**ARIC Manuscript Proposal #4152**

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**1.a. Full Title**: Social relationships and self-rated health in the Atherosclerosis Risk in Communities (ARIC) Study and Jackson Heart Study (JHS) shared cohort

**b. Abbreviated Title (Length 26 characters)**: Social relationships self-rated health

**2. Writing Group**:

Writing group members: Kennedy M. Peter, Kelly R. Evenson, Annie Green Howard, Sara Jones Berkeley, Joanna Maselko, Mario Sims, Anna Kucharska-Newton, Kevin Sullivan, Wayne Rosamond, others welcome

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


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**3. Timeline**: ~ 2 years

This work will be part of Kennedy Peter's dissertation, the timeline of which is outlined below:
Dissertation proposal: Early spring 2023
Dissertation defense: Fall 2023 or Spring 2024
Submission for publication: Fall 2023 or Spring 2024

**4. Rationale**:

Poor measures of social relationships (small social networks and low social support) are associated with increased risk of all-cause mortality,[1] and poor mental and physical health outcomes.[1-6] There is a renewed urgency to understand how social relationships and changes in social relationships affect health over time due to psychosocial consequences of the COVID-19 pandemic,[7] as preliminary data suggest prevalence of social isolation, loneliness, and mental health conditions have increased, especially among younger to middle-aged adults.[7-10] With the prevalence of these adverse social and mental health conditions rising, it is imperative to understand how social relationships and changes in social relationships are related to long-term repeated measures of self-rated health (SRH). While it will take decades to assess the effects of pandemic-related changes in social relationships on long-term general and cardiovascular health, much can be learned from existing data.

SRH is a simple measure of a complex construct that combines physical and mental perceived well-being. Poor SRH is associated with many clinical outcomes such as greater mortality,[11] incident stroke, and healthcare utilization, and is a measure of overall subjective physical, mental, and social well-being. Very few studies have investigated the role of social relationships and changes in social relationships with repeated measures of SRH as an outcome.[12] More favorable measures of social relationships have been cross-sectionally related to better SRH, but few studies have investigated the relationship of mid-life social relationships and their changes with repeated measures of SRH.[13,14]

Various studies have assessed the role of social relationships at baseline with changes in SRH over two measurements, finding that less favorable measures of social relationships are associated with decreases in SRH.[15-17] We are aware of only three studies that examined a singular measure of social relationships and its association with repeated measures of SRH. Wolinsky et al. evaluated 4-year trajectories of SRH based on 5 measurements among African Americans, and found that social support was not associated with repeated measures of SRH.[18] This study found relatively stable repeated measures of SRH over a short follow-up period, and did not define the measure of social support used.[18] One study investigated repeated measures of SRH over the course of 12 years based on bi-annual measurements of SRH among American adults in the Health and Retirement Study (average age of 56 years), and found that those with lower frequency of contact with children, parents, and neighbors, had a steeper rate of decline in SRH.[19] However, the other measure of social relationships, whether the participant had friends or relatives living in their neighborhood, was not associated with repeated measures of SRH.[19] These social relationship measurements were taken two years after the first measurement of SRH.[19] Another study that looked at older, Japanese adults found that higher social integration (measured by a set of six questions) was associated with lower odds of reporting fair/poor health over 19 years of follow-up and across 7 measurements of SRH.[20] Of these three studies, only one accounted for informative attrition due to death and loss to follow-up through the use of inverse probability weights, and none allowed for the incorporation of death into the coding scheme of SRH. None of these three studies used validated, commonly used measures of social relationships.

Evidence is also needed to assess the stability of social relationships in mid-life and whether changes in social relationships affect long-term perceptions of health. Social relationships primarily change with life events that alter social circles, such as marriage, divorce, death of a partner, moving, retirement, and declines in health.[21,22] As it is common for middle-aged

populations to experience these events, it is important to assess social relationships at multiple time points and whether changes in social relationships are associated with repeated measures of SRH.

