PC Reviewed: 1/12/10   Status: <u>A</u>   Priority: <u>2</u>
SC Reviewed: _____   Status: _____   Priority: ____

1.a.   **Full Title**: Concordance of longitudinal blood pressure, antihypertensive treatment and risk factors for hypertension between spouse pairs in the Atherosclerosis Risk in the Communities Study (ARIC)

b.   Abbreviated Title (Length 26 characters): Blood pressure in couples

2.   **Writing Group**:
    Writing group members: Mara McAdams, Josef Coresh, Ken Butler, Linda Kao, Tom Mosley, Michelle Hindin, and Others welcome. [Invited Eric Boerwinkle, Aravinda Chakravarti]

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

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3. **Timeline**: Data analysis to start after approval of this manuscript proposal, first draft available by February, 2010

4. **Rationale**:

Previous studies have found that married couples share cardiovascular risk factors, which suggests there is an environmental component to the risk of cardiovascular disease.[1] Some previous studies of American spouse pairs have utilized cross-sectional data[2] or familial aggregation data.[3, 4] However, longitudinal data of cardiovascular risk factors may be the more appropriate to assess the concordance of risk factors such as blood pressure over time. Few studies have evaluated the longitudinal measures of blood pressure and none have evaluated the correlation of the change in blood pressure over follow-up between spouse pairs.[5] Multiple

measures of blood pressure over time would allow for calculation of the concordance of changes in blood pressure and initiation of anti-hypertensives in spouses.

Additionally, few studies have included an analysis of the correlation of risk factors for hypertension between spouse pairs. No studies assessed whether the correlations of blood pressure and risk of hypertension differed by race in a population-based study that includes both African-Americans and Caucasians. If positive correlations are observed in married couples over years of follow-up then an important public health message may emerge. Primary prevention may be effectively targeted to families or couples rather than individuals.

The Atherosclerosis Risk in the Communities Study (ARIC) presents a unique opportunity to investigate longitudinal changes in blood pressure between spouse pairs. ARIC has over 4,000 couples enrolled in the study. Therefore, ARIC contains up to four measures of blood pressure, records of antihypertensive medication use, and covariate history for these couples. The cohort also includes measures of Ankle Brachial Index (ABI). Additionally, ARIC contains both African-American and White race couples. Therefore, this study will address the concordance of longitudinal blood pressure among married couples in ARIC by comparing four measures blood pressure, change in blood pressure over 15 years, the development of hypertension, ABI and initiation of antihypertensive medication. This will be the first study of the spouse pairs data in ARIC. Therefore, we will pay particular attention to the initial linking variables and variables defining changes in marital status.

5. **Main Hypothesis/Study Questions**:

Primary study questions:
Are cross sectional measures of blood pressure at each of the four ARIC visits correlated between mid-adult spouse pairs?

Are longitudinal measures of blood pressure correlated in spouse pairs over 15 years of follow-up?

Are ankle-brachial index measures correlated in spouse pairs?

Secondary study questions:
What is the concordance of diagnosed hypertension between spouse pairs?

What is the concordance of antihypertensive treatment and control of hypertension between spouse pairs?

Are there differences in the observed association of blood pressure, and antihypertensive treatment between African-American and White spouse pairs?

To what extent does the concordance between spouse pairs in hypertension risk factors explain the concordance in hypertension and correlation in blood pressure?

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).

Population: All married couples that were identified in ARIC through the Household Enumeration Form. Both members of the spouse pairs must be ARIC participants. We will define couples by any of the five rules that are included in the ARIC Memorandum on Spouse Pairs (September 12, 2008). The pairing is based on the ARIC household enumeration conducted prior

to the first visit. We will then examine data on marital status change (widowhood and divorce) using similar analyses to those by Schwandt and Hindin (MP# 1386). Briefly, marital status and pairing will be established at Visit 1 when interviewers asked participants about their current marital status. Respondent options included married, never married, divorced, separated, and widowed. For Visit 2 (1990-1992) the same current marital status question was asked of participants. Marital status was not asked in Visit 3 or 4. After visit 2 we will be able to update status for deaths (widowhood). Currently, the analysis is limited by not having updated marital status after visit 2. In the future, we could try to address this limitation analytically (coordinating center could analyze the geocoded data to test whether spouse pairs are still cohabiting) or by added data collection (update marital status in the AFU or visit 5). As a result of this limitation the primary analysis will focus on 3-year change in blood pressure (when martial status is known) and secondary analyses could examine longer term change with the caveat that changes in marital status would be unknown.

