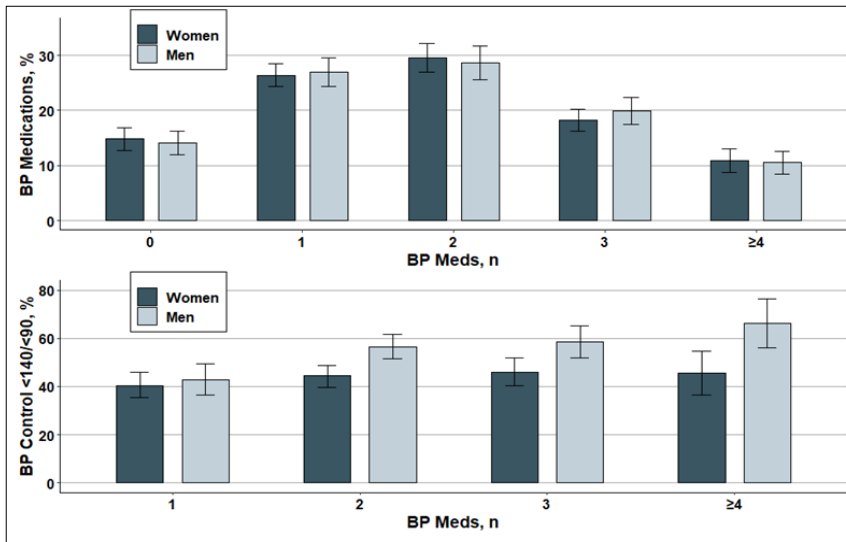
Age groups, Women

Age Groups, Men

Egan BM, Li J, Sutherland SE, Riesser BC, Mattix-Kramer H, Rakotz MK. *Hypertension*. 2025;82:1857-1865.

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**Women and Men ≥75 Years Report Similar Numbers of BP Meds
BUT Control Rises in Men but Not Women on More BP Meds**



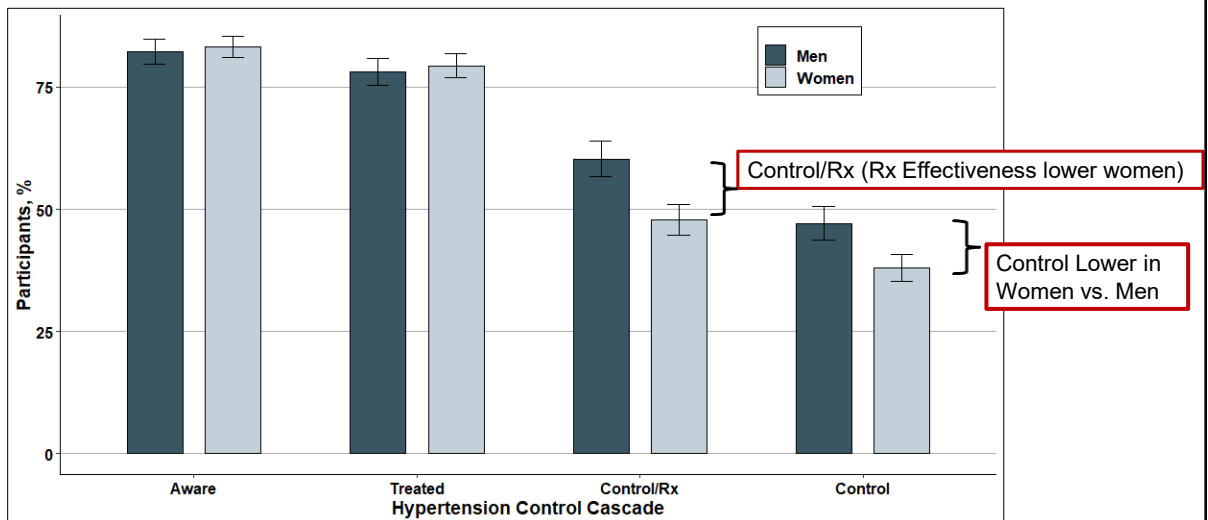
Older women and men reported taking the same number of BP medications

BP control to <140/<90 is relatively flat in women taking 1 to 4 BP meds but rises with BP med number in men

Egan BM, Li J, Sutherland SE, Riesser BC, Mattix-Kramer H, Rakotz MK. *Hypertension*. 2025;82:1857-1865.