To our knowledge, the only four studies that have directly investigated changes in social relationships with changes in SRH over time have been based on concurrent changes across two measurement points. In a study of UK-dwelling adults, those who decreased their social network size between two measurements six years apart had a higher probability of deteriorating SRH over the concurrent six-year period.[23] Additionally, only participants who reported participating in social groups at both time points did not have an increased probability of deteriorating SRH, and higher levels of participation at either time point or both were associated with a higher probability of improvements in SRH over the 6-year period.[23] However, when adjusted for covariates, only a decrease in social network size was associated with decreases in SRH, and maintained or improved social group participation was associated with SRH increases.[23] One study investigated changes in social support, social involvement, and social contact with concurrent 2-year changes in SRH among a population of Canadian adults ages 20-64.[24] This study found that increases in both social support and frequency of social contacts were associated with improvements in SRH over the 2-year period for both women and men, and similar findings for increased social involvement among men only.[24] Another study of 6-year concurrent changes in social relationships and SRH among German adults 65 and older found that changes in emotional support were not associated with changes in SRH.[25] Contrarily, 7-year increases in reception of instrumental social support among older Dutch individuals were associated with declines in SRH, but changes in social network size, composition, and frequency of contact were not associated with changes in SRH.[26] Two of these four studies adjusted for smoking status and physical activity,[23,24] mediators of the relationship between social relationships and overall health; therefore these results may not represent the total effect of social relationships on health. Additionally, none of these studies included coding schemes of SRH that represented death, and none of them accounted for deaths or loss to follow-up over the study period. The measures of social relationships used in all of these studies were either not detailed in the manuscripts or not validated measures.[23-26]

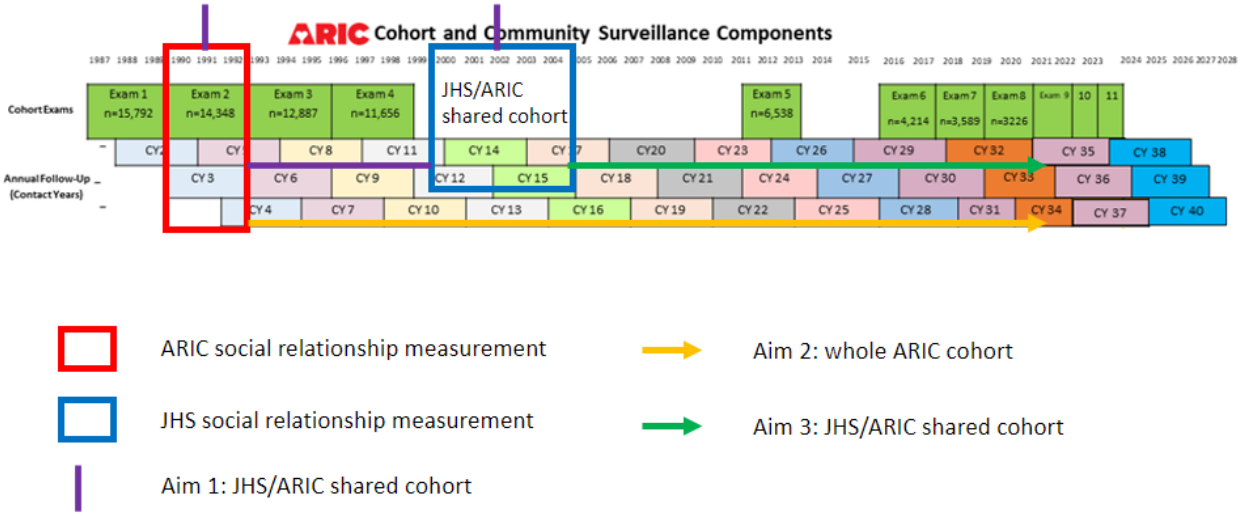
Three longitudinal studies have investigated multiple measures of social relationships with SRH measured across more than 2 time points, generally finding that sustained unfavorable levels of social relationships were associated with both negative SRH scores and declines in SRH over time.[27-29] However, some of these analyses did not account for deaths or loss to follow-up in their analyses. Although these analyses incorporated multiple measures of social relationships over time, none of them directly investigated the effects of changes in social relationships over time with repeated measures of SRH. Most prior evidence points generally to social relationships as a beneficial factor to long-term SRH. Investigation into associations of multiple aspects of social relationships and their changes with longer term, granular follow-up of SRH will provide a more detailed picture of these relationships.

