**ARIC Manuscript Proposal #4131**

**PC Reviewed: 10/11/2022** **Status: _____** **Priority: 2**
**SC Reviewed: _____** **Status: _____** **Priority: ____**

**1.a. Full Title**: Associations of psychosocial factors and cardiovascular health measured by Life's Essential 8: the Atherosclerosis Risk in Communities (ARIC) Study

**b. Abbreviated Title (Length 26 characters)**: Psychosocial factors LE8

**2. Writing Group**:

Writing group members: Kennedy M. Peter, Anna Kucharska-Newton, Eugenia Wong, Priya Palta, Yejin Mok, Pam Lutsey, 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]**

**First author**: **Kennedy M. Peter**
Address: UNC Department of Epidemiology
123 W. Franklin St., Suite 410
Chapel Hill, NC 27516
Phone: 919-966-7430
E-mail: kennedy_peter@unc.edu

**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).
Name: **Wayne Rosamond**
Address: UNC Department of Epidemiology
123 W. Franklin St., Suite 410
Chapel Hill, NC 27516
Phone:
E-mail: wayne_rosamond@unc.edu

**3. Timeline**:

Submit abstract to AHA Epi/Lifestyle: October 2022
Complete analyses Winter 2022/Spring 2023
Present at AHA: March 2023
Draft Manuscript: Spring/Summer 2023
Submit for publication: Summer/Fall 2023

**4. Rationale**:

Psychosocial factors include both characteristics of one's social setting and psychological traits and state experiences. Psychosocial factors such as social isolation, social support, trait anger, and depressive symptoms, can be connected to physical health through a variety of mechanisms. Some of these mechanisms may be bidirectional, as negative psychosocial factors may increase the risk of physical health conditions such as cardiovascular disease (CVD) as well as mental health problems, which may exacerbate the already poor psychosocial factors by limiting social participation and causing further distress (depression or anger).[1,2] Negative psychosocial factors, such as high levels of anger, depressive symptoms, or social isolation, may promote non-ideal coping behaviors, increase stress, and decrease tangible resources.[3-5] Social influence due to social support and connectedness may alter health behaviors such as physical activity participation, smoking, diet, alcohol intake, medication adherence, and other health seeking behaviors.[1,4-6] Additionally, social connections and support may affect health through access to health information and resources.[3,6] Depressive symptoms and distress caused by other factors such as social isolation or lack of social support may negatively impact sleep (disturbances, disorders, and quality of sleep).[7,8] Social isolation, social support, trait anger, and depressive symptoms may affect biological mechanisms related to the immune, neuroendocrine, and CV system via these mechanisms or directly.[1,2,4-6,9]

Psychosocial factors have been associated with the incidence of a variety of CVDs, CVD mortality, and the progression of CVD.[4,5,9-11] The majority of past studies have focused on the relationships between psychosocial factors and negative CV events rather than investigating whether they are related to achievement of good cardiovascular health (CVH). In 2010, the American Heart Association set a goal of improving CVH, rather than focusing on negative outcomes such as mortality and CVD events, defining a metric of CVH called Life's Simple 7 (LS7)[12] which has been widely used by CVD epidemiologists and researchers, and is prospectively associated with many CVD outcomes.[2]

In 2022, the American Heart Association released an updated definition of CVH, now called Life's Essential 8 (LE8).[2] This metric includes all health behaviors and factors (diet, physical activity, nicotine exposure, body mass index (BMI), blood lipids, blood pressure, and blood glucose) included in LS7, and adds sleep as a new component.[2] Additionally, in comparison to the LS7, the LE8 updates the scoring of metrics to be more continuous to better represent interindividual differences, and changes the definitions of component criteria to be in line with current clinical guidelines.[2] Major changes in the definitions of metrics are a shift from prioritizing the Dietary Approaches to Stop Hypertension (DASH)-diet to a modified version of the Mediterranean Eating Pattern for Americans (MEPA) for individuals but maintaining the DASH definition for population-level measures, the inclusion of e-cigarettes and vaping devices along with secondhand smoke exposure as smoking exposures, a shift from total cholesterol to non-high-density lipoprotein cholesterol, and adding hemoglobin A1c as a means of quantifying diabetes management.[2,12] Physical activity, blood pressure, and BMI definitions remained the same, but scoring for these measures was also updated.[2]