Study design: Longitudinal cohort

Data analysis:
The main factors we will assess concordance between spouse pairs are systolic and diastolic blood pressure (visit 1-visit 2), ankle brachial index (visit 1) and change in blood pressure between visit 1 and visit 2. First, we will look at the unadjusted Spearman or Pearson correlation, based on the normality distribution of the variables. Additionally, we will perform a linear regression of the husband's blood pressure as the dependent variable and the wife's blood pressure as the independent variable. This model will also be adjusted for the age and BMI of members of the married couple. We will then repeat this analysis for:
1. Blood pressure at each visit and the ABI at visit 1
2. Change in blood pressure between visit 1 and later visits.

Finally, we will stratify these models by race and present race-specific models. Models will be limited to married couples. Secondary analyses could examine change in blood pressure with change in marital status. If it is possible to confirm cohabitation in the same address at the latest contact information available (full address history may not be available in ARIC centrally) then an analysis of couples married for the duration of ARIC could be conducted.

Additionally, we will evaluate the correlation between hypertension (at any visit), and antihypertensive use (at any visit). The correlations will be calculated using tetrachoric correlations for discrete variables.

Finally, we will assess the correlation between spouse pairs for the following risk factors for hypertension:
1. BMI (visit 1)
2. Weight change (between visit 1 and visit 4)
3. Physical activity (visit 3)
4. Alcohol consumption
5. Smoking status (visit 1)
6. Kidney function (eGFR at visit 1)
7. Total calories (visit 1)

Associations for continuous risk factors of hypertension will be analyzed using spearman or Pearson correlations, depending on whether the normality assumption is met. The correlations between dichotomous variables will analyzed using tetrachoric correlations and categorical variables will be analyzed with polychoric correlations.

Limitations:
The unit of analysis is the couple. Therefore, missing data for one member of the spouse pair will negate the entire couple from the analysis. Additionally, we will need to update the marital status on the couples over follow-up.

Additionally, we will need the data on the couples from the Jackson, Mississippi site.

This study will be the first to use the spouse pairs data. We will keep a record of any observations, or limitations and share this with the ARIC Coordinating Center with the goal of distributing a cleaned spouse pair dataset to all centers.

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 ICTDER03 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.cscc.unc.edu/ARIC/search.php

     ___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)?

No studies have utilized the spouse pair data. However, one manuscript have evaluated:
#917. Marital status and mortality in the Atherosclerosis Risk on Communities Study
#1386. Marital status, coronary heart disease and diabetes among African-Americans: Incidence and Prevalence among participants in the Atherosclerosis Risk In Communities (ARIC) Study

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)* albuminuria, AS#_2002.02_)

*ancillary studies are listed by number at http://www.cscc.unc.edu/aric/forms/

12. 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.

Works cited:

1.   Di Castelnuovo A, Quacquaruccio G, Donati MB, de Gaetano G, Iacoviello L. Spousal concordance for major coronary risk factors: a systematic review and meta-analysis. Am J Epidemiol 2009;169:1-8.
2.   Suarez L, Criqui MH, Barrett-Connor E. Spouse concordance for systolic and diastolic blood pressure. Am J Epidemiol 1983;118:345-51.
3.   Havlik RJ, Garrison RJ, Feinleib M, Kannel WB, Castelli WP, McNamara PM. Blood pressure aggregation in families. Am J Epidemiol 1979;110:304-12.
4.   Hayes CG, Tyroler HA, Cassel JC. Family aggregation of blood pressure in Evans County, Georgia. Arch Intern Med 1971;128:965-75.
5.   Sackett DL, Anderson GD, Milner R, Feinleib M, Kannel WB. Concordance for coronary risk factors among spouses. Circulation 1975;52:589-95.