

ARIC Manuscript Proposal # 3255

PC Reviewed: 10/9/18
SC Reviewed: _____

Status: _____
Status: _____

Priority: 2
Priority: _____

1.a. Full Title: Characteristics of hypertension control in older adults – Atherosclerosis Risk in Communities Study

b. Abbreviated Title (Length 26 characters): Hypertension and older adults

2. Writing Group:

Writing group members: Kathryn Foti, Kunihiro Matsushita, Silvia Koton, Keenan Walker, Joe Coresh, Larry Appel, Elizabeth Selvin, Others welcome

I, the first author, confirm that all the coauthors have given their approval for this manuscript proposal. __KF__ **[please confirm with your initials electronically or in writing]**

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ARIC author to be contacted if there are questions about the manuscript and the first author does not respond or cannot be located (this must be an ARIC investigator).

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3. Timeline: All data are currently available. We will conduct the analysis for Aim 1 to submit an abstract in October for the 2019 American Heart Association Epi|Lifestyle conference. We will complete the entire analysis and submit a paper for publication within one calendar year.

4. Rationale:

Hypertension prevalence increases with age and affects 63% of US adults aged 60 and older, among whom 49% have their blood pressure controlled (<140/90 mmHg).¹

Hypertension treatment among older adults is a topic of much debate and professional societies in the US have published conflicting guideline recommendations in recent years. Prior to 2014, JNC7 was the prevailing guideline which recommended treatment to <130/80 mmHg for those with diabetes or chronic kidney disease and to <140/90 for all other patients.² In 2014, panel members of the JNC8 committee recommended treatment to <150/90 mmHg for adults aged 60 years or older without diabetes or chronic kidney disease and to <140/90 for other patients,³ though not all members of the panel agreed with the decision to increase the systolic blood pressure target to 150 mmHg for adults 60 and older without diabetes or chronic kidney disease.⁴ Subsequently, in 2015, results published from the Systolic Blood Pressure Intervention Trial (SPRINT) which compared treating systolic blood pressure to <120 mmHg versus <140 mmHg, provided evidence to support a lower systolic blood pressure treatment goal, including among adults ages 75 and older.⁵

More recently, the American College of Cardiology, American Heart Association and 9 other professional societies recommended a goal of <130/80 mmHg for people all ages on antihypertensive treatment;⁶ the American College of Physicians and American Academy of Family Physicians meanwhile continue to endorse a treatment goal of <150/90 mmHg among adults aged 60 and older and have published their own clinical practice guideline.⁷ Concerns about lower treatment to lower thresholds include the possibility of increased risk of hypotension, syncope, electrolyte abnormalities, or acute kidney injury.⁷

While there have been multiple trials of blood pressure treatment among older adults, few studies have examined blood pressure levels among community-based samples. Understanding more about which patients with hypertension are treated to what blood pressure levels can inform efforts to improve blood pressure control among the population and target interventions for subgroups who may benefit from additional blood pressure-lowering. ARIC Visit 5 was conducted from 2011-2013, when JNC7 was the prevailing guideline. ARIC Visit 6 was conducted from 2016-2017, following publication of the JNC8 panel member reports and the SPRINT trial.^{3,4} We will conduct cross-sectional analyses at each Visits 5 and 6 to assess the proportion of older adults with hypertension in the ARIC cohort who meet different blood pressure thresholds and characteristics (sociodemographic, lifestyle, clinical) associated with more intensive blood pressure control. To leverage the strength of the longitudinal data in ARIC, we will also examine change in blood pressure from Visit 5 to Visit 6 and characteristics associated with identified blood pressure trajectories.

5. Main Hypothesis/Study Questions:

Aim 1: Among older adults with hypertension at ARIC Visit 5, to assess the proportion with systolic blood pressures <130 mmHg, 130-<140 mmHg, 140-<150 mmHg, or ≥150 mmHg overall and by sociodemographic (age, sex, race-center, education, income), lifestyle and clinical factors, and to assess the factors associated with systolic blood pressure <130 mmHg at Visit 5.

Hypothesis: Men, those with higher socioeconomic status, and higher physical and cognitive functioning will be more likely to have systolic blood pressure <130 mmHg. It is unclear whether comorbidities will be associated with lower or higher systolic blood pressure.

Aim 2: Among older adults with hypertension at ARIC Visit 6, to assess the proportion with systolic blood pressures <130 mmHg, 130-<140 mmHg, 140-<150 mmHg, or \geq 150 mmHg overall and by sociodemographic, lifestyle and clinical factors, and to assess the factors associated with systolic blood pressure <130 mmHg at Visit 6.

Hypothesis: A lower proportion of participants will have systolic blood pressure <130 mmHg at Visit 6, though associations will be generally consistent with those at Visit 5.