Although the associations between psychosocial factors and individual components of CVH are relatively well understood,[4,5] fewer studies have focused on the associations between these factors and CVH. The majority of existing studies focus on associations between depressive symptoms and CVH, while very few investigate these associations with social isolation, social support, or trait anger. We are aware of 10 prior cross-sectional studies that investigated the association of depressive symptoms with CVH, of which 9 found greater depressive symptoms to be cross-sectionally associated with worse CVH,[13,14] with one finding no significant

association.[15] Additionally, three studies have investigated the prospective associations of depressive symptoms and CVH, finding depressive symptoms to predict worse LS7 scores prospectively and vice versa.[13] Very few studies have investigated the associations of social isolation, social support, and trait anger with LS7. Among participants 40 and older in the National Health and Nutrition Examination Survey (NHANES), lack of social support was cross-sectionally associated with lower LS7 scores.[16] A study of Finnish women ages 19-66 found social isolation to be associated with worse LS7 scores, but found no association between hostility (which is similar to trait anger) and CVH.[17] To our knowledge, no studies have investigated whether the well-established prospective association between CVH and incidence of CVD[18] is modified by these psychosocial factors.

Examination of the associations between psychosocial factors and CVH may suggest factors which can be targeted to improve CVH before CVD manifests, or may indicate individuals in need of CV risk factor intervention based on their psychosocial factor profile. To our knowledge, no studies have investigated the associations of psychosocial factors (social isolation, social support, trait anger, and depressive symptoms) with CVH as defined by the new LE8 score. We propose to investigate the cross-sectional associations of psychosocial factors with CVH defined by the American Heart Association's LE8, and individual CVH components, in the Atherosclerosis Risk in Communities (ARIC) Study. Furthermore, we will examine whether these psychosocial factors are effect measure modifiers in the association between CVH and CVD incidence.

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

Aim 1: Characterize the prevalence of high CVH (defined by LE8) and its components in the ARIC Study at mid-life (Visit 2).

Aim 2: Characterize the cross-sectional associations of psychosocial factors with CVH and its individual components at ARIC Visit 2.

Aim 3: Assess differences of the cross-sectional associations of psychosocial factors with CVH by sex and race.

Aim 4: Assess whether psychosocial factors are effect measure modifiers of the prospective association between CVH and incident total CVD.

**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 the psychosocial exposures and LE8 components at Visit 2 (except physical activity which will be taken from Visit 1) will be included in cross-sectional and prospective analyses. All demographic characteristics were collected at ARIC Visit 1.

**Exclusions**. Participants missing psychosocial factor or LE8 data from ARIC Visit 2. Non-white and non-Black participants. Participants with a history of CVD prior to ARIC Visit 2.

**Exposure assessment**. Psychosocial exposures for this analysis will include social isolation, social support, trait anger, and depressive symptoms, all measured at ARIC Visit 2 (1990-1992). All measures were assessed using self-administered questionnaires.

Social isolation: Social isolation addresses the number and frequency of interactions with social contacts, along with involvement in social networks and the community.[19] The questionnaire used to assess social isolation at ARIC Visit 2 was the Lubben Social Newtork Scale (LSNS), a psychometrically valid and well validated questionnaire that has high internal reliability.[20] This questionnaire asks participants to report the self-assessed availability of social interactions with friends, family, and other community members, as well as the number of persons of each type of interaction. The LSNS includes 10 questions that use a 0-5 rating scale with total scores ranging from 0-50. Previous studies have categorized this measure into levels of risk for social isolation: low risk (≥31), moderate risk (26-30), high risk (21-25), and socially isolated (≤20).[21]

Social support: Perceived social support measures the extent and types of support available from existing relationships.[3] An abbreviated version of the Interpersonal Support Evaluation List (ISEL) was used at ARIC Visit 2. The ISEL has an internal consistency ranging from 0.88 to 0.90, a six-week test-retest correlation of 0.70, and is highly correlated with other measures of social support.[22,23] This measure asks 16 questions based on 4 subscales of social support: appraisal, belonging, self-esteem, and tangible. Questions are summed to create an overall score of total perceived support, of which there are no widely accepted cut points or categorizations available.

Trait anger: Anger is an emotion that arises from feelings of being treated unfairly and is accompanied by an agitated state.[4] The ARIC Study measures trait anger using the Spielberger Trait Anger Scale, which includes 10 questions that measure the frequency and intensity of symptoms of anger, particularly concepts such as Type A behavior, hostility, and anger.[24] Response options range from “almost never” to “almost always” and are scored from 1-4, with total scores ranging from 10-40. Previous studies have categorized this measure as low trait anger (10-14), moderate trait anger (15-21), and high trait anger (22-40).[25]

Depressive symptoms: Depressive symptoms are measured using the Maastricht Vital Exhaustion Questionnaire.[26] Originally, this measure includes 21 questions, but some of these will be used to assess sleep quality/sleepiness. We will utilize 18 of the 21 questions as a measure of depressive symptoms. Subtopics of the questions included are vegetative depressive symptoms (concentration), non-vegetative symptoms (hopelessness, crying symptoms, irritability, reduced libido, and suicidal thoughts), and functional depressive symptoms (coping and productivity). Questions are scored as 0 (No), 1 (Don’t Know), and 2 (Yes), and overall scores range from 0-36 with higher scores indicating greater number of depressive symptoms.

