

ARIC Manuscript Proposal # 674

PC Reviewed: 01/08/03
SC Reviewed: _____

Status: A
Status: _____

Priority: _____
Priority: _____

1.a. Full Title: Independent and Combined Influences of Body Mass index and Blood Pressure on Left Ventricular Mass Index and Geometry in African Americans

b. Abbreviated Title (Length 26 characters): Effect of BMI and BP on LVMI

2. Writing Group (list individual with lead responsibility first):

Lead: Ervin Fox, MD

Address: University of Mississippi Medical Center, Cardiology Division
2500 North State Street, Jackson, MS 39216

Phone: (601) 984-2250

Fax: (601) 984-2693

E-mail: efox@medicine.umsmed.edu

Writing group members:

Herman Taylor, MD

Michael Andrew, PhD

Hui Han, MD

Emad Mohammed, MD

Robert Garrison, MD

Thomas Skelton, MD

3. Timeline:

Rationale: . Increased LVM by echocardiography is a predictor of cardiovascular morbidity and mortality. There exists a racial difference in the prevalence and potentially in the severity of increased left ventricular mass. Despite the question of racial differences in LV mass and patterns of LV remodeling, risk factors contributing to increased LVM and LVM index such as BMI and BP have not been extensively investigated in African Americans but mostly in large, predominantly white population-based cohorts such as Framingham Heart Study. Generalizability of these studies to the black population has not been well-defined.

This report will focus on an analysis of the independent and combined effects of BMI and BP on LVMI and LV geometry in African Americans. Many investigators have found the risk of death and other sequelae attributable to hypertension and obesity to be disproportionately greater in African Americans. Although there is a high prevalence of both of these risk factors in this population often accompanying each other in individuals, their joint influence on LVMI (unlike their independent effects) has not been studied in a population-based African American cohort. Findings from this study should add to existing literature helping to better explain the association of these factors on LVMI in

African Americans and give insight into reasons for the reported racial disparity in the prevalence of left ventricular hypertrophy (LVH).

5. Main Hypothesis/Study Questions:

Is the racial disparity in LVH merely due to increased prevalence of risk factors in the African American community or is a component of the ethnic difference due to an unique interaction between BMI and BP on LVMI in blacks reflecting a difference in cardiac adaptation?

Other questions include: For the ARIC population, is there a significant association between BP and LVMI? Is there a significant association between BMI and LVMI? What is the combined effect of BMI and BP on LVMI? What are the effects of BMI and BP independently and combined on left ventricular septal wall thickness, left ventricular posterior wall thickness, left ventricular internal diameter and relative wall thickness? How do our findings compare to that of Framingham?

We hypothesize that there will be a strong positive association between BMI and LVMI and between BP and LVMI. We hypothesize that BMI and BP combined effect on LVMI will be additive; less likely synergistic (positive interaction). We also hypothesize that relative wall thickness defined as the ratio between total wall thickness and LV internal diastolic diameter will increase with both BMI and BP. These findings will be similar to that in Framingham suggesting that cardiac adaptation to BMI and BP is similar in blacks and whites.

6. Data (variables, time window, source, inclusions/exclusions):

LVM and LVMI {indexed by height (g/m)} will be derived from standard formulas. BP categories will be based on a modified JNC VI classification. BMI categories will be based on modified National Heart, Lung and Blood Institute guidelines. The association between LVM, LVMI, LV dimensions and BMI in each BP category and between LVM, LVMI, LV dimensions, and BP in each BMI category will be assessed using the analysis of covariance (ANCOVA) with adjustment for age, diabetes status, hypertension medication and smoking status. All significant associations will be determined by $p < 0.05$. The study will exclude subjects with known coronary artery disease, history of angina, congestive heart failure or valvular heart disease (moderate or greater mitral regurgitation, moderate or greater aortic regurgitation, moderate or greater mitral stenosis or any degree of aortic stenosis). Participants with missing M-mode measurements (including inadequate quality echocardiograms which prohibited measurement of left ventricular dimensions for calculating LVM), height, weight or blood pressure measurements will also be excluded.