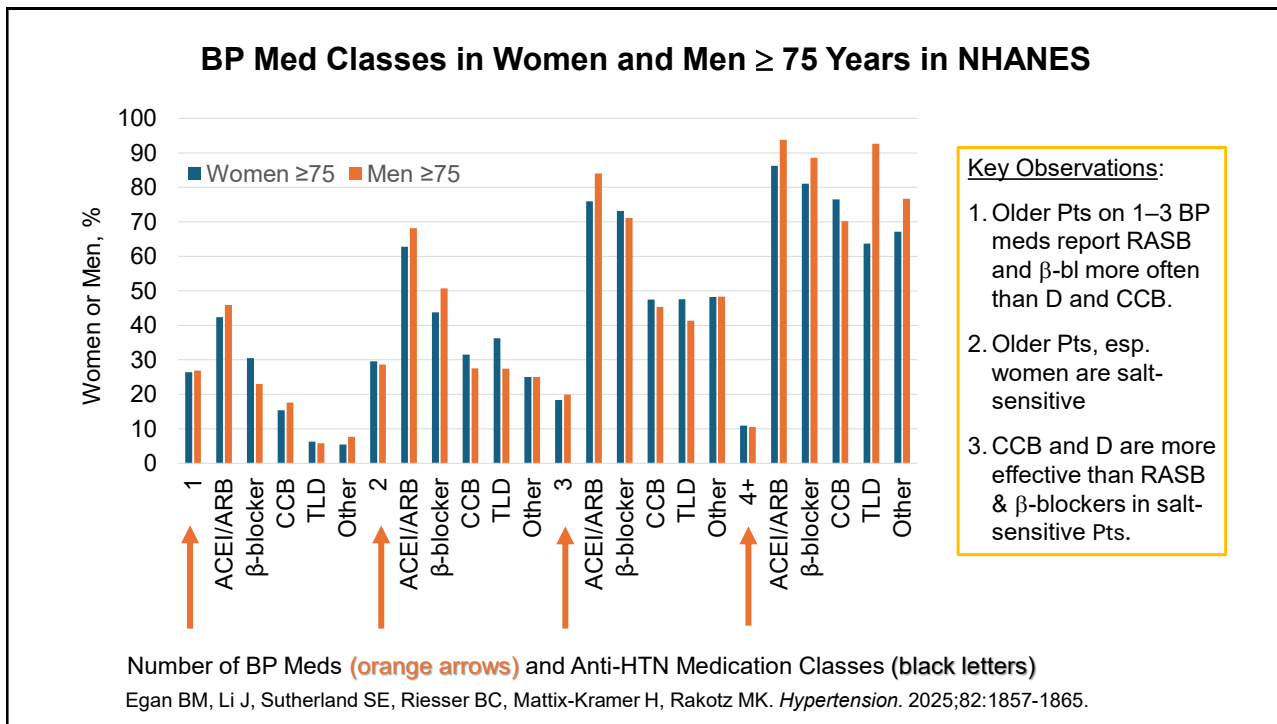
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Less Effective BP Rx Explains Lower BP Control in Women than Men ≥75 Years Old



Egan BM, Li J, Sutherland SE, Riesser BC, Mattix-Kramer H, Rakotz MK. Height may explain sex differences in systolic blood pressure in older adults. *Hypertension*. 2025;82:1857-1865

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Systolic BP Increases More with Aging in Shorter People

Height and SBP with aging:

- In a birth cohort, SBP from age 36 to 53 years increased 0.013 mmHg more annually for each cm decrement in baseline height.¹
- Average height for U.S. adults ≥20 years is 69 inches for men and 63.5 inches for women.²
- The sex difference in height of 5.5 inches (14 cm) would translate to a 3.1 mmHg greater rise of SBP in women than men from age 36 to 53 years.³
- If the linear trend persisted, SBP would be 7 mmHg higher in women than men at age 75 and account for the observed 6.4 mmHg sex difference.³

References:

1. Langenberg C, et al. *Int J Epidemiol*. 2005;34:905-13.
2. Body measurements. National Center for Health Statistics, CDC. <https://www.cdc.gov/nchs/fastats/body-measurements.htm> (accessed 22 January 2025).
3. Egan BM, et al. *Hypertension*. 2025;82:1857-1865.