**Outcome assessment**. CVH will be defined using the American Heart Association’s new metric, LE8. Additionally, individual components of CVH will be investigated as outcomes, categorized according to LE8.

Diet: Dietary intake was assessed by a modified version of the 66-item Harvard food frequency questionnaire.[27] This questionnaire asks participants how frequently they eat a certain quantity of

a specific food (eg. ½ cup serving of ice cream), with response options including: > 6 per day, 4-6 per day, 2-3 per day, 1 per day, 5-6 per week, 2-4 per week, 1 per week, 1-3 per month, and almost never. Coding for ideal CVH diet according to the LE8 is based on points assigned to quintiles of particular foods. Quintile points range from 1-5, with total scores ranging from 8-40. Higher scores indicate a more ideal diet.

| **Component** | **LE8 foods** | **ARIC foods** | **Scoring** |
|---|---|---|---|
| Fruits | Fruits and fruit juices | Apples/pears, oranges, oranges/grapefruit juice, peaches/apricots/plums, bananas, other fruits | 1 = Quintile 1<br>2 = Quintile 2<br>3 = Quintile 3<br>4 = Quintile 4<br>5 = Quintile 5 |
| Vegetables | Vegetables (except potatoes and legumes) | Green beans, broccoli, cabbage/cauliflower/brussels sprouts, carrots, corn, spinach/collards, squash, sweet potatoes, tomatoes | |
| Nuts and legumes | Nuts, peanut butter, dried beans, peas, tofu | Peas/lima beans, beans/lentils, peanut butter, nuts | |
| Whole grains | Brown rice, dark breads, cooked cereal, whole grain cereal, other grains, popcorn, wheat germ, bran | Cooked cereal, dark/whole grain bread | |
| Low-fat dairy | Skim milk, yogurt, cottage cheese | Skim milk, yogurt, cottage cheese | |
| Sodium | Sum of all sodium content | Sum of all sodium content | 1 = Quintile 5<br>2 = Quintile 4<br>3 = Quintile 3<br>4 = Quintile 2<br>5 = Quintile 1 |
| Red and processed meats | Beef, pork, lamb, deli meats, organ meats, hot dogs, bacon | Hamburgers, hot dogs, processed meats, bacon, beef/pork/lamb sandwich, beef/pork/lamb dish | |
| Sweetened beverages | Carbonated and non-carbonated sweetened beverages | Low calorie soft drinks, regular soft drinks, fruit-flavored punch/non-carbonated beverages | |

Physical activity: Physical activity was measured by the Baecke questionnaire at Visit 1 which will be used as an approximation of physical activity at Visit 2. The Baecke questionnaire measures the participant's yearly frequency of participating in sports (up to four entries) and walking habits.[28] These logs are converted to metabolic equivalents (METs) per the Compendium of Physical Activities. Duration of weekly physical activity * number of months per year are used to derive MET-minutes per week of physical activity.

Nicotine exposure: Smoking status was measured at Visits 1 (1987-1989) and 2 (1990-1992) as current, former, or never smokers. Questions also asked when/for how long they had stopped smoking, which will be used to derive the number of years since having quit smoking. Non-smokers were asked how many hours/week they were in close contact with people while they were actively smoking as a measure of second-hand smoke.

Sleep: Sleep problems and tiredness were measured at ARIC Visit 2 as part of the Maastricht Vital Exhaustion Questionnaire. The first three questions on this survey will be used to represent sleep:

1. "Do you often feel tired?"
2. "Do you often have trouble falling asleep?"
3. "Do you wake up repeatedly during the night?"

Response options to these questions include Yes (2), No (0), or Don't Know (1). Possible scores for this sleepiness subscale will range from 0 to 6, with greater scores indicating greater sleepiness and poorer sleep quality.

Hours of sleep was also measured on a subset of 1667 ARIC participants using in-home polysomnography in 1996-1998 as a part of the Sleep Heart Health Study, about 6 years after Visit 2.[29] Self-reported hours of sleep was also measured as a part of this study. The correlation between hours of sleep per night and sleep-related questions from the Vital Exhaustion Questionnaire will be assessed among the ~1667 ARIC participants who have both measures.

BMI: Weight was measured using a balance beam scale. Height was measured in cm by a stadiometer. BMI is calculated as weight (kg) / height squared ($m^2$).