Bibliography

1. Levy D, Garrison RJ, Savage DD, Kannel WB, Castelli WP. Prognostic Implications of Echocardiographically Determined Left Ventricular Mass in the Framingham Heart Study. *N Engl J Med* 1990; 322; 1561 – 1566.

2. Liao Y, Cooper RS, McGee DL, Mensah GA, Ghali JK. The Relative Effects of Left Ventricular Hypertrophy, Coronary Artery Disease, and Ventricular Dysfunction on Survival Among Black Adults. *JAMA* 1995; 273:1592-1597.
3. Gardin JM et. al. Relationship of Cardiovascular Risk Factors to Echocardiographic Left Ventricular Mass in Healthy Young Black and White Adult Men and Women: The CARDIA Study. *Circulation*. 1995; 92: 380 – 387.
4. Mayet J, Shahi M, Foale RA, Poulter NR, Sever PS, McG Thom SA. Racial differences in cardiac structure and function in essential hypertension. *Br Med J*. 1994; 308: 1011 – 1014.
5. Schneider RE, Rockstroh JK, Luchters G, Hammerstein U, Messerli FH. Comparison of Early Target Organ Damage Between Blacks and Whites With Mild Systemic Arterial Hypertension. *Am J Cardiol*. 1997; 79: 1695 – 1698.
6. Zabagotia M et. al Impact of Ethnicity on Left Ventricular Mass and Relative Wall Thickness in Essential Hypertension. *Am J Cardiol* 1998; 81:412-417.
7. Benjamin EJ, Levy D. Why Is Left Ventricular Hypertrophy So Predictive of Morbidity and Mortality? *Am J Med Sci*. 1999; 317(3): 168 – 175.
8. Clark L. Primary Prevention of Cardiovascular Disease in High-Risk Patients: Physiologic and Demographic Risk Factor Differences Between African American and White American Populations. *Am J of Medicine*. Vol 107 (2A): 22S-24S.
9. Neaton JD, Kuller LH, Wentworth D, Borhani NO. Total and cardiovascular mortality in relation to cigarette smoking, serum cholesterol concentration, and diastolic blood pressure among black and white males followed up for five years. *Am Heart J*. 1984;108:759-769.
10. Cooper RS, Liao Y, Rotimi C. Is hypertension more severe among U.S. blacks, or is severe hypertension more common? *Ann Epidemiol*. 1996; 6:173-180.
11. Liao Y, Cooper RS, McGee DL, Mensah GA, Ghali JK. The relative effects of left ventricular hypertrophy, coronary artery disease, and ventricular dysfunction on survival among black adults. *JAMA*. 1995;273:1592-1597.
12. Clark LT. Anatomic substrate differences between black and white victims of sudden cardiac death: hypertension, coronary artery disease, or both? *Clin Cardiol*. 1989; 12 (suppl 4):IV13-IV17.
13. Gavin JR III. Diabetes in minorities: reflections on the medical dilemma and the healthcare crisis. *Trans Am Clin Climatol Assoc*. 1995;107:213-223.

