Implications of the 2017 American College of Cardiology/American Heart Association Hypertension Guideline in a Modern Primary Prevention Multi-Ethnic Prospective Cohort (Multi-Ethnic Study of Atherosclerosis)

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The American College of Physicians and the American Academy of Family Physician did not endorse the 2017 American College of Cardiology/American Heart Association (ACC/AHA) hypertension guidelines citing multiple concerns. We assessed the increase in antihypertensive medication eligibility introduced by the 2017 hypertension guideline and the risk profile of those newly eligible for blood pressure medication using participants from the MultiEthnic Study of Atherosclerosis. The antihypertensive medication eligibility criteria of the Joint National Commission (JNC) VII, JNC VIII, and the 2017 ACC/AHA hypertension guidelines were applied to the cohort and the risk profile of those newly eligible was compared with those ineligible for antihypertensive medication under the 2017 ACC/AHA guidelines using Kaplan-Meier and Cox proportional hazard analysis. The new guideline increased antihypertensive medication eligibility by 46.8% and 96.7% compared with the JNC VII and JNC VIII guideline respectively. The newly eligible group did not have an increased risk of incident atherosclerotic cardiovascular disease, heart failure, or death compared with those ineligible (HR [95%CI]: 1.26 [0.96 to 1.65], p = 0.10; 0.75 [0.45 to 1.26], p = 0.27; 1.06 [−0.84 to 1.36], p = 0.62, respectively) after adjusting for age, gender, and race. The 2017 ACC/AHA hypertension guidelines extend antihypertensive medication to a substantial number of individuals, although the risk profile of the newly eligible group appears similar to those ineligible for antihypertensive medication after adjusting for non-modifiable risk factors. **(Am J Cardiol 2019;123:1076−1082)**

Hypertension is a leading cause of mortality and morbidity in both developing and developed countries and is the most common modifiable cardiovascular risk factor. The 2017 American College of Cardiology/American Heart Association (ACC/AHA) hypertension guideline[1] was developed to replace the Joint National Commission (JNC) VII[2] and its updated guideline JNC VIII,[3] although the new guideline was met with significant criticism from the American College of Physicians and the American Academy of Family Physicians. Neither group endorsed the guideline but rather introduced a joint recommendation to supplant the 2017 ACC/AHA,[4] citing concerns including the lack of systematic review data,[1] the inclusion of the unvalidated atherosclerotic cardiovascular risk tool, and most importantly the lack of hard evidence supporting cardiovascular benefit.[5−7] Although studies have been done evaluating how the new guideline affects the prevalence of hypertension and may reduce important outcomes,[8−9] it is still unknown whether those that are newly eligible for blood pressure medication have an increased risk of adverse cardiovascular events. We used data from the Multiethnic Study of Atherosclerosis (MESA) to measure incident atherosclerotic cardiovascular disease (ASCVD), congestive heart failure (CHF), and death in those newly eligible for antihypertensive medication under the 2017 ACC/AHA guideline.

Methods

The design of the MESA study has been published elsewhere.[10] In brief, MESA is a prospective community-based cohort study to investigate the prevalence, correlates, and progression of subclinical cardiovascular disease (CVD) in patients without known CVD at baseline. The full cohort

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includes 6,814 women and men of ages 45 to 84 years recruited from 6 U.S. communities (Baltimore, Maryland; Chicago, Illinois; Forsyth County, North Carolina; Los Angeles County, California; northern Manhattan, New York; and St. Paul, Minnesota). MESA included 38% white, 28% African-American, 22% Hispanic, and 12% Chinese adults. Demographics, medical history, anthropometric and laboratory data for the present study were taken from the first examination (July 2000 to August 2002). The MESA study was approved by the institutional review boards of each study site, and written informed consent was obtained from all participants. Blood pressure was measured at rest in the sitting position using a Dinamap automated device (model PRO 100, GE Healthcare). Three measurements were taken 5 minutes apart using the right arm and the average of the last 2 measurements were used. For the current analysis, we excluded participants who had missing data related to traditional risk factors, follow-up, or those who were using antihypertensive medications at the baseline examination. Thus the cohort used for this analyses were free of clinical CVD (primary prevention) and were also not on any antihypertensive medication during the MESA baseline examination.