Aim 3: Among older adults with hypertension at ARIC Visit 5, to characterize the change in systolic blood pressure levels from Visit 5 to Visit 6 and sociodemographic, lifestyle and clinical factors associated with systolic blood pressure trajectories.

Hypothesis: Stable or increasing blood pressure trajectories will be more common than decreasing blood pressure trajectories. Clinical comorbidities and poorer physical and cognitive functioning will be associated with increasing blood pressure trajectories.

6. Design and analysis (study design, inclusion/exclusion, outcome and other variables of interest with specific reference to the time of their collection, summary of data analysis, and any anticipated methodologic limitations or challenges if present).

The study population for this proposal will include black and white participants at ARIC Visit 5. Hypertension will be defined based on previous diagnosis of hypertension, current use of antihypertensive medication, or blood pressure at or above 140/90 mmHg during the study examination. Prior to conducting our analyses, we will compare the sample of participants identified with this definition to those identified using a definition of blood pressure at or above 140/90 during the study examination or current use of antihypertensive medication to better understand our study population.

Aim 1 is a cross-sectional analysis at Visit 5. We will examine the proportion of participants with systolic blood pressure values <130 mmHg, 130-<140 mmHg, 140-<150 mmHg, or \geq 150 mmHg overall and by sociodemographic, lifestyle and clinical factors measured at Visit 5. Sociodemographic characteristics of interest include: age, sex, race-center, education, and household income. Lifestyle factors include: smoking status, alcohol use, and physical activity. Clinical characteristics include: duration of hypertension, antihypertensive medication use and class of medications, body mass index, diabetes, reduced kidney function (creatinine-based estimated glomerular filtration rate (eGFR) <60 mL/min/1.73 m²), prevalent cardiovascular disease (composite and separately, coronary heart disease, stroke, heart failure), physical function (assessed using the Short Physical Performance Battery), cognitive function (assessed using the Mini Mental State Examination) and depressive symptoms (assessed using the Center for Epidemiological Studies-Depression scale).

We will then examine unadjusted and adjusted associations between meeting currently-recommended systolic blood pressure targets (ie, <130 mmHg). We will use Poisson regression with robust variance to calculate prevalence ratios. Model 1 will be the unadjusted model. Model 2 will include age, sex, and race-center. In sensitivity analyses, we will examine unadjusted and adjusted associations between meeting less intensive systolic blood pressure targets (ie, <140 mmHg and <150 mmHg).

Aim 2 will be a similar analysis to Aim 1 using systolic blood pressure values and covariates for sociodemographic, lifestyle and clinical factors measured at Visit 6. We will use the results of this analysis to explore whether associations are consistent across visits.

For Aim 3, we will categorize adults with hypertension into systolic blood pressure trajectory categories as follows:

| | | Systolic blood pressure at Visit 6 | | | |
|---|----------|---|----------|----------|------|
| | | <130 | 130-<140 | 140-<150 | ≥150 |
| Systolic blood pressure at Visit 5 | <130 | | | | |
| | 130-<140 | | | | |
| | 140-<150 | | | | |
| | ≥150 | | | | |

Trajectories will be further categorized based on the data (for example, stable, increasing, decreasing). We will then examine unadjusted and adjusted associations of sociodemographic, lifestyle and clinical factors measured at Visit 5 with trajectory categories. One methodologic challenge in this Aim is potential selection bias, ie, participants who are not observed at Visit 6. We will examine whether loss to follow up is differential by blood pressure level at baseline (Visit 5) and if so, consider methods to address selection bias such as inverse probability weighting. We may also observe decreases in systolic blood pressure due to illness. We will examine this possibility and consider, if appropriate, methods to account for underlying illness such as stratifying by disease status. As a sensitivity analysis, we will also consider categorizing participants based on the extent of change in systolic blood pressure between Visits 5 and 6.

This project has several limitations. First, blood pressure levels among ARIC participants may reflect treatment practices in local health care systems and may not be representative of blood pressure levels among white and black older adults nationally. Second, we are also not fully able to account for medication adherence by the participants or all lifestyle factors which may affect blood pressure. Third, selection bias is a potential concern at both Visits 5 and 6 and participants who remain in the study may be healthier than those who we do not observe. Fourth, blood pressure is reported back to participants at each study visit, so the probability of incident hypertension between Visits 5 and 6 may be influenced by reporting information to participants at Visit 5; further because cases of incident hypertension may be more likely to be diagnosed among ARIC participants than the general population of older adults, blood pressure may be better managed. This project also has a number of strengths. The cohort includes a large number of community-dwelling white and black adults over age 65. Blood pressure measurements at each study visit are made using a consistent, standardized protocol which facilitates comparison over time. Our results will provide actionable information on blood pressure levels among older adults in contemporary settings prior to the implementation of the most recent guideline from the American College of Cardiology and American Heart Association.