Blood lipids: Fasting blood samples were taken from ARIC participants. Total cholesterol, high-density lipoproteins, and low-density lipoproteins were measured using standardized enzymatic methods. Cholesterol-lowering medication use within the past two weeks were taken by self-report and or from prescription bottles.

Blood pressure: Sitting blood pressures (systolic and diastolic, mmHg) were measured 3 times after a 5 minute rest period, using a random zero sphygmomanometer. The final two measurements were averaged and will be used in the proposed analyses. Antihypertensive use within the past two weeks were taken by self-report and or from prescription bottles.

Blood glucose: Fasting blood samples were taken from ARIC participants. Serum blood glucose and Hemoglobin A1c (HbA1c) were both measured at ARIC Visit 2, with HbA1c measured retrospectively as part of an ancillary study. Serum blood glucose levels were measured using the hexokinase/glucose-6-phosphate dehydrogenase procedure. HbA1c was measured using the Tosoh 2.2 Plus HPLC instrument and the Tosoh G7 HPLC instrument.[30] Intraclass correlation between these two instruments was 0.98.[30] Blood glucose lowering medication use within the past two weeks were taken by self-report and or from prescription bottles.

LE8: Total CVH is calculated as the sum of the average of all CVH health metrics, and can range from 0-100 with higher scores indicating better CVH.[2] Recommended categories of scores include 80-100 as high CVH, 50-79 as moderate CVH, and 0-49 as low CVH.[2]

| CVH metric | LE8 definition | Coding for analyses |
|---|---|---|
| Diet | Population scoring using quantiles of DASH-style adherence or Healthy Eating Index:<br>100 = ≥ 95$^{th}$ percentile (top/ideal)<br>80 = 75$^{th}$-94$^{th}$ percentile<br>50 = 50$^{th}$-74$^{th}$ percentile<br>25 = 25$^{th}$-49$^{th}$ percentile<br>0 = 1$^{st}$-24$^{th}$ percentile (bottom/least ideal) | Same |
| Physical activity | Minutes of moderate-to-vigorous activity per week:<br>100 = ≥ 150 mins<br>90 = 120-149 mins<br>80 = 90-119 mins<br>60 = 60-89 mins<br>40 = 30-59 mins<br>20 = 1-29 mins<br>0 = 0 mins | Same |
| Nicotine exposure | Combustible tobacco use or nicotine-delivery system, or secondhand smoke exposure:<br>100 = never smoker<br>75 = former smoker, quit ≥ 5 years<br>50 = former smoker, quit 1-5 years<br>25 = former smoker, quit < 1 year or currently using nicotine delivery system<br>0 = current smoker | Cigarette smoking status:<br>100 = never smoker<br>75 = former smoker, quit ≥ 5 years<br>50 = former smoker, quit 1-5 years<br>25 = former smoker quit < 1 year, or the upper quartile of hours/week of exposure to second hand smoke<br>0 = current smoker |
| Sleep | Average hours of sleep per night:<br>100 = 7 to ≤ 9 hours<br>90 = 9 to ≤ 10 hours<br>70 = 6 to ≤ 7 hours<br>40 = 5 to ≤ 6 or ≥ 10 hours<br>20 = 4 to ≤ 5 hours<br>0 = < 4 hours | Score on Maastricht Vital Exhaustion sleep-related questions:<br>100 = 0<br>90 = 1<br>70 = 2<br>60 = 3<br>40 = 4<br>20 = 5<br>0 = 6<br><br>Hours of sleep per night (sensitivity analysis) |
| Body mass index | BMI (kg/m$^2$):<br>100 = < 25 kg/m$^2$<br>70 = 25.0-29.9 kg/m$^2$ | Same |

| | | |
|---|---|---|
| | 30 = 30.0-34.9 kg/$m^2$<br>15 = 35.0-39.9 kg/$m^2$<br>0 = ≥ 40.0 kg/$m^2$ | |
| Blood lipids | Plasma total cholesterol and HDL cholesterol used to calculate non-HDL cholesterol (mg/dL):<br>100 = < 130 mg/dL<br>60 = 130-159 mg/dL<br>40 = 160-189 mg/dL<br>20 = 190-219 mg/dL<br>0 = ≥ 220 mg/dL<br>If drug-treated level, subtract 20 points | Same |
| Blood glucose | Fasting Blood Glucose (FBG) mg/dL or HbA1c (%):<br>100 = No history of diabetes and FGB < 100 (or HbA1c < 5.7)<br>60 = No diabetes and FBG 100-125 (or HbA1c 5.7-6.4)<br>40 = Diabetes with HbA1c < 7.0<br>30 = Diabetes with HbA1c 7.0-7.9<br>20 = Diabetes with HbA1c 8.0-8.9<br>10 = Diabetes with HbA1c 9.0-9.9<br>0 = Diabetes with HbA1c ≥ 10.0 | Same<br>Diabetes defined as fasting blood glucose ≥ 126 mg/dL |
| Blood pressure | Systolic/diastolic blood pressures (mmHg)<br>100 = <120 / < 80 mmHg<br>75 = 120-129 / < 80 mmHg<br>50 = 130-139 or 80-89 mmHg<br>25 = 140-159 or 90-99 mmHg<br>0 = ≥ 160 or ≥ 100 mmHg<br>Subtract 20 points if treated level | Same |