As part of the baseline examination, clinical teams collected information on traditional and nontraditional cardiovascular risk factors. Current smoking was defined as having smoked a cigarette in the last 30 days. Use of medications was based on medication inventory. Diabetes mellitus was defined as self-reported history of diabetes mellitus, diabetes medication use, or fasting glucose ≥126 mg/dl. Blood pressure at rest was measured 3 times in the seated position, and the average of the second and third readings was recorded. Body mass index (BMI) was calculated as weight (kg) divided by height (m^2). Total and high density lipoprotein (HDL) cholesterol were measured from blood samples obtained after a 12 hour fast. Low-density lipoprotein (LDL) cholesterol was estimated by the Friedewald equation.[11] Left ventricular ejection fraction during the MESA baseline examination was measured using cardiac magnetic resonance imaging as extensively reported in previous studies.[12]

Antihypertensive medication eligibility (AHTE) definitions were based on JNC VII, JNC VIII, and 2017 ACC/AHA guidelines. JNC VII AHTE was defined as: all MESA participants with systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg during.[2] JNC VIII AHTE was defined as: all MESA participants without diabetes mellitus and chronic kidney disease (CKD), SBP ≥ 150 mmHg or DBP ≥90 mmHg if age ≥60 years and SBP 140 mmHg or DBP 90 mmHg if < 60years. For participants with diabetes mellitus and/or CKD, SBP ≥ 140 mmHg or DBP ≥ 90 mmHg defines AHTE irrespective of age.[3] 2017 ACC/AHA AHTE was defined as: all MESA participants with SBP ≥ 140 mmHg or DBP ≥ 90 mmHg. In addition, participants with a 10-year atherosclerotic cardiovascular risk calculated using the Pooled Cohort Equation[13] ≥10% and SBP 130 to 139 mmHg or DBP 80 to 89 mmHg.[1]

A detailed description of the event ascertainment procedures and the adjudication process in MESA has been published.[14] Briefly, MESA participants were contacted at regular intervals following baseline examination to inquire about changes in their medical history, including hospitalization and new diagnoses. Documentation is then sent to at least 2 MESA morbidity and mortality committee members for adjudication using a standard protocol. The MESA morbidity and mortality committee include cardiologists, physician epidemiologists, and neurologists. For the purposes of this study, we define incident ASCVD as adjudicated myocardial infarction, coronary heart disease death, and fatal and nonfatal stroke as described by the MESA protocol (www.mesa.nhlbi.org).

Incident CHF is adjudicated as definite, probable, or absent. Definite or probable CHF require heart failure symptoms, such as shortness of breath or edema; probable CHF required CHF diagnosed by a physician and patient receiving medical treatment for CHF. Definite CHF required 1 or more other criteria, such as pulmonary edema/congestion by chest x-ray; dilated ventricle or poor LV function by echocardiography or ventriculography; or echocardiography evidence of left ventricular diastolic dysfunction. Participants who had only a physician diagnosis of CHF without any other evidence were classified as "no CHF." Individuals with adjudicated definite or probable CHF were used in our analysis. Demographic, clinical, and CVD risk factor characteristics were reported for MESA participants eligible for antihypertensive medications per the 3 guidelines (JNC VII, JNC VIII, and 2017 ACC/AHA) and the newly eligible defined as participants who are eligible under 2017 ACC/AHA but not under the JNC VIII guidelines. Mean and standard deviation or percent were reported for continuous and categorical variables, respectively.