Social relationships have been shown to be alterable through interventions such as cognitive behavioral therapy[21] and peer support programs.[30,31] By investigating which aspects of social relationships are most associated with maintenance of SRH, we may be able to identify specific aspects to target for future interventions, and identify other potential windows for these interventions. We propose to examine premorbid structural aspects (social isolation) and functional aspects (perceived social support) of social relationships, along with specific types of social support (appraisal support, belonging support, self-esteem support, and tangible support),

at mid-life and their 10-year changes, and their associations with annual repeated measures SRH over 30 years. Analysis will employ secondary data from the Atherosclerosis Risk in Communities (ARIC) Study, which measured social relationships in 1990-1992. Assessment of 10-year changes in social relationships will be conducted among ~1,250 ARIC participants who also participated in the Jackson Heart Study (JHS), which measured social relationships in 2000-2004.

**5. Main Hypothesis/Study Questions**:
Figure 1 accompanies these three aims.

**Figure 1**. Timeline of proposed aims and description of which aims will take place in which cohort/sub-cohort.




Aim 1: Describe the cardiovascular risk factors associated with 10-year changes in social relationships among the ARIC/JHS shared cohort.
*Hypothesis: Preservation of low social isolation and high social support across the 10-year period will be associated with a more favorable cardiovascular risk profile, both at the beginning and ending of the 10-year period.*

Aim 2: Estimate the associations of premorbid structural (social isolation) and functional (social support) aspects of social relationships at mid-life with annual repeated measures SRH over 30 years among the full ARIC cohort.
*Hypothesis: Lower premorbid social isolation and greater premorbid social support will be associated with higher levels of SRH over 30 years.*

Aim 3: Estimate the associations of 10-year changes in structural and functional aspects of social relationships with annual repeated measures of SRH over 20 years among the ARIC/JHS shared cohort.
*Hypothesis: Preservation of low social isolation and high social support across the 10-year period will be associated higher levels of SRH over 20 years.*

**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).**

All ARIC participants who have measures of social relationships at Visit 2 will be included in this prospective, longitudinal cohort study. Analyses looking at social relationships measured 10-years later and their changes will include all ARIC/JHS shared cohort participants with measures of structural and functional aspects of social relationships at both ARIC Visit 2 and JHS Visit 1. All medical histories and demographic characteristics were collected at ARIC Visit 1.

**Exclusions.** Participants missing social relationship data from ARIC Visit 2. Participants with a history of cardiovascular disease or other serious conditions such as cancer prior to ARIC Visit 2. Non-white and non-Black participants.

**Exposure assessment.** At ARIC visit 2 (1990-1992), social relationships were assessed by a self-administered health and life profile questionnaire. At the first JHS visit (2000-2004), social relationships were assessed by two self-administered questionnaires: the Approach to Life a questionnaire and the social support questionnaire. Inconsistent language is often used in current literature to explain various measures of social relationships. To avoid these inconsistencies, this project will refer to aspects of social relationships in two categories: structural and functional aspects of social relationships, as outlined by Valtorta et al.[32]

Structural aspects of social relationships (social isolation). Structural aspects of social relationships, a measure of relationship quantity, assesses the frequency and number of social contacts, along with involvement in social networks.[32] ARIC uses the Lubben Social Network Scale (LSNS) measured at mid-life. The LSNS is a well validated[33] and psychometrically valid questionnaire with high internal reliability, based on the full Berkman-Syme Social Network Index (BSNI).[34] The LSNS was designed for measurement in older populations, whereas the BSNI was developed for the general population.[34] The full BSNI includes questions related to marital status, relationships with friends and family, and church and organization membership.[34] The LSNS measures the self-reported availability of social contacts with family, friends, and peers, along with network size, dropping marital status and organization participation from the full BSNI as there is limited variation in these aspects among older adults.[34] It uses 10 questions with a 0-5 rating scale, and previously total scores ranging from 0-50 have been categorized into levels of risk for social isolation: socially isolated ($\leq$20), high risk (21-25), moderate risk (26-30), and low risk ($\geq$31).[35]

JHS measures structural aspects of social relationships by three items adapted from the BSNI.[36] The BSNI has been previously validated. The JHS version consists of three questions from the BSNI: 1) how many close friends do you have?, 2) how many close relatives to you have?, 3) how many of these friends or relatives do you see at least once a month?. Responses to these questions include the following categories: none, 1 to 2, 3 to 5, 9 to 9, and 10 or more. Previous JHS manuscripts have assigned a score of 0 to 4 to each item.[37] Then, they computed a total value for all three questions ranging from 0 to 12, and used the lowest tertile to approximate low structural aspects of social relationships.[37] Both the LSNS and BSNI primarily measure

involvement in relationships, and while they do include some functional aspects of social relationships, are primarily measures of structural aspects.[32]