Incident Total Cardiovascular Disease: Cardiovascular disease events will include heart failure, definite fatal coronary heart disease, definite or probable myocardial infarction, and definite or probable stroke. Events were ascertained by annual contact with participants, which were confirmed by hospitalization and death records from the previous year.[31-34] Heart failure was defined as an ICD-9 discharge code of 428.0-428.9 in any position, or the same code on death certificates.[31,33] Hospitalized myocardial infarction events were confirmed by medical record abstraction using symptoms, electrocardiograms, and cardiac biomarkers.[32] Fatal coronary heart disease was confirmed by death certificates. Probable and definite stroke were confirmed by medical record abstraction using reported symptoms, diagnostic reports, and neuroimaging.[34]

**Covariates of interest**. Models will be adjusted for race-center, biologic sex, and education, all measured at ARIC Visit 1 (1987-1989). Additionally, models will adjust for age at Visit 2.

Visit 1 (1987-1989) Variables:

- Race
- Study center
- Biologic sex
- Education
- Age at Visit 1

Visit 2 (1990-1992) Variables:

- Depression medication use
- Prevalent CVD
- Age at Visit 2

**Statistical Evaluation**. As there are no established categories for perceived social support, we will use tertiles of the measure to indicate high, medium, and low social support. Similarly, we will represent depressive symptoms using tertiles that indicate high, medium, and low levels of depressive symptoms.

The distribution of CVH and its components will be assessed, and if necessary, we will recategorize and adjust our analysis plan. We will examine descriptive statistics of demographics, psychosocial variables, and CVH components. We will also assess descriptive statistics of demographic, psychosocial variables, and CVH components stratified by different levels (high, moderate, low) of CVH (LE8).

CVH will be assessed both as a continuous outcome, and as a dichotomous outcome comparing the odds of high CVH to moderate and low CVH. Individual components of CVH will be assessed as a dichotomous variable, with moderate and low combined as the referent, and ideal CVH as the comparator.

Crude and adjusted associations of individual psychosocial factors with CVH outcomes (LE8) and its individual components will be assessed using linear regressions for continuous outcomes and logistic regressions for dichotomous measures of CVH. Effect measure modification by sex and race will be examined by including interaction terms in the models, and by examining stratified estimates and their confidence interval overlap.

Adjusted Cox proportional hazards models will be used to assess the association of CVH at Visit 2 with incident CVD. Effect measure modification of this association by psychosocial factors will be assessed by including interaction terms in the models and assessing p-values at an alpha of 0.05, and by examining stratified estimates and their confidence interval overlap.

Sensitivity analyses will categorize the sleep scores in relation to the cumulative prevalence of that score out of 100% added to the prevalence of lower value sleep scores. We will utilize the data on hours of sleep among 1667 ARIC participants in 1996-1998, as an approximation of hours of sleep at Visit 2, as a further sensitivity analysis completed only among those with in-home polysomnography measurements. Another sensitivity analysis will adjust for depression-related medication use for analyses using depressive symptoms as the exposure.

**Limitations**. Race and study center are highly correlated in this population, as most of the Black Americans live in Jackson, MS. Therefore, we will use the covariate race-center to account for this association, rather than race and center as separate covariates. Physical activity was not measured at Visit 2, however, the measurement at Visit 1 taken approximately 3 years prior will serve as an approximation of physical activity at Visit 2. The ARIC study does not measure hours of sleep at Visit 2 as recommended by the LE8 scoring method, however the sleep-related questions on the Maastricht Vital Exhaustion questionnaire will serve as a stand-in measure. Sensitivity analyses will explore different specifications of this variable, along with its correlation with hours of sleep measured among a subset of the population measured 6 years after Visit 2, and a sensitivity analysis comparing hours of sleep and the Maastricht Vital Exhaustion sleep-related questions as part of LE8 among this subset of the population. The measurement of depressive symptoms is not a validated measure, as we selected certain questions to represent sleep and sleep quality and used the remaining questions to represent depressive symptoms from the Maastricht Vital Exhaustion questionnaire. Additionally, this measure only represents depressive symptoms, not diagnosis with clinical depression. However, previous studies looking at depression and LS7 have used one or two questions to define depressive symptoms, although some have used validated measures of depressive symptoms.[17] We were unable to investigate other psychosocial factors such as anxiety, stress, optimism, life satisfaction, and more, as ARIC only measured the four factors presented in this proposal. ARIC does not have a measure of nicotine-delivery systems (such as vaping devices) as these largely did not exist when Visit 2 occurred. Self-reported diet, smoking status, and physical activity may be subject to recall and social desirability biases.