We sought to answer 3 important questions in our analysis. (1) *What percentage of individuals will be newly eligible for antihypertensive medications under the 2017 ACC/AHA hypertension guidelines (primary prevention)?* Using the 3 guidelines, participants who are eligible for antihypertensive medications are determined for each guideline. The difference between those eligible under 2017 ACC/AHA and the JNC VII is expressed as a percentage. The difference between those eligible under 2017 ACC/AHA and JNC VIII is also expressed as a percentage. (2) *What is the risk associated with AHTE per each guideline for ASCVD, CHF, and total mortality?* Cox proportional hazard regression analysis was used to assess the risk associated with AHTE under each of the 3 guidelines and 10 years of incident ASCVD, CHF, and total mortality adjusting for confounders such as age, gender, race/ethnicity, LDL & HDL cholesterol, GFR, BMI, diabetes mellitus, statin use, and smoking status. To estimate the risk reduction associated with the treatment of blood pressure in those eligible versus those ineligible per each guideline, blood pressure was not adjusted for in our full models. (3) *How does the observed 10-year risk of ASCVD, CHF, and total mortality of the newly eligible compares with those ineligible for antihypertensive medications under the 2017 ACC/AHA hypertension guideline?* For this analysis the newly eligible group was defined as those eligible under the 2017 ACC/AHA but not under the JNC VIII hypertension guidelines. The comparative group is participants not eligible for AHTE under the 2017 ACC/AHA guideline (ineligible). Kaplan-Meier analysis was used to compare the event-free survival of the newly eligible participants with the ineligible

participants. Cox proportional hazard regression analysis was used to assess the risk associated with new eligibility and 10 years of incident ASCVD, CHF, and total mortality adjusting for (1) age, gender, and race/ethnicity (model 2) and (2) confounders such as age, gender, race/ethnicity, LDL & HDL cholesterol, GFR, BMI, diabetes mellitus, statin use, and smoking status (model 3). To estimate the risk reduction associated with the treatment of blood pressure in the newly eligible versus those ineligible per the 2017 ACC/AHA guideline, blood pressure was not adjusted for in our full models. The association between increasing SBP and incident ASCVD/CHF/death in the newly eligible group was also assessed using adjusted cubic spline analysis with knots at SBP of 130 mmHg, 135 mmHg, and 140 mmHg (reference SBP = 130 mmHg).

Results

Of 6,814 MESA participants recruited, 4,547 (66.7%) were not on antihypertensive medications during the baseline exam and therefore were included in this analysis. Those eligible for antihypertensive medication were 772 of 4,547 (18%), 576 of 4,547 (12.7%), and 1113 of 4,547 (24.9%) based on the JNC VII, JNC VIII, and the 2017 ACC/AHA, respectively. Comparing the 2017 ACC/AHA guideline with JNC VII, there was a 361 of 772 (46.8%) increase in AHTE. Comparing the 2017 ACC/AHA with the JNC VIII, there was 557 of 576 (96.7%) increase in antihypertensive medication eligibility.

Table 1 shows the demographic, clinical, and CVD risk characteristics of the groups under consideration. Participants in the newly eligible group were older, less likely to be females, have lower blood pressure, more likely to be on statins and less likely to have CKD at baseline compared with those eligible under the 3 blood pressure guidelines. After 10 years of follow-up, 413 of 4,547 (9.1%) ASCVD events occurred, 135 of 4,547 (3.0%) heart failure events occurred, and 546 of 4,547 (12.0%) total mortality (deaths) occurred. AHTE by each of the 3 guidelines was independently associated with incident ASCVD and CHF but not with total deaths (Table 2).

For the sake of this analysis, newly eligible is defined as participants eligible for antihypertensive medication under the 2017 ACC/AHA hypertension guideline but not under the JNC VIII update (n = 557). After 10-years of follow-up 82 of 557 (14.7%) had an adjudicated ASCVD, 20 of 557 (3.6%) had adjudicated CHF, and 125 of 557 (22.4%) died.

The newly eligible participants had a significantly lower event-free survival for incident ASCVD (Figure 1), CHF (Figure 2), and death (Figure 3) compared with those not eligible for antihypertensive medications under the 2017 ACC/AHA guideline. As shown in Table 3, compared with the ineligible

Table 1
Demographic characteristics of MESA participants and those who qualify for antihypertensive medications per each guideline, and those newly eligible (2017 ACC/AHA minus JNC VIII)

Variable	Total (N = 4547) (Mean ± SD)	JNC VII Eligible (N = 772) (Mean ± SD)	JNC VIII Eligible (N = 576) (Mean ± SD)	2017 ACC/AHA (N = 1133) (Mean ± SD)	Newly Eligible (N = 557) (Mean ± SD)
Age (Years)	60.5 ± 10.2	66.1 ± 9.7	64.5 ± 10.2	67.2 ± 9.2	70.0 ± 7.0
Women	51.1%	50.9%	51.4%	54.8%	38.8%
White	42.4%	38.5%	36.4%	39.5%	42.7%
Black	21.6%	27.5%	29.2%	26.3%	23.3%
Chinese	12.8%	10.8%	10.6%	10.9%	11.2%
Hispanic	23.2%	23.2%	23.8%	23.3%	22.8%
BMI (kg/m^2)	27.6 ± 5.2	28.4 ± 5.5	28.9 ± 5.6	28.2 ± 5.2	27.4 ± 4.8
Cholesterol (mg/dl)					
Total	196.5 ± 35.6	200.6 ± 34.2	200.3 ± 34.4	200.1 ± 36.2	199.9 ± 38.0
LDL	119.5 ± 31.5	121.3 ± 29.8	121.4 ± 29.9	121.3 ± 30.5	121.3 ± 31.1
HDL	51.3 ± 15.1	52.3 ± 16.7	51.1 ± 15.0	51.0 ± 15.3	51.0 ± 1.5
Triglycerides	129.0 ± 87.5	137.5 ± 82.2	142.0 ± 85.9	141.0 ± 106.3	140.0 ± 123.9
Blood Pressure (mmHg)					
Systolic	121.6 ± 19.6	153.7 ± 13.0	156.7 ± 13.6	147.2 ± 14.6	137.5 ± 7.2
Diastolic	70.7 ± 9.9	80.5 ± 9.7	82.0 ± 9.9	78.8 ± 9.5	75.4 ± 7.9
Cigarette smokers					
Never	49.5%	47.6%	48.6%	45.6%	42.5%
Former	36.2%	39.9%	37.3%	40.5%	43.9%
Current	14.3%	12.5%	14.1%	13.9%	13.6%
LVEF (%)	68.6 ± 7.2	68.9 ± 8.4	68.5 ± 8.5	68.7 ± 8.2	68.9 ± 8.0
Statin Use	10.0%	10.9%	9.6%	11.3%	13.3%
Diabetes Mellitus	8.0%	10.9%	14.6%	14.6%	7.9%
CKD	14.2%	21.6%	27.0%	22.2%	15.3%
ASCVD Events	9.1%	17.6%	18.1%	16.3%	14.6%
CHF Events	3.0%	6.6%	7.8%	5.7%	3.6%
MI	3.2%	6.0%	6.4%	5.1%	3.8%
Stroke	2.4%	4.9%	5.2%	5.0%	4.0%

MI = myocardial infarction, CKD = chronic kidney disease; LVEF = left ventricular ejection fraction; CHF = congestive heart failure; ASCVD = atherosclerotic cardiovascular disease; BMI = body mass index.

Table 2
Association between antihypertensive medication eligibility per the JNC VII, JNC VIII, 2017 ACC/AHA hypertension guidelines; and the newly eligible for antihypertensive medication (2017 ACC/AHA minus JNC VIII) , and incident atherosclerotic cardiovascular disease (ASCVD) (n = 413), congestive heart failure(CHF) (n = 135) and total mortality (n = 546) in MESA after 10 years of follow-up

Guideline	N	Event	Univariate HR (95%CI)	P value	Multivariable* HR (95%CI)	P value
JNC VII Eligible Versus JNC VII Ineligible	772	ASCVD	2.67 (2.17-3.22)	<0.0001	1.89 (1.53-2.34)	<0.0001
		CHF	3.21 (2.27-4.55)	<0.0001	1.84 (1.18-2.87)	0.007
		Total Death	1.99 (1.65-2.40)	<0.0001	1.14 (0.94-1.39)	0.18
JNC VIII Eligible Versus JNC VIII Ineligible	576	ASCVD	2.55 (2.05-3.19)	<0.0001	1.95 (1.55-2.45)	<0.0001
		CHF	3.72 (2.60-5.32)	<0.0001	2.33 (1.48-3.67)	0.0003
		Total Death	1.78 (1.44-2.20)	<0.0001	1.14 (0.91-1.41)	0.25
2017 ACC/AHA Eligible Versus 2017 ACC/AHA Ineligible	1133	ASCVD	2.74 (2.26-3.33)	<0.0001	1.57 (1.28-1.94)	<0.0001
		CHF	3.05 (2.17-4.27)	<0.0001	1.54 (1.00-2.39)	0.048
		Total Death	2.42 (2.04-2.86)	<0.0001	1.11 (0.93-1.33)	0.25

