1.a. Full Title: Title: Body weight, diet, and physical activity as modifiers of pulmonary function decline from exposure to personal and environmental tobacco smoke

b. Abbreviated Title (Length 26 characters): Life-style modifiers of smoking-related lung function decline

2. Writing Group (list individual with lead responsibility first): Gloria David. PhD, NIEHS

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3. Timeline: A first manuscript should be available for circulation to the ARIC investigators nine months after receipt of the data

4. Rationale:

   The relation between personal smoking and longitudinal change in lung function is well known. Smoking accelerates the age-related decline in pulmonary function. However, several factors may modify that smoking related decline in pulmonary function. In addition to genetic variation, obesity and weight gain have been shown to predict pulmonary function decline (1, 2). This association is supported by recent evidence that obesity modifies deposition of particles in the airways of the lung (3). Tobacco smoke is an important source of particles in the indoor air. However the modifying effect of obesity on decline in pulmonary function has not been explored.

   The relation between environmental tobacco smoke and pulmonary function decline is less clear. In general the data support a small decline in pulmonary function associated with ETS. In studies in which only home exposure is assessed, relations are weaker (4). Other factors may modify the effect of environmental tobacco smoke on pulmonary function.

   In addition to obesity, dietary factors may modulate the effects of exposure to tobacco smoke on decline in lung function. These include intakes of fruits, vegetables, and associated nutrients such as vitamin C (5). Fish intake, as a source of n-3 fatty acids, may have beneficial effects on
obstructive lung disease (6). In cross-sectional analysis from the ARIC data, subjects with higher consumption of n-3 fatty acids had higher levels of lung function and lower prevalence of chronic obstructive pulmonary disease (7, 8). We have recently found an inverse association between soluble fiber intake and the incidence of chronic bronchitis symptoms in a prospective cohort among a Singapore Chinese population (9).

Higher levels of physical activity has recently been associated with slower decline in pulmonary function (FEV1) in adults (10). Whether physical activity modifies the effects of smoking or environmental tobacco smoke on lung function has not been explored. Physical activity results in increased ventilation and could increase particle deposition on that basis. However, favorable effects on exercise on ventilatory muscle strength may influence the effects of smoking on lung function decline. We can examine this later possibility by including the measures of maximal inspiratory pressure (MIP) that were collected at visit two. The ARIC data is unusual in the inclusion of MIP measurements.

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

   a. Subjects with greater levels of obesity, especially abdominal obesity, have accelerated decline in lung function in relation to personal smoking and in nonsmokers, to environmental tobacco smoke.
      
      It will be necessary to first examine the slope of pulmonary function decline in relation to smoking and environmental tobacco smoke without respect to obesity.
   
   b. Subjects with higher intakes of fresh fruits, vegetables, vitamin C, and fish have reduced decline in lung function related to personal or environmental tobacco smoke.
   
   c. Subjects with higher levels of physical activity have reduced decline in pulmonary function in relation to personal and environmental tobacco smoke.

5.a. **Analysis**

Decline in pulmonary function will be defined as the change in pulmonary function from visit one to visit two. By pulmonary function, we mean the following pulmonary function parameters examined in separate models -- FEV1, FEV1/FVC ratio, FEF25-75, and FVC. The relation between smoking and decline in lung function will be examined, after adjusting for age, height, race, study center, and sex. We will examine whether weight adjustment is necessary; it was not in a recent paper on lung function in the ARIC study (11). Smoking will be modeled as number of cigarettes per day in analyses adjusted also for years smoked, past and current smoking, and for past smokers, years since quitting. Models will include nonsmokers. We will also conduct separate models of the smoking-pulmonary function relation by the following categories to examine whether the smoking-pulmonary function relations are different and need to be presented separately -- current and past smokers, sex, and race. For environmental tobacco smoke exposure, analyses will be conducted among nonsmokers. The ETS variable available is hours per week of exposure in the past year. After examining the smoking related decline in pulmonary function as described above, we will examine whether the coefficient for smoking differs by levels of obesity, specific dietary intakes, and physical activity.
6. Data (variables, time window, source, inclusions/exclusions):

   Visit 1 – demographics, respiratory illness and symptoms, smoking, ETS, diet, physical activity
   Visit 2 – smoking, ETS, respiratory illness and symptoms, physical activity, maximum inspiratory pressure
   Visit 1 and 2 – pulmonary function measures, anthropometric measures.

   The respiratory illness and symptom data will be necessary for excluding various groups of symptomatic subjects for sensitivity analyses.

   The ARIC study has only two measures of pulmonary function three years apart. Ideally, we would have more than two measures to estimate the relation between smoking and decline in pulmonary function. However, it should be noted that here are few studies of the size of the ARIC study with longitudinal measures of pulmonary function. There have been important observations on factors influencing decline in pulmonary function from studies with only two measures. These include the Normative Aging Study (12), in which the two measures were 3 years apart, the Framingham Heart Study (13) and studies of diet (14)

7.a. Will the data be used for non-CVD analysis in this manuscript?  __X__ 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?  __X__ 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  __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 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

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)?

11. 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.
References: