SPECIAL ARTICLE

The 2017 U.S. Hypertension Guidelines: What Is Important for Older Adults?

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In late 2017, the American College of Cardiology (ACC) and the American Heart Association (AHA), joined by a number of other organizations, including the American Geriatrics Society (AGS), published a new comprehensive hypertension guideline.[1] Since the 1970s, the most broadly accepted U.S. hypertension guidelines, the Joint National Committee (JNC) reports, were developed under the sponsorship and direction of the U.S. National Heart, Lung, and Blood Institute (NHLBI), but in 2013, after JNC 8 had been developed and the recommendations completed, NHLBI decided not to publish any further guidelines in preventive cardiology, so in 2014, a majority of the JNC 8 guideline panel instead published the JNC 8 recommendations independently.[2] The 2017 ACC/AHA hypertension guideline was intended, with the concurrence of NHLBI, to replace and update the JNC guidelines.[3]

The purpose of this review is to provide the authors' summary and perspectives on some of the most important aspects of the 2017 ACC/AHA hypertension guideline, especially as it relates to older adults with hypertension. Hypertension is present in the majority of older adults seen in primary care settings, so clinicians and older adults make frequent decisions about management of hypertension in these settings.

Blood Pressure Classification and Hypertension Prevalence

Although the JNC 8 panel recommended several blood pressure (BP) treatment goals that differed from the JNC 7 guideline, changing the classification of BP was not one of its charges. Therefore, the 140/90 mmHg threshold for the definition of hypertension had not changed for decades, although based on epidemiological data, newer BP goal trials, and meta-analyses, the 2017 guideline changed the definition of the threshold for hypertension in adults, regardless of age, to a systolic BP (SBP) of 130 mmHg or greater or a diastolic BP (DBP) of 80 mmHg or greater (Table 1). Using data from the 2011 to 2014 National Health and Nutrition Examination Survey (NHANES), it has been estimated that the prevalence of hypertension in U.S. adults increased from 32% based on the older definition of hypertension to 46% based on the newer definition.[4] The prevalence of hypertension increases with age, and the prevalence was estimated to be 76% in adults aged 65 to 74 and 82% in those aged 75 and older, according to the new definition, compared with 64% and 75%, respectively, using the JNC 7 definition. Thus, primary care providers who care for older persons will be faced with important care decisions for the increase in the percentage of their patients who will now have a diagnosis of hypertension.

The ACC/AHA 2017 guidelines dropped the term "prehypertension" from the JNC 7 classification and replaced it with "elevated BP," defined as a BP of 120–129/<80 mmHg, and Stage 1 hypertension, defined as a SBP of 130–139 mmHg or a DBP of 80–89 mmHg. Stage 2 hypertension now corresponds to the previous definition of "hypertension" (SBP ≥140 mmHg or DBP ≥90 mmHg). These new definitions of hypertension will result in primary care providers, especially those who care for older persons, having to make important clinical decisions on how best to treat this population group.

Blood Pressure Measurement

There is a much greater emphasis in the 2017 ACC/AHA hypertension guideline than in the previous general hypertension guidelines on proper measurement of BP in the clinic setting and for out-of-office measurement. Although most JNC guidelines recommended that routine clinic BP measurements follow a consistent methodology, including such components as proper positioning and cuff size, 5-minute quiet rest period before measurement, and using the average of multiple measurements, the 2017 guideline gives more detail about proper technique and using validated BP measurement instruments and strongly emphasizes the importance of proper BP measurement technique in informing appropriate diagnosis and management decisions. Using validated equipment and proper technique is critically important because most major epidemiological

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Table 1. Changes in Blood Pressure (BP) Categories from JNC 7 to the 2017 American College of Cardiology (ACC) and the American Heart Association (AHA) Guideline

SBP, mmHg		DBP, mmHg	JNC7	2017 ACC/AHA
<120	and	<80	Normal BP	Normal BP
120–129	and	<80	Prehypertension	High BP
130–139	or	80–89	Prehypertension	Stage 1 hypertension
140–159	or	90–99	Stage 1 hypertension	Stage 2 hypertension
≥160	or	≥100	Stage 2 hypertension	Stage 2 hypertension