* Adjusted for age, gender, race/ethnicity, BMI, diabetes mellitus status, cigarette smoking status, LDL cholesterol, HDL cholesterol, statin use status. Additionally for CHF: LVEF and antecedent MI.

group (n = 3,414), the newly eligible had a higher risk for incident ASCVD, CHF, and total death in (model 1) univariate Cox analysis (HR [95%CI]: 2.44 [1.89 to 3.14], o < 0.0001; 1.90 [1.16 to 3.12], p = 0.01, and 2.68 [2.18 to 3.30], p < 0.0001, respectively). The increased risk was attenuated when model 1 was adjusted for age gender and race (model 2) (HR [95%CI]: 1.26 [0.96 to 1.65], p = 0.10; 0.75 [0.45 to 1.26], p = 0.27, and 1.06 [0.85 to 1.36], p = 0.62, respectively). In our full model which adjusted for confounders except blood pressure, the risk for 10 year ASCVD, CHF, and death was also not significantly higher in the newly eligible compared with those ineligible (HR [95%CI]: 1.18 [0.90 to 1.55], p = 0.23; 0.83 [0.44 to 1.54], p = 0.54 and 1.06 [0.85 to 1.32], p = 0.61, respectively) (Table 2). The adjusted cubic spline analysis with reference risk of 130 mmHg SBP showed a significant nonlinear association between increasing SBP (130 to 140 mmHg) for