**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

___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)?**

There are currently no published manuscripts or manuscript proposals relating CVH defined by LS7 or LE8 and psychosocial factors. Below listed are several papers having to do with LS7 or psychosocial factors in general.

**LS7 papers/proposals:**

Plante: Cardiovascular health as quantified by the American Heart Association's life's simple 7 (LS7) metric and risk of Covid-19 hospitalization
Enduru: Genetic risk, midlife life's simple 7 and incident ischemic stroke in the ARIC study
Tin: An evaluation of life's simple 7 score in midlife in offsetting the genetic risk of dementia
Song: Association between life's simple 7 and cardiovascular disease in cancer patients compared to noncancer controls in the ARIC cohort
Wang: Income changes across federal poverty level, change in American Heart Association's life's simple 7 score, and incident cardiovascular disease: the ARIC study
Onyeaghala: Relationship between polygenic risk score and life's simple 7 guidelines on the lifetime risk of coronary artery disease
Rebholz: Relationship of the American Heart Association's impact goals (life's simple 7) with risk of chronic kidney disease: results from the ARIC cohort study
Folsom: Community prevalence of ideal cardiovascular health, by the American Heart Association definition, and relationship with cardiovascular disease incidence
Lee: Education and cardiovascular health as effect modifiers of APEO E4 on dementia: the ARIC study
Tin: Genetic risk, midlife life's simple 7, and incident dementia in the atherosclerosis risk in communities study
Palta: Midlife cardiovascular health and robust versus frail late-life status: the ARIC study
Krishnappa: Life's simple 7 cardiovascular health score and premature atrial contractions: the ARIC study
Wang: Association of life's simple 7 with atrial fibrillation burden (from the ARIC study)
Evans: Lifestyle moderates genetic risk of venous thromboembolism: the ARIC study
Oyenuga: Association of life's simple 7 with reduced clinically manifest abdominal aortic aneurysm: the ARIC study
Oyenuga: Greater adherence to life's simple 7 is associated with less arterial stiffness: the atherosclerosis risk in communities study
Garg: American Heart Association's life simple 7 and risk of atrial fibrillation in a population without known cardiovascular disease: the ARIC study
Mok: American Heart Association's life's simple 7 at middle age and prognosis after myocardial infarction in later life
Garg: Life's simple 7 and peripheral artery disease risk: the ARIC study
Gonzalez: Midlife cardiovascular health and 20-year cognitive decline: ARIC study results
Fretz: Relation of lifestyle factors and life's simple 7 score to temporal reduction in troponin levels measured by a high-sensitivity assay (from the ARIC study)
Windham: Relationship between midlife cardiovascular health and late-life physical performance: the ARIC study

Rebholz: Relationship of the American Heart Association's impact goals (life's simple 7) with risk of chronic kidney disease: results from the ARIC cohort study
Folsom: American Heart Association's life's simple 7 and incidence of venous thromboembolism
Folsom: American Heart Association's life's simple 7: avoiding heart failure and preserving cardiac structure and function