The categorization of BP should be based on the average of ≥2 readings on ≥2 occasions following a standardized protocol.
Adults with systolic BP (SBP) and diastolic BP (DBP) in 2 categories are assigned to the higher category.

studies defining the risk of different BP levels and most major hypertension trials demonstrating the BP thresholds and goals that are benefitted by nonpharmacological or drug treatment have used consistent methodology and validated BP manometers.[2,5] Failing to use proper measurement technique can not only lead to inaccurately recorded BP values, but the amount of error is also unpredictable in an individual, leading to potentially incorrect diagnosis of hypertension or inaccurate treatment decisions.[6]

From the 1960s to the 1990s, hypertension outcome trials mostly used manual auscultatory determinations, usually with standard or random-zero mercury manometers, but more recent trials have used automated manometers because mercury has been banned or strongly discouraged in most clinical settings, and even with extensive training and retraining, observer bias, such as digit preference, was difficult to eliminate with manual auscultatory determinations. Because of the cardiovascular benefits demonstrated in the Systolic Blood Pressure Intervention Trial (SPRINT) with a SBP goal of less than 120 mmHg in the intensive treatment group,[5] there is a growing emphasis on the importance of proper technique with a validated automated manometer, as was used in SPRINT.[7] Although some authors have been critical of the BP measurement technique used in SPRINT as not representative of those of other clinical trials or clinical practice,[8] the SPRINT BP measurement methodology was based on the technique used in previous trials.[5] One criticism of SPRINT is based on an incorrect contention that SPRINT BP measurements were taken with participants alone in an examination room (unattended) and that, if it had been attended, the intensive treatment goal of less than 120 mmHg in SPRINT would correspond to 10 to 15 mmHg higher SBP values in other trials, but a recent study showed no difference in mean BP between attended and unattended automated BP readings using the same manometer (Omron 907XL, Omron Healthcare, Lake Forest, IL) and technique as used in SPRINT.[9] In addition, SPRINT recently reported that BP was measured with the participant alone for 5 minutes of rest and the 3 BP determinations (unattended) in 44% of participants and with personnel in the room for the entire time (attended) in 24% of participants. In these 2 groups, achieved BP levels were similar within randomized groups and the intensive group had a similar reduced risk for the primary CVD outcome compared with the standard group when the BP measurement technique used was unattended (HR 0.62, 95% CI 0.51–0.76) or attended (HR 0.64, 95% CI 0.46–0.91, interaction p-value = 0.88)[10]

Although BP can be measured accurately using an auscultatory method, proper technique with the auscultatory method is commonly not observed in clinical practice.[11] Therefore, we strongly recommend the routine use of an automated manometer that can be set to wait for 5 minutes and take and average multiple readings while the person is resting quietly in the proper position. It does not appear to matter whether the person is attended or alone in a room as long as proper BP measurement technique is followed.

Initiation of Therapy

Figure 1 shows the 2017 Hypertension guideline algorithm for BP treatment thresholds and recommendations for treatment and follow-up based on BP levels. Just as JNC 7 class "prehypertension" (SBP 120–139 mmHg or DBP 80–89 mmHg) was coined to call attention to a population at higher risk of development of hypertension and at twice the risk of cardiovascular disease (CVD) as individuals with normal BP (<120/80 mmHg in JNC 7 and 2017 hypertension guidelines) to encourage implementation of lifestyle changes, time will tell whether people learning they have "elevated BP" or "Stage 1" hypertension will be more likely to implement nonpharmacological changes with their provider's guidance. Because a greater percentage of individuals will now have a diagnosis of hypertension, it is incumbent upon primary care providers to emphasize the importance of nonpharmacological interventions to lower BP. The nonpharmacological interventions recommended in the 2017 guidelines are similar to what has been recommended previously: weight loss, heart-healthy diet, sodium reduction, potassium supplementation where appropriate, increase in physical activity, and in those who drink alcohol, moderation of alcohol intake to no more than 2 standard drinks per day in men and 1 in women.