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Systolic BP Rises More with Age in Salt-Sensitive People and Women Are More Salt-Sensitive than Men

- Salt contributes to the age-related increase of systolic BP. INTERSALT reported that a 2300 mg higher daily sodium intake was associated with ~10 mmHg rise of SBP from age 25 to 55 years.¹
- BP increases more with age in salt-sensitive than resistant individuals (+1.4 mmHg/yr in SS vs. slight decrease in SR [small numbers of subjects]).²
- Women are more salt sensitive than men.³

Salt may contribute to the greater age-related increases of systolic BP in women than men.^{3,4}

1. Intersalt Cooperative Research Group. *BMJ*. 1988;297:319–28.
2. Weinberger MH, Fineberg NS. *Hypertension*. 1991;18:67–71.
3. Chapman N, et al. *Hypertension*. 2023;80:1140-1149.
4. Egan B, Lackland D, et al. *J Hum Hypertension*. 2025;39:241-245.

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Other Factors That May Contribute to the Greater Age-Related Rise of SBP in Women than Men

- Greater age-related sympathetic activation in women than men.¹
- Lower rates of statin therapy in women than men.²⁻⁴
- Earlier mortality in men than women with high systolic BP and pulse pressure.^{5,6}
- Post-menopausal hormonal changes,⁷ although hormone replacement therapy with estrogen alone or with progesterone raises BP slightly in post-menopausal women.⁸

1. Chapman N, Ching SM, et al. *Hypertension*. 2023;80:1140-1149.
2. Nanna MG, Wang TY, et al. *Circ: Cardio Qual Outcomes*. 2019;12:e0005562.
3. Egan BM, Li J, et al. *Circulation*. 2013;128:29-41.
4. Zhou YF, Wang Y, et al. *JAMA Netw Open*. 2022;5:e2218323.
5. Franklin SS, Khan SA, et al. *Circulation*. 1999;100:354-60.
6. Domanski M, Norman J, et al. *Hypertension*. 2001;38:793-797.
7. Barton M, Meyer MR. *Hypertension*. 2009;54:11-18.
8. Xuezhi J, Aragaki AK, et al. *Menopause*. 2023;30:28-36.

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Lifestyle Interventions to Reduce Salt Sensitivity

Longer-term effects of salt on BP are probably greater than short-term effects, especially in salt-sensitive individuals !!

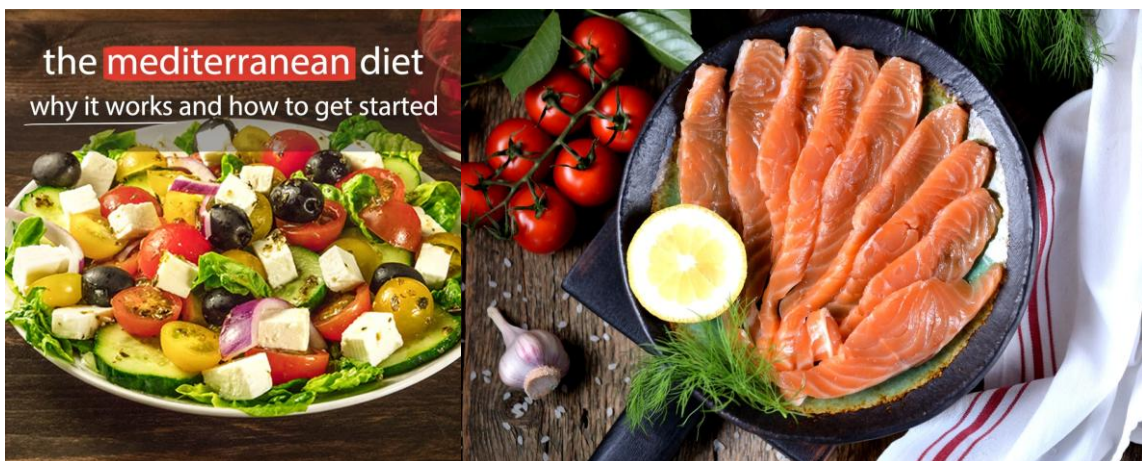
In addition to the short and long-term effect of reducing dietary sodium intake on BP, several lifestyle interventions reduce salt sensitivity including:¹

- Increasing potassium intake
- Increasing intake of whole foods (DASH, Mediterranean-type eating plans)
- Increasing cocoa intake (limited processing)²
- Increasing physical activity
- Weight loss
- Diabetes prevention
- CKD prevention

1. Egan B, Lackland D, et al. *J Hum Hypertension*. 2025;39:241-245.
2. Hollenberg NK, et al. *JASH*. 2009;3:105-112.

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The Mediterranean Diet: Why It Works and How to Get Started



<https://healthwholeness.com/weight-loss/the-mediterranean-diet/> (accessed 24 Aug 2022)

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Healthy Food Doesn't Taste Good & Costs More – Myth Buster!



DASH FOR GOOD HEALTH SOUTHERN STYLE



A Sensible Eating Plan to Promote Good Health
Based on the DASH for Good Health series



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BP Change from Baseline to Year 01 in SPRINT Standard and Intensive Treatment

SPRINT Women ≥75 Years of Age Blood Pressure at Baseline and Month 12 by Treatment Arm*						
	Standard Treatment (N=437)			Intensive Treatment (N=436)		
	Baseline	12 Months	Diff	Baseline	12 Months	Diff
SBP, mmHg	143.7	139.6	4.1	143.2	125.6	17.6
DBP, mmHg	70.7	70.0	0.7	71.3	64.2	7.2
MBP, mmHg	95.0	93.2	1.8	95.3	84.6	10.7
PP, mmHg	73.1	69.7	3.4	72.8	61.4	10.4

* Unpublished observations (analysis in progress)

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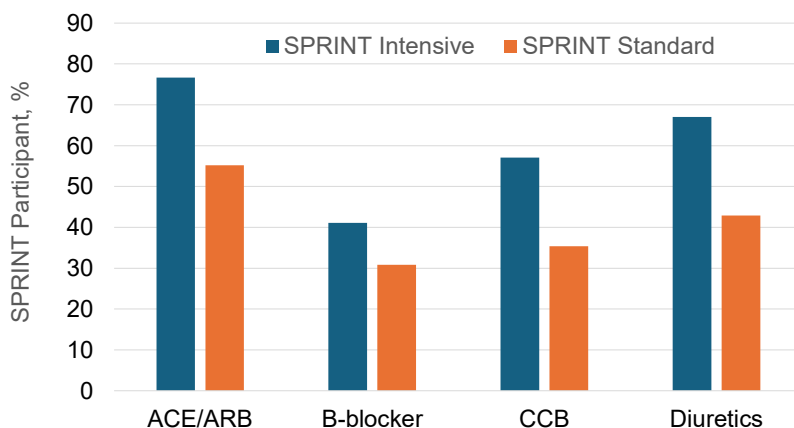
BP Medications at Most Recent Visit in SPRINT Intensive and Standard Treatment Groups: Diuretics & CCBs More Frequent than β -Blockers

	SPRINT Intensive	SPRINT Standard
BP Meds, avg (N)	2.7	1.8
0, %	2.7	11.3
1, %	10.6	31.1
2, %	30.5	33.3
3, %	31.8	17.2
4, %	24.3	6.9
ACEI or ARB	76.7	55.2
Beta-blockers	41.1	30.8
CCBs	57.1	35.4
Diuretics	67.0	42.9
Alpha1 antagonists	10.3	5.5
Central sympatholytics	2.3	0.9
Direct Vasodilators	7.3	2.4

Supplement to: The SPRINT Research Group. A randomized trial of intensive versus standard blood-pressure control. N Engl J Med. DOI: 10.1056/NEJMoa1511939 (2015)

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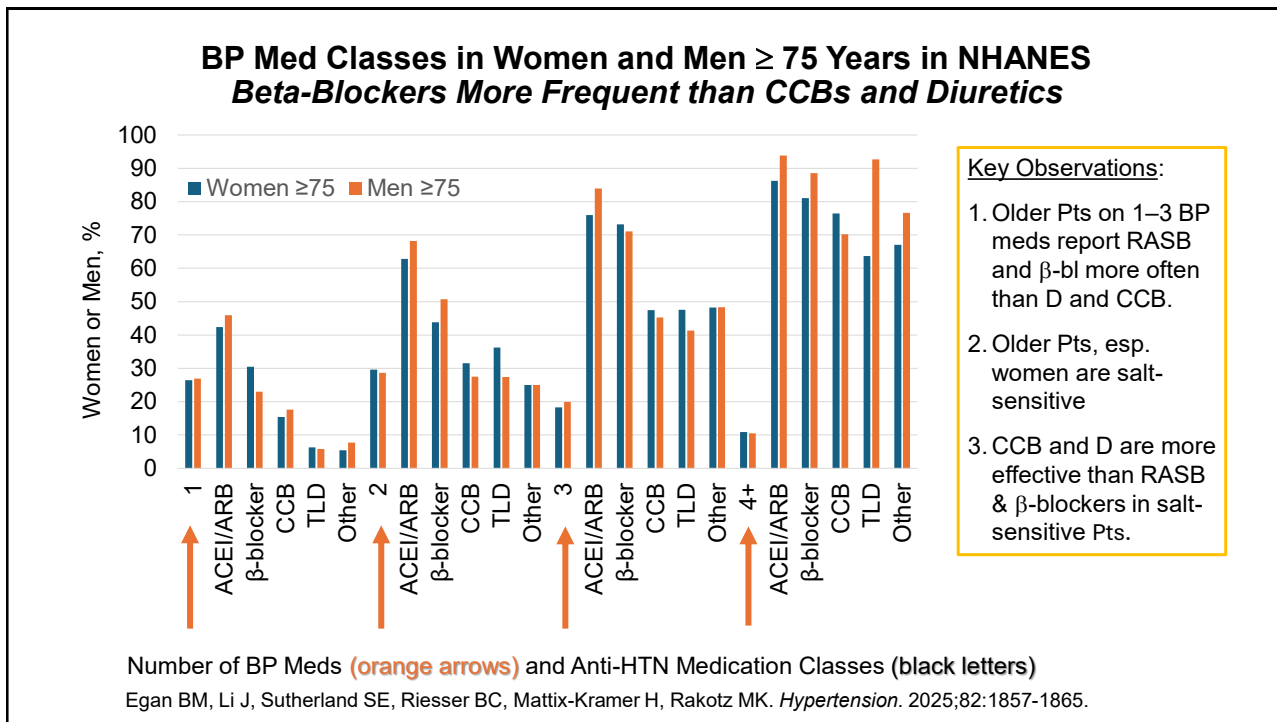
SPRINT: Frequency of Major BP Med Classes – CCBs and Diuretics More Frequent than β -Blockers



In SPRINT, subjects with symptomatic heart failure in the past 6 months or LVEF <35% were excluded, which could lead to less β -blocker use.

Supplement to: The SPRINT Research Group. A randomized trial of intensive versus standard blood-pressure control. N Engl J Med. DOI: 10.1056/NEJMoa1511939 (2015)

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Pharmacotherapy to Control BP in Older Women

- CCBs and diuretics are more effective in volume-sodium dependent HTN; older women are a salt-sensitive (volume-dependent, low-renin) group
- An ACEI or ARB is often indicated for comorbidities and effective when plasma volume is controlled (CCBs and/or diuretics, low salt diet)
- Consider HCTZ 50 mg/d or chlorthalidone 25 mg/d to attain good TLD BP effect
- β-blockers are indicated for compelling indications or 4th agents if aldosterone antagonists or ENaC inhibitors contraindicated
- Dual CCB, e.g., diltiazem and amlodipine have additive antihypertensive effects and can be considered
- Timely addition of a 3rd or 4th BP med may be required to control BP !!!

References: Carey RM, et al. Resistant Hypertension. *Hypertension*. 2018;72:e53-e90. Alviar CL, et al. *Am J Hypertension*. 2013;26:287–297; Jones DW, et al. AHA/ACC High BP Guideline. *Hypertension*. 2025;82:e212-e316. Mancia G, et al. 2023 ESH Guidelines for hypertension. *J Hypertension*. 2023;41:1874-2071.

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Clinical Management of Pre-Older Women to Limit the Excessive Age-Related Rise in BP

- Limit sodium intake to <2300 mg daily, preferably lower (1500 mg)
- Overall healthy lifestyle pattern: weight, physical activity, nutrition
- For chocolate lovers – consume dark chocolate with proven health benefits
- Avoid excess drug and / or alcohol use including cigarettes
- Excellent BP control (aim for 90% of reading <140/<90, which will typically lead to mean SBP <125 and usually closer to 120)
- Attention to lipids (non-HDL cholesterol), statins

1. Egan B, Lackland D, et al. *J Hum Hypertension*. 2025;39:241-245. 2. Hollenberg NK, et al. *JASH*. 2009;3:105-112. 3. Egan BM, et al. *Hypertension*. 2010;55:1289–1295

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Summary of key points:

1. SBP and PP rise more sharply with aging in women than men and HTN control falls more, reflecting less effective Rx
2. Shorter height and greater salt-sensitivity in women likely contribute to adverse changes in SBP, PP, Rx effectiveness, and BP control
3. Sodium restriction in an overall healthy lifestyle plan, excellent BP and lipid control across the lifespan, and prompt use of 3 and 4 BP med regimens when required are likely beneficial

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