14. Sherif K, Barrett M, Kushner H, Falkner B. The Association of Left Ventricular Mass with Cardiovascular Risk Factors in African American Women. *Am J Med Sci.* 2000; 320(1): 13 – 7.
15. Urbina EM, Gidding SS, Bao W, Pickoff AS, Berdusis K, Berenson GS. Effect of Body Size, Ponderosity, and Blood Pressure on Left Ventricular Growth in Children and Young Adults in the Bogalusa Heart Study. *Circulation.* 1995; 91: 2400 – 2406.
16. Harris MM, Stevens J, Thomas N, Schreiner P, Folsom AR. Associations of Fat Distribution and Obesity with Hypertension in a Bi-ethnic Population: The ARIC Study. *Obesity Research.* 2000; 8(7): 516 –524.
17. Jones D. What is the Role of Obesity in Hypertension and Target Organ Injury in African Americans? *Am J Med Sci* 1999; 317(3): 147 –151.
18. Lauer MS, Anderson KM, Kannel WB, Levy D. The Impact of Obesity on Left Ventricular Mass and Geometry: The Framingham Heart Study. *JAMA.* 1991; 266: 231 – 236.
19. Liebson PR, Granditis G, Prineas R, Dianzumba S, Flack JM, Cutler JA, Grimm R, Stamler J. Echocardiographic Correlates of Left Ventricular structure Among 844 Mildly Hypertensive Men and Women in the Treatment of Mild Hypertension Study (TOMHS). *Circulation.* 1993; 87: 476 – 486.
20. Lauer MS, Anderson KM, Levy D. Separate and Joint Influences of Obesity and Mild Hypertension On Left Ventricular Mass and Geometry: The Framingham Heart Study. *J Am Coll Cardiol* 1992; 19: 130 – 134.
21. Gottdiener JS et al. Importance of Obesity, Race and Age to the Cardiac Structural and Functional Effects of Hypertension. *J Am Coll Cardiol.* 1994; 24: 1492 – 1498.
22. The ARIC Investigators. The Atherosclerosis Risk in Communities (ARIC) Study: design and objectives. The ARIC investigators. *Am J Epidemiol* 1989; 129:687-702.
23. Troy BL, Pombo J, Rackley CE. Measurement of left ventricular wall thickness and mass by echocardiography. *Circulation* 1972; 45:602-611.
24. Devereux RB, Alonso DR, Lutas EM, Gottlieb GJ, Campo E, Sachs I, et al. Echocardiographic assessment of left ventricular hypertrophy: comparison to necropsy findings. *Am J Cardiol* 1986; 57:450-58.
25. VanItallie TB. Health implications of overweight and obesity in the United States. *Ann Intern Med.* 1985;103:983-988.
26. Stevens J, Gautam SP, Keil JE. Body mass index and fat patterning as correlates of lipids and hypertension in an elderly, biracial population. *J Gerontol Med Sci.* 1993;48:M249-M254.

27. Blair D, Habicht JP, Sims EA, Sylvester D, Abraham S. Evidence for an increased risk for hypertension with centrally located body fat and the effect of race and sex on this risk. *Am J Epidemiol.* 1984; 119:526-540.
28. Johnson AL, Cornoni JC, Cassel JC, et al. Influence of race, sex and weight on blood pressure behavior in young adults. *Am J Cardiol.* 1975;35:523-530.
29. Selmer R, Tverdal A. Body mass index and cardiovascular mortality at different levels of blood pressure: a prospective study of Norwegian men and women. *J Epidemiol Community Health* 1995;49:265-270.
30. Bloom E, Reed D, Yano K, MacLean C. Does Obesity Protect Hypertensive Against Cardiovascular Disease? *JAMA* 1986;256:2972-2975.
31. Messerli FH. Cardiovascular effects of obesity and hypertension. *Lancet* 1982;1:1165-1168.
32. Grossman W, Jones D, McLaurin LP. Wall stress and patterns of hypertrophy in the human left ventricle. *J Clin Invest* 1975;56:56-64.
33. Whalley GA et. al. Left ventricular mass correlates with fat-free mass but not fat mass in adults. *J Hypertens* 1999;17:569-574.

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

b. If Yes, is the author aware that the file ICTDER02 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 ICTDER02 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 ☒ No

8.b. If yes, is the author aware that either DNA data distributed by the Coordinating Center must be used, or the file ICTDER02 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://bios.unc.edu/units/csc/ARIC/stdy/studymem.html>

☒ Yes ☐ No

This is an updated version of previous proposal #674

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)?

The ARIC Investigators. The Atherosclerosis Risk in Communities (ARIC) Study: design and objectives. The ARIC investigators. Am J Epidemiol 1989; 129:687-702.

Harris MM, Stevens J, Thomas N, Schreiner P, Folsom AR. Associations of Fat Distribution and Obesity with Hypertension in a Bi-ethnic Population: The ARIC Study. Obesity Research. 2000; 8(7): 516 –524.