The 2017 guideline recommends nonpharmacological therapy for anyone with confirmed "elevated BP" or hypertension. We agree with this recommendation, as well as considering nonpharmacological therapy for anyone else at high risk of developing hypertension, which probably includes most older individuals; in the Framingham Heart Study, approximately 90% of adults free of hypertension at age 55 or 65 developed hypertension during their lifetimes.[12]

The 2017 guideline recommends consideration of antihypertensive drug treatment for anyone with confirmed SBP of 140 mmHg or greater or DBP of 90 mmHg or greater (Stage 2 hypertension), but for those with SBP of 130 to 139 mmHg or DBP of 80 to 89 mmHg, drug treatment is based on known clinical CVD or an estimated 10-year atherosclerotic CVD risk of 10% or greater using the ACC/AHA Pooled Cohort Equations.[13] Virtually all individuals aged 70 and older and most aged 65 and older will be above this level of CVD risk.[4]

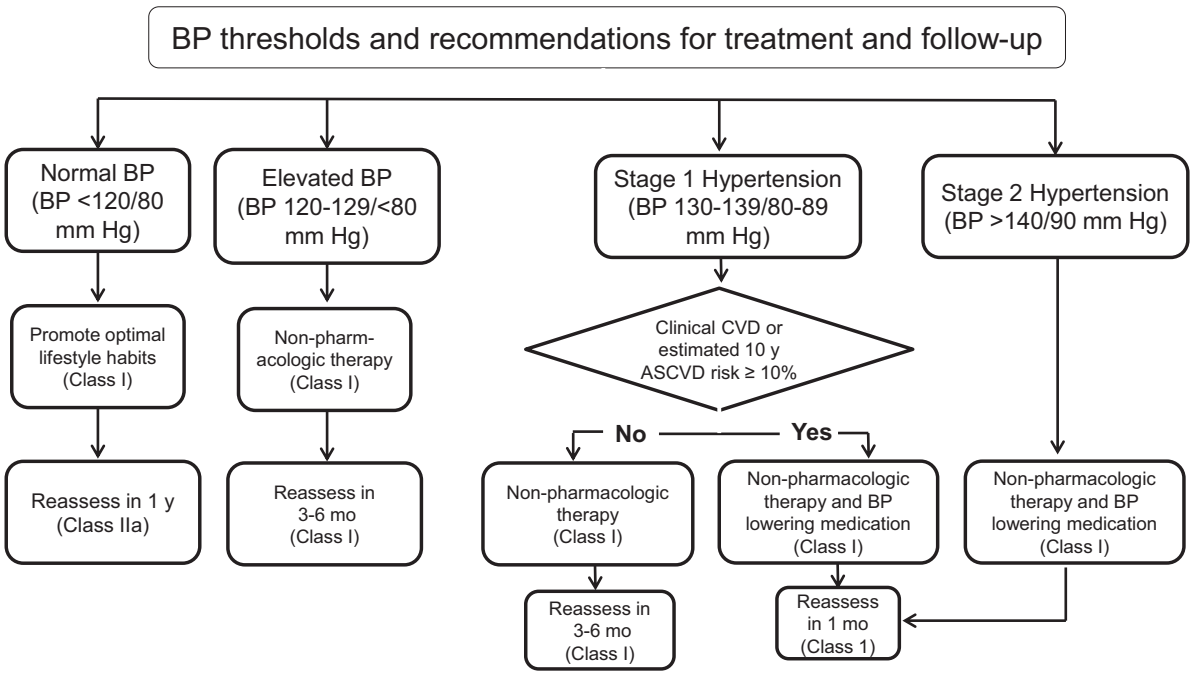

Figure 1. 2017 American College of Cardiology and American Heart Association Hypertension guideline for blood pressure thresholds and recommendations for treatment and follow-up.[1]

We agree with the threshold of drug treatment for SBP of 130 mmHg or greater for persons at high CVD risk. The SPRINT clinical trial, which included individuals aged 50 and older with a SBP of 130 mmHg or greater at high CVD risk and was stopped early for benefit (3.26 years median follow-up) because of a 25% lower chance of the primary CVD outcome and a 27% lower total mortality with an intensive BP treatment goal (SBP <120 mmHg) than a standard BP treatment goal (SBP <140 mmHg) supports this.[5]

Although the 2017 guideline recommendation to initiate antihypertensive drug therapy for a DBP threshold of 80 mmHg for high-risk individuals may be reasonable, it is primarily based on an "expert opinion" recommendation, with a low level of evidence. We are concerned that this expert opinion–based recommendation may distract from the high level of evidence from a number of clinical trials demonstrating the benefit of treating confirmed DBP of 90 mmHg or higher.[2] This "A" level evidence to treat DBP of 90 mmHg or higher is not adequately reflected in the current ACC/AHA guideline and may lead to less emphasis on treatment of diastolic hypertension. Fortunately, in older adults, DBP is less important as a risk factor and unlikely to be high, especially if SBP is treated with medications.[14]

SBP Goals

For individuals initiated on antihypertensive drug therapy, the 2017 guideline recommends a SBP goal of less than 130 mmHg, regardless of age. For individuals with known CVD or with a 10% or greater 10-year ASCVD risk, there is a strong (I) class of recommendation based on a relatively high level of evidence (B) from systematic reviews of meta-analyses of randomized controlled trials (RCTs), whereas for individuals at lower risk, the same goal is considered "reasonable," but the recommendation is based more on observational data.

The guideline goes on to make 2 recommendations specifically for older adults with hypertension. The first is that treatment of hypertension with a SBP treatment goal of less than 130 mmHg is recommended for noninstitutionalized ambulatory community-dwelling adults aged 65 and older with an average SBP of 130 mmHg or higher. This recommendation is given an "A" level of evidence primarily based on the SPRINT results because of the overall results and the even greater absolute benefit in the senior (aged ≥75) subgroup.[5,15] Previous trials had conclusively demonstrated the CVD and mortality benefit of treating older adults to a SBP goal of less than 150 mmHg, which was the basis for the JNC 8 panel recommending that SBP goal in adults aged 60 and older,[2,16–18] but that recommendation was developed nearly 2 years before the reporting of the primary SPRINT results. Not only does SPRINT demonstrate a significant reduction in CVD and mortality in high-risk individuals with hypertension aged 50 and older and similar benefits in the senior subgroup, but the Hypertension in the Very Elderly Trial (HYVET) and SPRINT also reported CVD benefit with the lower treatment goals in each trial in the subgroups of participants who were frail but still living independently in the community.[15,19] Furthermore, the absolute CVD benefits are greater during the course of these trials for older adults because the event rates are higher, but the relative risk reduction is similar regardless of age. For example, in SPRINT the relative risk reduction was 27% overall and 34% for those aged 75 and older, but numbers needed to treat to prevent a CVD event over the course of the trial was 61 overall but 27 for those aged 75 and older; the numbers needed to treat to prevent a death were 90 overall; and 41 for those aged 75 and older. Thus,

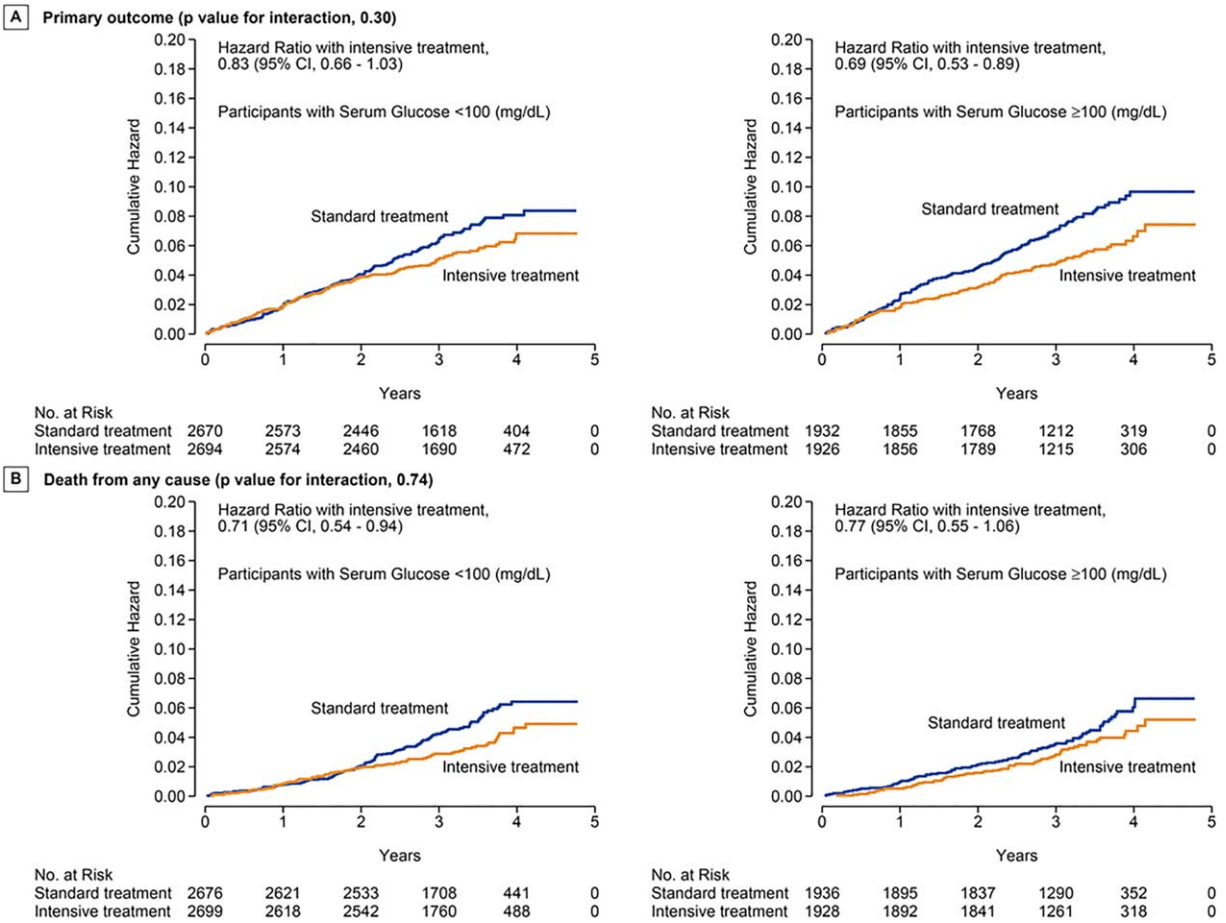

Figure 2. Cumulative incidence of (A) primary outcome and (B) all-cause mortality according to treatment arm stratified according to normoglycemia and prediabetes at baseline in the Systolic Blood Pressure Intervention Trial.[23]

consideration of treatment of older adults with Stage 1 hypertension is important and may carry even more benefit than in younger individuals with hypertension.

The Action to Control Cardiovascular Risk in Diabetes Blood Pressure (ACCORD BP) trial also compared CVD events with an SBP goal of less than 120 mmHg with events with a goal of less than 140 mmHg in individuals with diabetes at high risk of CVD (age 80 years or less).[20] Although the 12% reduction in the primary CVD outcome was not statistically significant, the lower-than-expected event rate contributed to a wide CI (0.73–1.06) that included the point estimate for benefit seen in SPRINT. In addition, stroke was 41% lower (p=.01), the CVD outcome was 26% lower (p=.049) in the standard glycemia subgroup, and a meta-analysis of the only 2 trials (ACCORD and SPRINT) testing a SBP goal of less than 120 mmHg showed significantly fewer CVD events.[20–22] Lending further support for inclusion of individuals with dysglycemia at high risk of CVD in the lower SBP goal recommendation is a post hoc analysis of the "prediabetes" subgroup from SPRINT.[23] Although a known diagnosis of diabetes was an exclusion in SPRINT, 42% (3,898) of participants (mean age 68) had fasting serum glucose of 100 mg/dL or greater, including some with glucose of 125 mg/dL or greater (i.e., diabetes mellitus). The beneficial effects of intensive SBP treatment in SPRINT were similar in those with prediabetes and normoglycemia (Figure 2).[23]

Although the guideline acknowledges that the intensive SBP goal was less than 120 mmHg in SPRINT and ACCORD and that that some high-risk individuals will benefit from a SBP treatment goal of less than 120 mmHg, it recommends the less than 130 mmHg SBP goal because it was more consistent with the results of meta-analyses, the "specific inclusion and exclusion criteria of any RCT may limit extrapolation to a more general population with hypertension," and the BP measurements in trials were more consistent with guideline recommendations than is common in clinical practice, resulting in lower absolute values for SBP. However, if BP is measured correctly, which we believe should become the norm because incorrectly measured BP leads to unpredictable variation and uncertainty of what the BP would be if taken correctly, clinicians should consider the SBP goal of less than 120 mmHg, not less than 130 mmHg, in the appropriate individuals at high risk of CVD, including older adults.

The second 2017 guideline recommendation concerning SBP goals in older adults is that, for older adults (≥65) with hypertension and a high burden of comorbidity and limited life expectancy, clinical judgment, individual preference, and a team-based approach to assess risks and benefits is reasonable for decisions regarding intensity of BP lowering and choice of antihypertensive drugs. This recommendation is based on expert opinion but seems to

be an appropriate caveat, but clinicians should be careful not to use this precaution to avoid pursuing an intensive SBP goal in older adults who are likely to attain CVD or mortality benefits regardless of age. Although older adults treated with antihypertensive drugs are more likely to experience serious adverse events (SAEs), as was seen in SPRINT, and should undergo more careful monitoring than younger individuals, the intensive group in SPRINT did not experience more overall SAEs than the standard group, including in those aged 75 and older.[15] In SPRINT, the incidence of the SAEs of hypotension, electrolyte abnormalities, and acute kidney injury was 1.0% to 1.5% greater in the intensive group than the standard group. There were similar differences, but they did not achieve statistical significance, in those aged 75 and older, and intensive treatment did not increase orthostatic hypotension, syncope, and falls in those aged 75 and older or overall. Nevertheless, adverse events, whether caused by or potentially modified by antihypertensive drugs, will occur more often in older than younger adults with hypertension, so monitoring of and adjustments in medications should be conducted based on clinical response. The SPRINT investigators were encouraged to modify therapy based on individual response, and most SAEs were managed successfully, including in the older adults.

DBP Goals

As mentioned previously, the 2017 guideline recommends initiating antihypertensive drugs in individuals at high risk of CVD at a DBP threshold of 80 mmHg, but it also recommends a DBP treatment goal of less than 80 mmHg for adults with confirmed hypertension, with or without additional markers of CVD risk, for a combined BP treatment goal of less than 130/80 mmHg. The class of recommendation is stronger for those at higher risk, but the level of evidence for both is expert opinion. Only one major RCT, the Hypertension Optimal Treatment Trial (HOT), compared a DBP goal of 80 mmHg or less with higher DBP goals ($\leq$85 and $\leq$90 mmHg); it did not find any benefit or harm with the lower goal in nearly 19,000 individuals with hypertension, except for fewer CVD events in a post hoc analysis of the diabetes subgroup.[24] Although this expert opinion recommendation for a DBP treatment goal of less than 80 mmHg may be reasonable in light of the lifetime greater CVD risk associated with levels above 80 mmHg, clinicians and individuals may forget the very strong evidence ("A") for a DBP treatment goal of less than 90 mmHg, based on RCTs beginning in the 1960s, as the JNC 8 panel summarized.[2] High DBP is much less common in older persons, and isolated systolic hypertension is the predominant form of hypertension in older persons, but DBP should also be treated, if it is high.[25]

There has been renewal of concern for the J-curve hypothesis—that treating DBP to below some threshold level (e.g., 70 mmHg) using antihypertensive drugs will result in more cardiovascular events or mortality.[26] This has been based on observational analyses and not been demonstrated in groups randomized to a lower BP goal in RCTs. Recently, the SPRINT investigators reported that low baseline DBP in the trial was associated with greater risk of the primary CVD outcome, as has been observed in other trials, although the intensive SBP intervention reduced CVD and mortality to a similar degree across baseline DBP quintiles, including the lowest DBP quintile (<68 mmHg, mean 61 mmHg) (Table 2).[27]

Selection of Antihypertensive Drug Therapy

Similar to the JNC 8 panel guideline, the 2017 hypertension guideline recommends initiation of antihypertensive drug therapy with one of the classes with the best CVD outcome data from RCTs: thiazide diuretics, calcium channel blockers (CCBs), and angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs), but not ACEIs and ARBs together. Primary consideration should be given if particular drug classes are indicated for comorbid conditions, if present. In blacks, thiazide diuretics or CCBs were preferred over ACEIs or ARBs. For older adults, thiazide diuretics, especially chlorthalidone, were mentioned as being particularly desirable because of their prevention of heart failure, an increasingly common event in older persons. Beta-blockers were significantly less effective than diuretics for prevention of stroke and cardiovascular events in the meta-analysis conducted with the 2017 guideline.[28] Alpha$_1$ blockers and central alpha$_2$ agonists were highlighted as likely to produce more adverse effects in older adults.

As in JNC 7, the 2017 guideline recommended initiation of antihypertensive drug therapy with 2 first-line agents of different classes as separate agents or in a fixed-dose combination in adults with Stage 2 hypertension and an average BP more than 20/10 mmHg above their BP target, although caution was advised in initiating 2-drug therapy in older adults because hypotension or orthostatic hypotension may develop in some individuals. In SPRINT, therapy was usually initiated with at least 2-drug therapy in the intensive group. Investigators had the option of initiating therapy with 1 drug in individuals aged 75 and older with SBP less than 140 mmHg on 1 or fewer medications at study entry, although a second medication was to be added at the 1-month visit if the participant was asymptomatic and SBP was 130 mmHg or greater.

Table 2. Effects of Intensive Systolic Blood Pressure (SBP) Lowering on Primary Cardiovascular Disease (CVD) Outcome and Comparison of Mortality Between Lowest and Upper Four Diastolic Blood Pressure (DBP) Quintiles of baseline DBP in Systolic Blood Pressure Intervention Trial[27]

Outcome	Intensive vs Standard in Lowest DBP Quintile	Intensive vs Standard in Upper 4 DBP Quintiles	Interaction P-Value
	Hazard Ratio (95% Confidence Interval)		
Primary CVD outcome	0.78 (0.57–1.07)	0.74 (0.61–0.90)	.78
All-cause death	0.88 (0.60–1.29)	0.68 (0.53–0.87)	.29

All of these drug therapy recommendations are similar to the approach used in SPRINT—other approaches may lead to more SAEs than observed in SPRINT, especially in older adults.

Summary

The 2017 ACC/AHA hypertension guideline is a comprehensive document that is largely based on systematic reviews and meta-analyses. Therefore, the classification of BP, BP thresholds for initiating drug therapy, and BP treatment goals do not completely line up with specific levels proven in RCTs but are largely reasonable based on lifetime risk. Nevertheless, when caring for older adults, we believe it is important for clinicians to be mindful of the specific BP goals proven to reduce CVD events in this population; be attentive to proper BP measurement technique to apply the goals correctly; encourage prudent nonpharmacological interventions; and monitor people appropriately for concomitant conditions, adverse drugs effects, and complications of hypertension. Adjustments to therapy and goals may be necessary as older adults become increasingly frail, cognitively impaired, or institutionalized, or have a limited life expectancy,[29] although many frail older adults will still benefit from appropriate antihypertensive nonpharmacological and drug therapy.

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