Functional aspects of social relationships (social support). Social support, a measure of the quality of relationships, assesses perceived support from relationships and their purposes.[1] ARIC and JHS both use the 16-item Interpersonal Support Evaluation List (ISEL), which measures total perceived social support. The ISEL uses questions from 4 subscales of the 40-item ISEL: tangible, appraisal, belonging, and self-esteem. Every question on the 16-item ISEL corresponds to one of these subtypes; scores for each specific type will be calculated based on the relevant questions. The ISEL is highly correlated with other measures of perceived social support.[38] Six-week test-retest correlation for this measure is 0.70, and the range of internal consistency is 0.88 to 0.90.[39]

**Outcome assessment.** Self-rated health (SRH) was measured during an annual phone interview in the ARIC and JHS cohorts beginning with the first study visit. These measures span 30 years for participants who are still in the study.

The SRH question reads as follows: "Now I will ask you some questions about your health. Over the past year, compared to other people your age, would you say that your health has been excellent, good, fair or poor?" The responses are listed in the same order in a vertical descending fashion. This question defines a time period for the participant to consider, and specifies that the referent to compare to should be "people your age." This measure will be interpreted as the annual perceived health status of a participant. The specification of a time period in this question allows us to examine the progression of SRH over the course of 30 years.

We will assign the following values to SRH categories based on the recommendations by Diehr et al.[40] and that have been previously used in longitudinal analyses of SRH in the ARIC cohort: excellent = 95, good = 80, fair = 30, poor = 15, death = 0. These values represent the probability of being healthy 2 years from the initial SRH measurement, conditional on the initial value of SRH, and allows for deaths to be represented in analysis rather than being excluded as is common in previous analyses.[41] These conditional probability values were defined in previous studies, applied to the ARIC cohort, and will be used in this study.[40,42]

**Covariates of Interest.**

1. Visit 1 (1987-1989)
    a. Biologic sex
    b. Education
    c. Self-reported race
    d. Physical activity
    e. Dietary intake
2. Visit 2
    a. Age
    b. Occupational status
    c. Family income
    d. Marital status

    e. Living arrangement
    f. Hypertension
    g. High cholesterol
    h. Diabetes
    i. BMI
    j. Multivitamin use
    k. Frequency of physical examinations
    l. Alcohol use
    m. Smoking status
    n. Vital exhaustion
    o. Medications fordepression or anxiety
    p. Cognitive function
    q. Health insurance coverage
    r. Heart attack
    s. COPD
    t. Cancer
3. Annual follow-up forms
    a. Heart attack
    b. Hospitalizations
    c. Outpatient treatment
    d. Peripheral vascular disease
    e. Blockage of arteries in legs
    f. Cancer
    g. Heart failure
    h. Blood clot in lungs
    i. Stroke/TIA
    j. ED visits
    k. Invasive cardiovascular surgery
4. Follow-up
    a. Stroke
    b. Coronary heart disease
    c. Incident HF hospitalization

The following variables will be considered as confounders of the effect of social relationships on SRH trajectories, as determined using a directed acyclic graph (DAG): biologic sex, education, self-reported race, age, occupational status, family income, marital status, living arrangement, hypertension, high cholesterol, diabetes, and BMI. Mediators of the relationship between social relationships and progression of SRH include both health behaviors (dietary intake, physical activity, multivitamin use, frequency of physical examinations [healthcare utilization], alcohol use, and smoking status) and mental health markers (vital exhaustion and depression/anxiety related medications). These mediators along with other listed cardiovascular risk factors and cardiovascular health conditions will be examined at in Aim 1. Time-varying variables measured again at JHS Visit 1 may also be used in analyses involving measures of social support from JHS.

**Statistical Evaluation.** Social isolation will be analyzed as a categorical variable, using the established scores that correspond to levels of risk for social isolation.[35] There are no established categories of perceived social support scores derived from the Interpersonal Support Evaluation List; therefore, we will use tertiles to categorize these scores (high, medium, and low social support). Perceived total social support will be the total score of the ISEL conglomerate measure, and a score for each subscale of social support will also serve as separate exposures in exploratory analyses.[43]

We will start with directed acyclic graphs (DAGs) to assess confounders and will use these in combination with model selection techniques including for example 10% change in estimate to determine an adjustment set that maximizes parsimony. We will examine descriptive statistics of demographics, social relationships, and clinical measures in both the full ARIC cohort and the ARIC/JHS shared cohort. We will also examine baseline characteristics stratified by categories of social relationships and changes in social relationships.