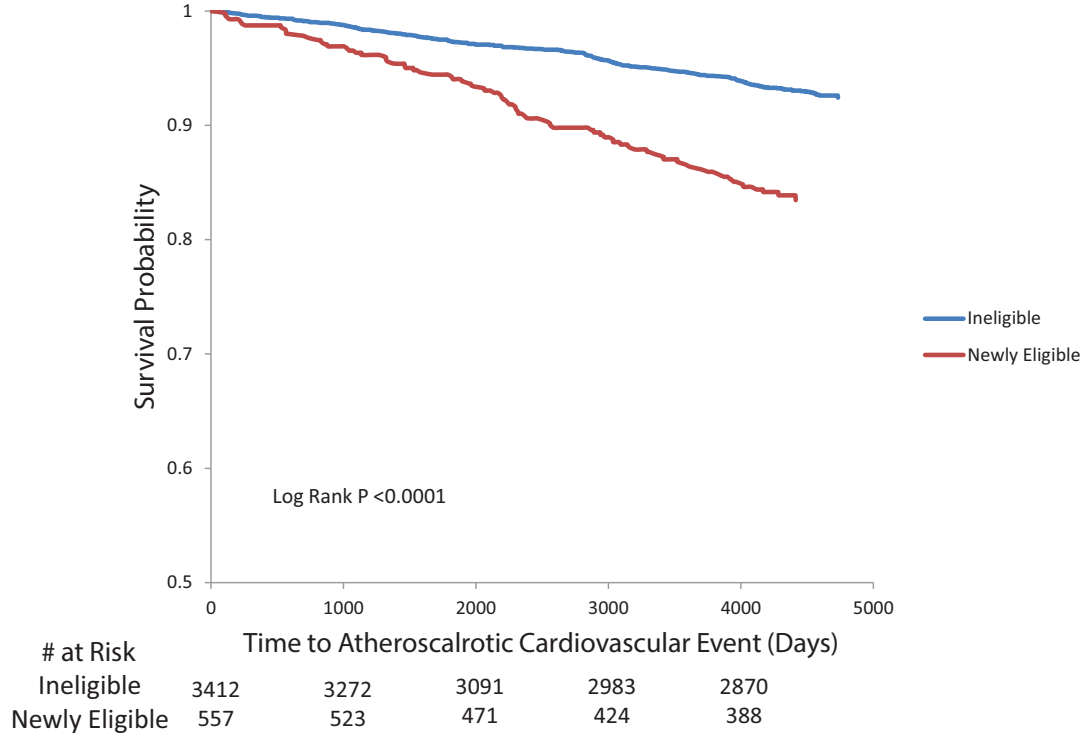
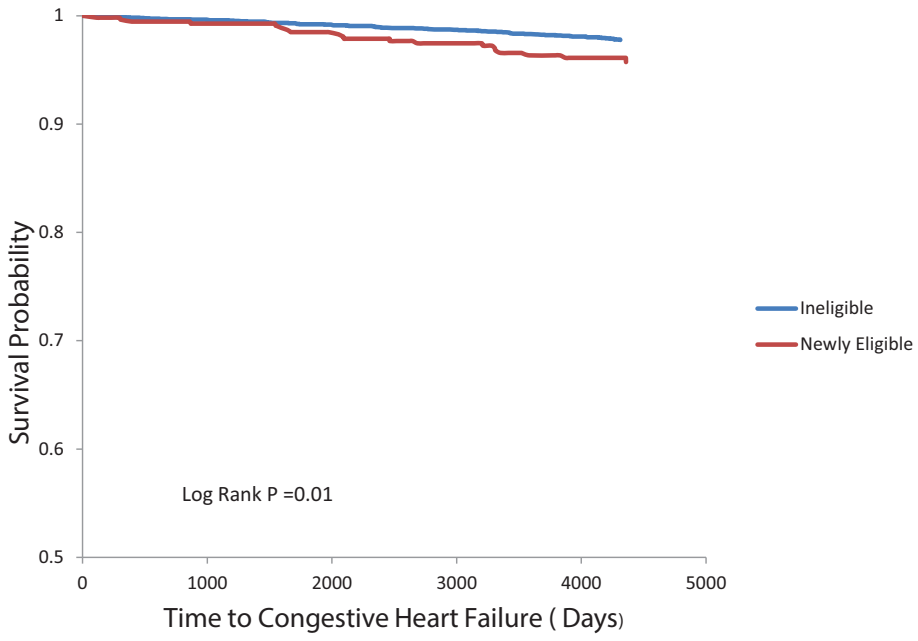
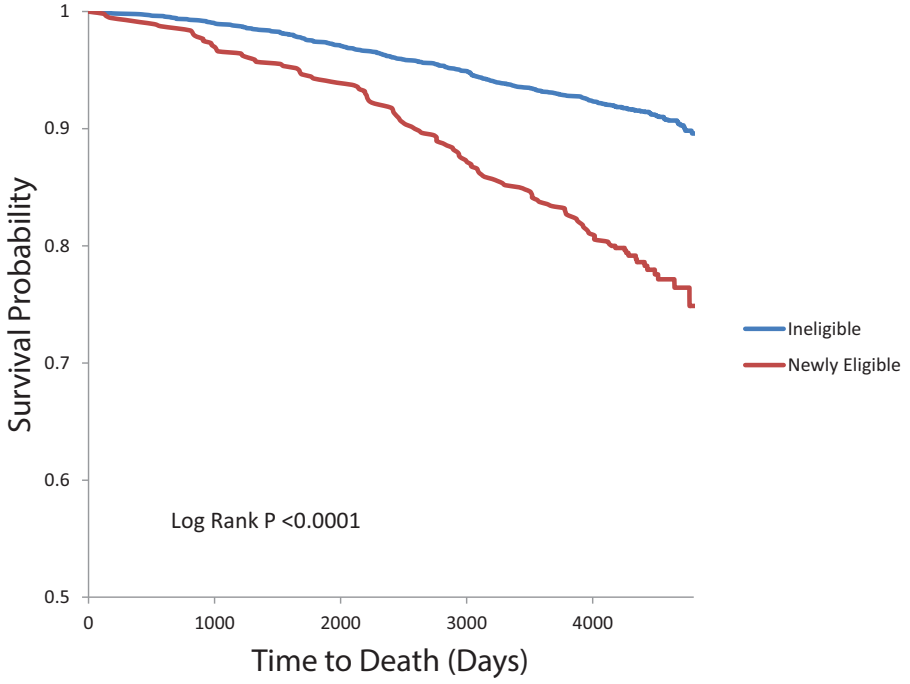


Figure 1. Kaplan-Meier curves showing the event-free survival of ineligible and newly eligible (2017 ACC/AHA minus JNC VIII) for incident Atherosclerotic cardiovascular disease events in MESA.



