1.a. **Full Title**: The Association of Lifecourse Socioeconomic Status with Hypertension Treatment and Control in Adults

b. **Abbreviated Title (Length 26 characters)**: LCSES & HT Trtmt/Ctrl

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

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   Other interested Life-Course or ARIC investigators

3. **Timeline**:

   Submit proposal to Publications Committee: July 2004  
   Complete Analysis: Dec 2004  
   Submit draft to Publications Committee: Feb 2005

4. **Rationale:**

   In the US, elevated blood pressure requiring some form of treatment is estimated to affect >50 million, or approximately 30% of the population. ¹ Awareness, treatment and control of high blood pressure among American adults have improved in the last several decades rising from 51 to 70%, 31 to 54% and 10 to 27% for awareness, treatment and control, respectively. ² However, despite this progress, disparities in the prevalence of hypertension remain, particularly with respect to race and socioeconomic status (SES). Many studies have established that single, individual-level measures of SES are inversely associated with the prevalence³-⁶ and incidence⁷-¹⁰ of high blood pressure. While the benefits of lifestyle modification (such as salt reduction, increased physical activity and low-fat diet) in the prevention and treatment of high blood pressure¹¹-¹³ have been established, barriers among socioeconomically disadvantaged
populations remain\textsuperscript{14,15}. A cross-sectional study of the third National Health and Examination Survey showed that persons with high levels of income demonstrated greater hypertension control compared to those with lower income levels\textsuperscript{16}. In addition to economic burdens (such as transportation costs, inability to take time off work, and medication costs), persons with low SES may have social, psychological and educational barriers that make behavioral changes, early treatment and adherence to hypertension therapy difficult \textsuperscript{14,17,18}. Patients’ SES may determine the level of adherence to physician recommendations\textsuperscript{19}. Patients with lower SES may have more comorbidity or psychosocial profiles that hinder preventive care or compete for the physicians’ attention. In addition, persons with higher SES may be more likely to be assertive about voicing there need for required care than persons of low SES\textsuperscript{19}.

Physician characteristics may also play role in hypertension treatment and control among low SES populations such as unconscious stereotyping, or lower physician competency in socioeconomically disadvantaged areas. Additionally physicians often do not have time to educate patients on favorable lifestyle changes and other non-pharmacologic treatments in the prevention of hypertension and hypertensive patients are often not fully educated about their antihypertensive medications. Several studies of patient satisfaction with physician care demonstrate that black patients often feel that a white physician is less participatory than a black physician\textsuperscript{20}. It is clear that patients’ SES as well as physicians’ perception of the patients’ SES may be a potential health care problem.

A recent clinical trial was conducted to improve medical care for high blood pressure in young, inner city black men by establishing a team of a nurse and community health worker and delivering an educational-behavioral intervention in addition to usual care. Barriers to hypertension treatment and control that were identified in this population at baseline included no current hypertension care, alcoholism, use of illicit drugs, social isolation, unemployment, and lack of health insurance. This trial demonstrated that high rates of hypertension treatment participation in this minority, low SES population is possible with culturally acceptable ways of delivering care\textsuperscript{14}.

The concept of cumulative low SES exposure and risk of hypertension treatment and control has not yet been fully studied using life course SES measures (at childhood, mid-life and adulthood). In a recent study by Diex Roux et al., \textsuperscript{21} exposure adverse socioeconomic characteristics in adulthood including income, education, occupation, and neighborhood SES were assessed in relation to blood pressure. The study demonstrated that age-related elevations in blood pressure and incidence of hypertension are inversely related to socioeconomic indicators. In a study of employed women by Heslop et al., \textsuperscript{10} cumulative SES was measured over life course. Authors demonstrated that SES exposures operating over time were better predictors of CVD risk factors (including diastolic blood pressure) and CVD mortality among women than SES indicators measured at a single point in time.