Aim 1: Describe the cardiovascular risk factors associated with 10-year changes in social relationships.

We will assess changes in social relationships as a continuous numeric change where possible, and change between categories of social relationships over 10 years, including categories such as "high to high", "high to medium", "high to low", "low to high", and so on, based on how many categories are defined. We will explore various methods of comparing the 3-question BSNI and the LSNS. Questions from the BSNI and LSNS will be matched as closely as possible and will be scored according to the following table, for a total score ranging from 0-9:

| LSNS Questions | | BSNI Questions | |
|---|---|---|---|
| Question | Response (Scoring) | Question | Response (Scoring) |
| 1.How many relatives do you feel close to? That is, how many of them do you feel at ease with, can talk to about private matters, or can call on for help? | Zero (0)<br>One (1)<br>Two (1)<br>Three or Four (2)<br>Five to Eight (3)<br>Nine or more (3) | 1.How many relatives do you have that you feel close to? | None (0)<br>1 or 2 (1)<br>3 to 5 (2)<br>6 to 9 (3)<br>10 or more (3) |
| 2.Do you have any close friends? That is, do you have any friends with whom you feel at ease, can talk to about private matters, or can call on for help? If so, how many? | Zero (0)<br>One (1)<br>Two (1)<br>Three or Four (2)<br>Five to Eight (3)<br>Nine or more (3) | 2.How many close friends do you have (people you feel at ease with, can talk to about private matters, and can call on for help)? | None (0)<br>1 or 2 (1)<br>3 to 5 (2)<br>6 to 9 (3)<br>10 or more (3) |
| | | | |
| 3a.How many relatives do you see or hear from at least once a month? | Zero (0)<br>One (1)<br>Two (2)<br>Three or Four (3.5)<br>Five to Eight (6.5)<br>Nine or more (9) | 3.How many of these friends or relatives do you see at least once per month? | None (0)<br>1 or 2 (1)<br>3 to 5 (2)<br>6 to 9 (3)<br>10 or more (3) |

| | | | |
|---|---|---|---|
| 3b.How many of these friends do you see or hear from at least once a month? | Zero (0)<br>One (1)<br>Two (2)<br>Three or Four (3.5)<br>Five to Eight (6.5)<br>Nine or more (9) | | |
| 3.Scores from these two questions will be summed together, and the grouped according to the following categories for a final summary score of how many relatives and friends are seen each month:<br>0 = 0<br>1-2 = 1<br>3-4 = 2<br>> 5 = 3 | | | |

If distributions show a large proportion of participants reporting 9+ or 10+ friends/family, this will instead be scored on a scale of 0-4, with a total possible score ranging from 0-12. Based on distributions of these scores, we will create categories that represent low, moderate, and high social isolation. Change in social isolation will be assessed by changing from one category to another. Continuous changes in scores for structural aspects of social relationships will not be assessed as it may imply a higher level of precision than we actually have.

We will also conduct a sensitivity analysis using dichotomous scoring of each question (0 = 1-2 friends/family, 1 = >2 friends/family), summing for a total potential score of 0-3 points. These 4 potential scores will be assessed as a categorical variable, and 10-year changes will be assessed as changes between these 4 categories.

Differences in the prevalence of cardiovascular risk factors at ARIC Visit 2 and JHS Visit 1, by class of 10-year change in social isolation and social support and cardiovascular risk factors (behavioral, clinical, demographic, etc.), will be assessed using descriptive statistics. This analysis will only be conducted among ARIC/JHS shared cohort participants with both measures of social support at ARIC Visit 2 and JHS Visit 1.

<u>Aim 2: Estimate the associations of premorbid structural and functional aspects of social relationships at mid-life with annual repeated measures of SRH over 30 years.</u>
Associations of social relationship measures at mid-life with 30-year trajectories of SRH will be assessed using linear mixed effects models. Multiple imputation by chained equations will be used to account for differential attrition and missing outcome data. This cohort experienced some degree of loss to follow-up and missing data over 30 years, with annual follow-up questionnaire response rates ranging from 99.6% - 80.4% over the course of 30 years, which will likely cause selection bias and reduce power in the complete case analysis sample. However, participants whose annual telephone calls were answered by a proxy will have missing data on SRH, which will be imputed using prior measurements of SRH along with other relevant health information collected on the annual follow-up call. These additional variables used in imputation models will not be used as adjustment variables in main models. These analyses will be done both in the full ARIC cohort, and in the ARIC/JHS shared cohort as a sensitivity analysis.