# at Risk					
Ineligible	3412	3297	3142	3049	2952
Newly Eligible	557	531	488	452	420

Figure 2. Kaplan-Meier curves showing the event-free survival of ineligible and newly eligible (2017 ACC/AHA minus JNC VIII) for incident Congestive Heart Failure events in MESA.



# at Risk					
Ineligible	3412	3379	3313	3239	3151
Newly Eligible	557	544	526	489	454

Figure 3. Kaplan-Meier curves showing the event-free survival of ineligible and newly eligible (2017 ACC/AHA minus JNC VIII) for total death in MESA.

Table 3
Comparing the observed risk between the newly eligible (2017 ACC/AHA vs JNC VIII) and individuals ineligible for antihypertensive medication under the 2017 ACC/AHA hypertension guidelines for 10 year atherosclerotic cardiovascular disease event (ASCVD), congestive heart failure (CHF), and death

Comparison	Outcomes	Model 1 HR(95%CI)	P value	Model 2 HR(95%CI)	P value	Model 3 HR(95%CI)	P value
Newly Eligible (n = 557) Versus Ineligible (n = 3414)	ASCVD	2.44 (1.89-3.14)	<0.0001	1.26 (0.96-1.65)	0.10	1.18 (0.90-1.55)	0.23
	CHF	1.90 (1.16-3.12)	0.01	0.75 (0.45-1.26)	0.27	0.83 (0.44-1.54)	0.54
	Total Death	2.68 (2.18-3.30)	<0.0001	1.06 (0.84-1.36)	0.62	1.06 (0.85-1.32)	0.61

Model 1: Univariate Cox model; Model 2: model 1 adjusting for age, gender and race/ethnicity; Model 3: model 1 adjusting for age, gender, race/ethnicity, BMI, diabetes mellitus status, cigarette smoking status, LDL cholesterol, HDL cholesterol, statin use status. Additionally for CHF: left ventricular ejection fraction and antecedent myocardial infarction.

incident ASCVD (Supplemental Figure 1A) in the newly eligible group. A nonsignificant association was found in the adjusted cubic spline analysis for incident CHF (Supplemental Figure 1B) and total death (Supplemental Figure 1C) in the newly eligible group.

As a sensitivity analysis, we repeated the analysis using the newly eligible based on the JNC VII guideline (n = 361). Those who had an adjudicated ASCVD, CHF, or died after 10 years of follow-up were 49 of 361(13.6%), 14 of 361 (3.9%), and 81 of 361 (22.4%). In the univariate Cox models, new eligibility based on JNC VII was associated incident ASCVD, CHF and death (HR [95%CI]: 2.27 [1.67 to 3.09], $p < 0.0001$; 2.05 [1.16 to 3.64], $p = 0.014$ and 2.70 [2.11 to 3.45], $p < 0.0001$, respectively). The association was attenuated when the Cox model was adjusted for age, gender, and race/ethnicity (HR [95%CI]: 1.44 [0.99 to 2.09], $p = 0.06$; 0.65 [0.28 to 1.50], $p = 0.31$ and 1.03 [0.75 to 1.41], $p = 0.87$). No significantly increased risk was found when the newly eligible was compared with those ineligible for ASCVD, CHF, and death in the full Cox models in which blood pressure was excluded (HR [95%CI]: 1.01 [0.73 to 1.40], $p = 0.96$; 0.96 [0.49 to 1.89], $p = 0.91$ and 1.03 [0.80 to 1.33], $p = 0.82$, respectively).