7.a. Will the data be used for non-CVD analysis in this manuscript? ____ Yes __X__ No

b. If Yes, is the author aware that the file ICTDER03 must be used to exclude persons with a value RES_OTH = “CVD Research” for non-DNA analysis, and for DNA analysis RES_DNA = “CVD Research” would be used? ___ Yes ___ No

(This file ICTDER has been distributed to ARIC PIs, and contains the responses to consent updates related to stored sample use for research.)

8.a. Will the DNA data be used in this manuscript? ___ Yes ___X___ No

8.b. If yes, is the author aware that either DNA data distributed by the Coordinating Center must be used, or the file ICTDER03 must be used to exclude those with value RES_DNA = “No use/storage DNA”? ___ Yes ___ No

9. The lead author of this manuscript proposal has reviewed the list of existing ARIC Study manuscript proposals and has found no overlap between this proposal and previously approved manuscript proposals either published or still in active status. ARIC Investigators have access to the publications lists under the Study Members Area of the web site at: <http://www.csc.unc.edu/aric/mantrack/maintain/search/dtSearch.html>

___X___ Yes ___ No

10. What are the most related manuscript proposals in ARIC (authors are encouraged to contact lead authors of these proposals for comments on the new proposal or collaboration)?

- 2302: Parrinello et al, Risk factor control in older adults with diabetes
- 2394: Balakrishnan et al, Determinants of blood pressure trajectories from midlife to older age: the Atherosclerosis Risk in Communities (ARIC) Study
- 2146: Kucharska-Newton et al, Systolic blood pressure trajectories and incident cardiovascular disease

11.a. Is this manuscript proposal associated with any ARIC ancillary studies or use any ancillary study data? ___ Yes ___X___ No

11.b. If yes, is the proposal

- ___ A. primarily the result of an ancillary study (list number* _____)**
___ B. primarily based on ARIC data with ancillary data playing a minor role (usually control variables; list number(s)* _____)

*ancillary studies are listed by number at <https://www2.csc.unc.edu/aric/approved-ancillary-studies>

12a. Manuscript preparation is expected to be completed in one to three years. If a manuscript is not submitted for ARIC review at the end of the 3-years from the date of the approval, the manuscript proposal will expire.

12b. The NIH instituted a Public Access Policy in April, 2008 which ensures that the public has access to the published results of NIH funded research. It is **your responsibility to upload manuscripts to PubMed Central** whenever the journal does not and be in compliance with this policy. Four files about the public access policy from <http://publicaccess.nih.gov/> are posted in <http://www.csc.unc.edu/aric/index.php>, under Publications, Policies & Forms. http://publicaccess.nih.gov/submit_process_journals.htm shows you which journals automatically upload articles to PubMed central.

References

1. Fryar CD, Ostchega Y, Hales CM, Zhang G, Kruszon-Moran D. Key findings Data from the National Health and Nutrition Examination Survey. *NCHS Data Brief*. 2017;(289):2015-2016. <https://www.cdc.gov/nchs/data/databriefs/db289.pdf>. Accessed December 8, 2017.
2. Chobanian A V., Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure<It>SUBTITLE</SUBTITLE>The JNC 7 Report<It>/SUBTITLE</SUBTITLE> *JAMA*. 2003;289(19):2560. doi:10.1001/jama.289.19.2560
3. James PA, Oparil S, Carter BL, et al. 2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults. *JAMA*. 2014;311(5):507. doi:10.1001/jama.2013.284427
4. Wright JT, Fine LJ, Lackland DT, Ogedegbe G, Dennison Himmelfarb CR. Evidence Supporting a Systolic Blood Pressure Goal of Less Than 150 mm Hg in Patients Aged 60 Years or Older: The Minority View. *Ann Intern Med*. 2014;160(7):499. doi:10.7326/M13-2981
5. The SPRINT Research Group. A Randomized Trial of Intensive versus Standard Blood-Pressure Control. *N Engl J Med*. 2015;373(22):2103-2116. doi:10.1056/NEJMoa1511939
6. 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 Pr. *Hypertens (Dallas, Tex 1979)*. November 2017:HYP.0000000000000065. doi:10.1161/HYP.0000000000000065
7. Qaseem A, Wilt TJ, Rich R, Humphrey LL, Frost J, Forcica MA. Pharmacologic Treatment of Hypertension in Adults Aged 60 Years or Older to Higher Versus Lower Blood Pressure Targets: A Clinical Practice Guideline From the American College of Physicians and the American Academy of Family Physicians. *Ann Intern Med*. 2017;166(6):430. doi:10.7326/M16-1785