Aim 3: Estimate the associations of 10-year changes in structural and functional aspects of social relationships with annual repeated measures of SRH over 20 years.
Associations of 10-year changes in social relationships with 20-year trajectories of SRH will be assessed using linear mixed effects models and multiple imputation by chained equations to account for differential attrition and missing outcome data. Again, there may be selection bias in the complete case analysis sample due to loss to follow-up and missing data in this cohort in complete case analyses. This analysis will completed only among ARIC/JHS shared cohort participants who have two measures of social relationships.

We will explore whether the association between social support and repeated measures of SRH is modified by social isolation, as social support is generally determined by structural aspects of social relationships. This will elucidate whether it is important to have high levels of social interactions for health outcomes, even if the person perceives high levels of available social support. We will explore effect measure modification of aim 2 by gender, race, marital status, living arrangement, development of chronic disease, and later cognitive decline. We will likely be underpowered to do so in aim 3, but this may be an exploratory analysis.

We will conduct sensitivity analyses that categorize social support and change in social relationships by other quantiles (quartiles, quintiles, deciles, etc.). Another sensitivity analysis adding participants with serious chronic diseases back into the population will be conducted.

**Limitations.** The different measurement tools for structural aspects of social relationships used in the ARIC study and JHS and will cause difficulties in comparing the two to assess its 10-year change. Another limitation that study center and race are highly correlated, as most Black participants are located at the Jackson, MS site. We will have to use the covariate race-center to account for this correlation. Therefore, change in social relationships will only be conducted among Black participants, as there were no White participants from the Jackson, MS site. This may limit the generalizability of these findings. Two measurements of social relationships only exist for ARIC/JHS shared cohort participants, which will reduce power in these analyses that use the JHS measurement compared to only the ARIC measurement.

**7.a. Will the data be used for non-ARIC analysis or by a for-profit organization in this manuscript? ____ Yes __X__ No**

**b. If Yes, is the author aware that the current derived consent file ICTDER05 must be used to exclude persons with a value RES_OTH and/or RES_DNA = "ARIC only" and/or "Not for Profit" ? ____ Yes ____ No**
(The 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 current derived consent file ICTDER05 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/aricproposals/dtSearch.html

   _____ 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)?**

Published papers:
Foraker et al (2011) Socioeconomic status and the trajectory of self-rated health
Garg et al (2020) Associations of anger, vital exhaustion, anti-depressant use, and poor social ties with incident atrial fibrillation: The Atherosclerosis Risk in Communities Study
Kats et al (2016) Social support and cognition in a community-based cohort: the Atherosclerosis Risk in Communities (ARIC) Study
Wattanakit (2005) Association of anger proneness, depression, and low social support with peripheral arterial disease: the Atherosclerosis Risk in Communities Study
Cene (2012) Social isolation, vital exhaustion, and incident heart failure: findings from the Atherosclerosis Risk in Communities Study

Manuscript proposals:
Liu: Social isolation, social support, and the risk of incident dementia and MCI: the Atherosclerosis Risk in Communities (ARIC) Study
Liu: Social Isolation, social support, and cognitive decline: the Atherosclerosis Risk in Communities Study
Nagayoshi: Social isolation, social support, and risk of incident stroke: the Atherosclerosis Risk in Communities Study
Mosely: Dimensions of social support and risk of CHD events, carotid arterial wall thickness, and mortality
Mosely: The moderating effects of social support on the association between negative emotions and CHD events, carotid arterial wall thickness, and mortality
Kornegay: The effect of social support on the relationship between hostility and seated blood pressure
McGovern: The relationship of social support to incident myocardial infarction and ischemic stroke
Hagan: Individual and neighborhood SES and its association with measures of social support
Mu: Trajectories of self-rated health before and after acute-care hospitalization: a 30 year cohort study
Foraker: Socioeconomic status (SES) and the trajectory of self-rated health (SRH): before and after a heart failure event

**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 https://sites.cscc.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.cscc.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.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