Discussion

Our study showed that compared with the JNC VII guideline and its update JNC VIII, the 2017 ACC/AHA hypertension guideline resulted in a 47% and 97% increased AHTE in this multiethnic primary prevention cohort. Our study also showed that the newly eligible participants had similar risk for 10-year ASCVD, CHF, and death as those ineligible for AHTE per the 2017 ACC/AHA guideline when nonmodifiable CVD risk factors (age, gender, and race) were adjusted for in the model (and also in our full model that excluded blood pressure), suggesting that the risk associated with modifiable CVD risk factors including blood pressure was similar in the newly eligible and ineligible group for primary prevention.

Our study highlights residual risk considerations in primary prevention of CVDs. However, it should be noted that this residual risk is common to all CVD risk factors, modifiable and nonmodifiable. A joint effort to reduce the residual risk targeting CVD risk factor(s) in which aggressive treatment has been demonstrated to be associated with minimal or no risk is needed. For example, because aggressive management of lipids has been shown to be less harmful[15] than blood pressure,[9,16] residual risk may be targeted by aggressive lipid management instead of blood pressure for optimal risk-benefit ratios. Our study showed in our univariate Cox models that the newly eligible had high risk for ASCVD, CHF, and death. This increased risk was attenuated when age, gender, and race which are nonmodifiable risk factors are adjusted for (model 2). Thus, the residual risk in the newly eligible group versus the ineligible group may not necessarily be due to their blood pressure, lipids, or other modifiable risk factors.

The authors of the 2017 ACC/AHA hypertension guideline in addition to recommending antihypertensive medications to individuals with SBP ≥ 140 mmHg and or DBP ≥ 90 mmHg also added those with 10 year ASCVD risk > 10% and SBP 130 to 139 mmHg or 80 to 89 mmHg. The extending of AHTE to individuals with 10-year ASCVD >10% and SBP 130 to 139 mmHg or DBP 80 to 89 mmHg is the most contentious part of the new guideline with limited data to support it. However, the ASCVD risk calculator[13] has not been validated for blood pressure treatment. The Pooled Cohort Equation[13] was developed to determine statin/lipid lowering eligibility to reduce primary ASCVD events in the United States' population.[17] It should be noted that unlike cholesterol, blood pressure has numerous downstream complications which are not mediated through the atherosclerotic pathway such as cardiomyopathy/heart failure, CKD, and blindness in others. The multiplicity of pathways through which hypertension leads to end organ damage makes it very difficult to assess using a risk prediction tool or biomarker to refine treatment. There is also the potential that 1 risk tool or biomarker that help refines risk for 1 hypertension-related end organ damage may lead to worsening of another outcome. For example, it is possible that a risk tool or biomarker which leads to improved outcome for ASCVD may worsen CKD. Thus, given the myriad of complications associated with blood pressure/hypertension, caution must be exercised or at the very least the introduction of these risk tools or biomarkers into guidelines should be data driven.

Our study has several limitations. First, our study is observational and subject to residual confounding. We also excluded all MESA participants who were on antihypertensive medications during the baseline exam. We did so because MESA baseline exam was in 2000 to 2002. Before any of the hypertension guidelines were introduced. We therefore do not know what guideline was used to allot

antihypertensive medications to these participants and their recorded blood pressures were also as a result of antihypertensive therapy. Eliminating those on antihypertensive therapy at baseline may have introduced a bias in our findings. The sample size of the newly eligible may also have affected our findings. We also did not account for changes in medication usage, including antihypertensives, cholesterol lowering medications, and antiplatelet agents that may have occurred during the follow-up period. Lastly, MESA only included 4 race/ethnicities aged 45 to 84 years. Our results may not be applicable to other ethnicities and age groups.

In conclusion, the 2017 ACC/AHA hypertension guideline resulted in a 47% and 97% incremental increase in AHTE compared with the JNC VII and JNC VIII guideline respectively in this multiethnic cohort. However, our study did not observe significant excess risk for ASCVD, CHF, or death in the newly eligible group compared with the ineligible group when nonmodifiable risk factors were adjusted for in our models. Although our study has limitations, it suggests that the risk profile of those newly eligible for AHTE may not be different from those considered ineligible, resulting in over treatment with little benefit. More studies with larger cohorts are needed to assess the risk profile of this newly eligible group.

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Disclosure

The authors have no conflicts of interest to disclose.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.1016/j.amjcard.2018.12.040.

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