The effect of life epoch is important in exploring the relationship between SES and blood pressure because; (1) age is a major predictor of blood pressure in almost every population; (2) the level
of SES exposure may vary at different life-epoch; (3) other factors that accompany older age or later life
epochs may also affect SES exposure (such as decreased mobility and/or functional limitations
influencing their place of residence); and (4) sensitivity to the effects of SES exposure may vary by life
epoch. The contribution of SES exposure at different life epochs to risk of hypertension treatment
and control and in adulthood is potentially important because hypertension develops over a long period of
time. Childhood SES may play a critical role in hypertension treatment and control in adulthood through
differential exposure to a variety of other risk factors such as excessive alcohol consumption, and
obesity. It is possible that the longer duration of harmful lifestyle behaviors initiated at younger ages may
make adherence to hypertension treatments in adulthood more difficult. It is not clear from the literature
whether measures of childhood SES (such as parental occupation and education) or adulthood SES
measures (such occupation, education, access to healthcare) will demonstrate greater influence on
hypertension treatment and control in adulthood. We propose to examine, among whites and blacks
separately, the association between these measures of SES at different life epochs with hypertension
treatment and control in adulthood and explore the relative influence of life course SES factors.

5. Main Hypothesis/Study Questions:
I) Hypertension treatment and control in adulthood are associated with individual-level SES in adulthood
II) The cumulative effect of individual-level SES across life course is associated with hypertension
treatment and control in adulthood, independently of SES status in adulthood
III) Life course SES and adulthood SES are additive in their association with hypertension treatment and
control in adulthood
IV) The association between individual-level SES over the life course and (each of) hypertension
treatment and control in adulthood reflects a cumulative process (as opposed to SES during influential life
epochs)

6. Data (variables, time window, source, inclusions/exclusions):
I) Dependent variables – Several outcomes will be investigated in these analyses among hypertensive
(defined as SBP≥ 140 or DBP ≥90 or taking antihypertensive medications) participants: (1) hypertension
treatment (defined as taking antihypertensive medications); (2) hypertension control at visit 1 (defined as
receiving antihypertensive medication and SBP < 140 and DBP < 90 mmHg).

II) Independent variables – The analysis will include the analysis of cumulative individual SES exposure
variables: at childhood (including parental education and occupation), early adulthood (education and
occupation) and midlife (occupation and income).
III) Covariables – Age, alcohol consumption, BMI, diabetes, insurance status, and county-level SES at childhood, and census tract level SES at various points in adulthood will be examined as covariates in the examination of SES exposure and hypertension treatment and control. Stratification by race/center and/or gender will also be conducted.

IV) Sources – Individual level education and occupation will be obtained from the original baseline data of the ARIC cohort. Parent education, parent occupation and place of residence in childhood, early adulthood and midlife will be obtained from the Lifecourse SES Ancillary Study.

V) Inclusions/Exclusions – Participants with missing data on the outcomes of interest and with missing relevant lifecourse SES variables will be excluded from the analyses.

VI) Statistical Analysis – Exploratory analyses will be conducted to assess the distributions of the exposures and outcomes. In order to determine the influence of SES at the 3 life epochs on hypertension and hypertension control, the goodness of fit of various weighting functions (step, linear, quadratic, and sigmoid) in regression models to the observed data will be evaluated. After determining the best fit weighting function, the appropriate weights will be applied in univariate and multivariate Poisson regression models to assess the association between cumulative SES exposure with hypertension treatment and control. (Because the rare disease assumption does not apply to our outcome, Poisson rather than logistic models will be used). In order to assess the independent effect of cumulative SES at the individual-level while controlling for SES at the neighborhood level, multilevel Poisson regression models will be employed. Interactions between cumulative SES at the individual and neighborhood level will also be assessed. Limitations of applying differential weights to different life epochs, such as differences in validity of SES measures at each epoch will be considered.

VIII) References


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 ICTDER02 must be used to exclude persons with a value RES_OTH = “CVD Research” for non-DNA analysis, and for DNA analysis RES_DNA = “CVD Research” would be used? ____ Yes  ____X__ 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://www.csec.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)?
Manuscript 981: Lifecourse socioeconomic position and diabetes in middle-aged adults
Manuscript 916: A comparison of neighborhood effects on mortality in the ARIC and GLOBE cohorts

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.