**Psychosocial factor papers/proposals**:
Meyer: Association of psychosocial factors with arterial stiffness and its 5-year change in African Americans
Bey: Psychosocial moderators of the effects of neighborhood stressors on cognitive outcomes
Bey: Biological mediators and psychosocial moderators of the effects of neighborhood stressors on cardiovascular disease
Kucharska-Newton: Psychosocial impact of the social distancing imposed during the COVID-19 pandemic on cognitive and physical functioning among older adults
Gwizdala: Psychosocial moderators of the diabetes-brain relationship: the Jackson Heart Study and the ARIC study cohorts
Honda: Psychosocial factors and calcification of coronary arteries, aorta, and cardiac valves at older age: the ARIC study
Palta: Psychosocial and ideal vascular protection against cognitive decline
Joshu: Aging and psychosocial causes of cancer disparities in understudied subpopulations – residents of lower population/density areas, those of low SES, and the elderly, including those who are African American
Kardia: The effects of interactions between psychosocial factors and genes on blood pressure traits
Hickson: The associations of psychosocial stress and discrimination with brain MRI and cognitive function: the shared cohort of the ARIC study and the JHS
Chambless: ARIC CHD risk prediction from behavioral, psychosocial, and socioeconomic factors
Shah: Association of psychosocial factors with short-term resting heart rate variability: the ARIC study
Honda: Psychosocial factors and subsequent risk of hospitalizations with peripheral artery disease: the ARIC study
Smith: Gene-by-psychosocial factor interactions influence diastolic blood pressure in European and African Ancestry populations: a meta-analysis of four cohort studies
Kats: Social support and cognition in a community-based cohort: the ARIC study
Wattanakit: Association of anger proneness, depression and low social support with peripheral arterial disease: the ARIC study
Garg: Associations of anger, vital exhaustion, anti-depressant use, and poor social ties with incident atrial fibrillation: the ARIC study
Kucharska Newton: Anger proneness, gender, and the risk of heart failure
Williams: Race-gender differences in the association of trait anger with subclinical carotid artery atherosclerosis: the ARIC study
Golden: Anger temperament is modestly associated with the risk of type 2 diabetes mellitus: the ARIC study
Williams: Trait anger and arterial stiffness: results from the ARIC study

Williams: The association between trait anger and incident stroke risk: the ARIC study
Williams: Effects of an angry temperament on coronary heart disease risk: the ARIC study
Williams: Anger proneness predicts coronary heart disease risk: prospective analysis from the ARIC study
Bogle: Vital exhaustion and sudden cardiac death in the ARIC study
Cene: Social isolation, vital exhaustion, and incident heart failure: findings from the ARIC study
Williams: Vital exhaustion as a risk factor for adverse cardiac events (from the ARIC study)
Bryant: Obesity and vital exhaustion: analysis of the ARIC study
Schwartz: Synergism between smoking and vital exhaustion in the risk of ischemic stroke: evidence from the ARIC study

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

**11.b. If yes, is the proposal**

**___ A. primarily the result of an ancillary study (list number* _____)**
**_X__ B. primarily based on ARIC data with ancillary data playing a minor role (usually control variables; list number(s)* _1995.12_____ ___2006.15_____ _____)**

*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.


1. Uchino BN. Social support and health: a review of physiological processes potentially underlying links to disease outcomes. *J Behav Med.* 2006;29(4):377-387.
2. Lloyd-Jones DM, Allen NB, Anderson CAM, et al. Life's Essential 8: Updating and Enhancing the American Heart Association's Construct of Cardiovascular Health: A Presidential Advisory From the American Heart Association. *Circulation.* 2022:101161CIR0000000000001078.
3. Berkman LF, Krishna A. Social Network Epidemiology. In: *Social Epidemiology*. Oxford University Press; 2014.
4. Suls J. Anger and the heart: perspectives on cardiac risk, mechanisms and interventions. *Prog Cardiovasc Dis.* 2013;55(6):538-547.

5. Joynt KE, Whellan DJ, O'Connor CM. Depression and cardiovascular disease: mechanisms of interaction. *Biological Psychiatry.* 2003;54(3):248-261.
6. Hemingway H, Marmot M. Psychosocial factors in the aetiology and prognosis of coronary heart disease: systematic review of prospective cohort studies. *BMJ.* 1999;318:1460-1467.
7. Pakpour AH, Griffiths MD, Ohayon MM, Brostrom A, Lin CY. Editorial: A Good Sleep: The Role of Factors in Psychosocial Health. *Front Neurosci.* 2020;14:520.
8. Nordin M, Knutsson A, Sundbom E, Stegmayr B. Psychosocial factors, gender, and sleep. *J Occup Health Psychol.* 2005;10(1):54-63.
9. Ertel KA, Glymour MM, Berkman LF. Social networks and health: A life course perspective integrating observational and experimental evidence. *Journal of Social and Personal Relationships.* 2009;26(1):73-92.
10. Chin B, Cohen S. Review of the Association Between Number of Social Roles and Cardiovascular Disease: Graded or Threshold Effect? *Psychosom Med.* 2020;82(5):471-486.
11. Everson-Rose SA, Lewis TT. Psychosocial factors and cardiovascular diseases. *Annu Rev Public Health.* 2005;26:469-500.
12. Lloyd-Jones DM, Hong Y, Labarthe D, et al. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's strategic Impact Goal through 2020 and beyond. *Circulation.* 2010;121(4):586-613.
13. Ogunmoroti O, Osibogun O, Spatz ES, et al. A systematic review of the bidirectional relationship between depressive symptoms and cardiovascular health. *Prev Med.* 2022;154:106891.
14. Nmezi NA, Turkson-Ocran RA, Tucker CM, Commodore-Mensah Y. The Associations between Depression, Acculturation, and Cardiovascular Health among African Immigrants in the United States. *Int J Environ Res Public Health.* 2022;19(11).
15. Langford AT, Butler M, Booth JN, et al. Stress and Depression Are Associated With Life's Simple 7 Among African Americans With Hypertension: Findings From the Jackson Heart Study. *Am J Hypertens.* 2021;34(12):1311-1321.
16. Kieu C, Behforooz S, Wong N. Social isolation and cardiovascular health in US adults. *Scripta Medica.* 2020;51(1):9-14.
17. Veromaa V, Kautiainen H, Saxen U, Malmberg-Ceder K, Bergman E, Korhonen PE. Ideal cardiovascular health and psychosocial risk factors among Finnish female municipal workers. *Scand J Public Health.* 2017;45(1):50-56.
18. Benjamin EJ, Muntner P, Alonso A, et al. Heart Disease and Stroke Statistics-2019 Update: A Report From the American Heart Association. *Circulation.* 2019;139(10):e56-e528.
19. Valtorta NK, Kanaan M, Gilbody S, Hanratty B. Loneliness, social isolation and social relationships: what are we measuring? A novel framework for classifying and comparing tools. *BMJ Open.* 2016;6(4):e010799.
20. Lubben JE, Blozik E, Gerhard G, et al. Performance of an abbreviated version of the Lubben Social Network Scale among three European community-dwelling older adult populations. *The Gerontologist.* 2006;46(4):503-513.
21. Rubinstein RL, Lubben JE, Mintzer JE. Social Isolation and Social Support: An Applied Perspective. *Journal of Applied Gerontology.* 1994;13(1):58-72.
22. Heitzmann CA, Kaplan RM. Assessment of methods for measuring social support. *Health Psychology.* 1988;7(1):75-109.
23. Sarason BR, Shearin EN, Pierce GR, Sarason IG. Interrelations of Social Support Measures: Theoretical and Practical Implications. *Journal of Personality and Social Psychology.* 1987;52(4):813-832.
24. Spielberger CD. State-Trait Anger Expression Inventory. In: *The Corsini Encyclopedia of Psychology.*2010.
25. Garg PK, Claxton JNS, Soliman EZ, et al. Associations of anger, vital exhaustion, anti-depressant use, and poor social ties with incident atrial fibrillation: The Atherosclerosis Risk in Communities Study. *European Journal of Preventive Cardiology.* 2021;28(6):633-640.
26. Appels A, Hoppener P, Mulder P. A questionnaire to assess premonitory symptoms of myocardial infarction. *International Journal of Cardiology.* 1987;17:15-24.
27. Willett WC, Sampson L, Stampfer MJ, et al. Reproducibility and Validity of a Semiquantitative Food Frequency Questionnaire. *American Journal of Epidemiology.* 1985;122(1):51-65.
28. Baecke JAH, Burema J, Frijters JER. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *The American Journal of Clinical Nutrition.* 1982;36:936-942.

29. Lutsey PL, Misialek JR, Mosley TH, et al. Sleep characteristics and risk of dementia and Alzheimer's disease: The Atherosclerosis Risk in Communities Study. *Alzheimers Dement.* 2018;14(2):157-166.
30. Selvin E, Coresh J, Zhu H, Folsom A, Steffes MW. Measurement of HbA1c from stored whole blood samples in the Atherosclerosis Risk in Communities study. *J Diabetes.* 2010;2(2):118-124.
31. Loehr LR, Rosamond WD, Chang PP, Folsom AR, Chambless LE. Heart failure incidence and survival (from the Atherosclerosis Risk in Communities study). *Am J Cardiol.* 2008;101(7):1016-1022.
32. White AD, Folsom AR, Chambless LE, et al. Community Surveillance of Coronary Heart Disease in the Atherosclerosis Risk in Communities (ARIC) Study: Methods and Initial Two Years' Experience. *J Clin Epidemiol.* 1996;49(2):223-233.
33. Rosamond WD, Chang PP, Baggett C, et al. Classification of heart failure in the atherosclerosis risk in communities (ARIC) study: a comparison of diagnostic criteria. *Circ Heart Fail.* 2012;5(2):152-159.
34. Rosamond WD, Folsom AR, Chambless LE, et al. Stroke Incidence and Survival Among Middle-Aged Adults 9-Year Follow-Up of the Atherosclerosis Risk in Communities (ARIC) Cohort. *Stroke.* 1999;30(4):736-743.