1.a. Full Title: The Impact of Health Care Availability on Hospitalized MI Incidence Rates and CHD Mortality Rates: The ARIC Surveillance Study

b. Abbreviated Title (Length 26 characters): Health Care Availability

2. Writing Group:
   Writing group members:

   Norrina Allen, PhD; Anna Kucharska-Newton, PhD; Mercedes Carnethon, PhD; Wayne Rosamond, PhD

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

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3. Timeline:
We plan on submitting an abstract to the AHA CVD Epidemiology Conference in September 2010. The manuscript will be submitted for publication by the Spring of 2011.

4. Rationale:

Areas with fewer primary care physicians have been found to have higher mortality rates than counties with higher availability of primary care. Results from pooled analyses suggest that for every increase of one primary care physician per 10,000 population all-cause mortality is reduced by 5.3%. The majority of prior research has examined the impact of physician availability on all-cause mortality, and relatively fewer studies have specifically examined cardiovascular disease, the leading cause of death in the United States. Those few studies which have, report conflicting results. Among US counties in 1990, Shi et al. (2005) found that counties with low levels of primary care had on average 3% higher heart disease mortality rates than counties with more primary care physicians. In contrast, using more current data from 1996-2000, Ricketts and Holmes (2007) found no overall association between physician supply heart disease mortality. Even less is known about the impact of physician availability on the incidence of cardiovascular disease. Hence, it remains unclear how primary care physician availability impacts the incidence of cardiovascular disease and subsequent CVD mortality.

References:

5. Main Hypothesis/Study Questions:

Using data from the ARIC Surveillance Study we propose to examine the association between health care availability and hospitalized MI incidence, CHD mortality and hospitalization for heart failure.

Study Questions/Hypotheses:
1. Does the incidence of hospitalized MI differ by availability of primary care physicians?
   a. We hypothesize areas with fewer physicians will have higher MI incidence rates.
2. Do CHD mortality rates differ by availability of primary care physicians?
   a. We hypothesize areas with fewer physicians will have higher CHD mortality rates.
3. Do heart failure event rates differ by availability of primary care physicians?
   a. We hypothesize areas with fewer physicians will have higher CHF event rates.
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).

Study Design – We propose to study the cross-sectional association between physician availability and hospitalized MI incidence rates and CHD mortality rates by zip code across the 4 communities included in the ARIC Surveillance Study: Forsyth County, NC; Jackson, MS; suburbs of Minneapolis, MN and Washington County, MD.

Outcomes/Events – All definite and probable hospitalized MIs from 1999-2007 will be included in this analyses to determine hospitalized MI rates. Incident MI will be defined as those having no indications of prior MI in the medical history. Events classified as fatal CHD events from 1999-2007 will be used to determine CHD mortality rates. Inpatient (among ages 55 and older) heart failure events from 2005-2007 will be used to determine heart failure event rates.

Exposure – We will examine three measures of health care availability and their impact on MI incidence and CHD mortality: (1) primary care physician: population ratio; (2) percentage of population residing in a primary care health professional shortage area; (3) percentage of population residing in a medically underserved area. Each outcome will be divided into tertiles for analyses. Data on the numbers of primary care physicians per zip code are available for years 1999, 2001, 2005, and 2006 from the AMA/AOA through the Dartmouth Atlas of Health Care. The proportion of the population in each zip code that resides in a health professional shortage area and the proportion residing in a medically underserved area are available from the Health Resources and Services Administration for 2006-2007 through the Dartmouth Atlas for Health Care.

Additional Covariates – Additional covariates will include ARIC study center and the following zip-code level variables obtained from the US Census Bureau: median family income, percentage in poverty, percentage of population 65+ yrs, percentage of population non-white, percentage foreign born, percentage high school graduates, rural/urban status.

Analytic Plan – We will calculate indirectly age-standardized event rates for each sex- and race-specific population in each zip code using age-specific event rates from the standard population. The total ARIC population for the year of 2000 will be used as the standard population and will be divided into eight age strata (35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74 yrs). Standardized rates will be generated by applying the standard population rates to each age-, sex- and race-population within each zip code. We will then be able to calculate the expected number of events had the population experienced the same rates as the standard population. A standardized incidence ratio (SIR) and standardized mortality ratio (SMR) will be calculated for each zip code by dividing the observed over expected number of events. Lastly, the SIR/SMR will be multiplied by the crude event rate to determine the age-adjusted event rate per zip code.

For analyses examining the associations with primary care physician: population ratio, events will be further stratified by both zip code and time period (1999-2000, 2001-2003, 2004-2005, 2006-2007) to coincide with the available data on physician numbers.
We plan to use Poisson generalized linear mixed models to calculate SIRs and SMRs by tertile for each measure of health care availability. In the model we will include zip code as a random variable in order to account for any clustering of events by zip code. We will test for effect modification by neighborhood income, ARIC study center and year by testing to determine if interaction terms are significant in the model. Models will be run overall, by sex-race-specific group, and by ARIC study center. Models will be adjusted for covariates listed above.

In order to determine the proportionate burden of incident hospitalized MI and CHD mortality for each sex-race group by health care availability, we will calculate the estimated number of events for each tertile of healthcare availability within each sex-race-subgroup divided by the total number of events in the sex-race subgroup.

7.a. Will the data be used for non-CVD analysis in this manuscript?  ____ Yes  ___X___ No

   b. If Yes, is the author aware that the file ICTDER03 must be used to exclude persons with a value RES_OTH = “CVD Research” for non-DNA analysis, and for DNA analysis RES_DNA = “CVD Research” would be used?  ____ Yes  ____ No
   (This file ICTDER03 has been distributed to ARIC PIs, and contains the responses to consent updates related to stored sample use for research.)

8.a. Will the DNA data be used in this manuscript?  ____ Yes  ____X___ No

   b. If yes, is the author aware that either DNA data distributed by the Coordinating Center must be used, or the file ICTDER03 must be used to exclude those with value RES_DNA = “No use/storage DNA”?  ____ Yes  ____ No

9. The lead author of this manuscript proposal has reviewed the list of existing ARIC Study manuscript proposals and has found no overlap between this proposal and previously approved manuscript proposals either published or still in active status. ARIC Investigators have access to the publications lists under the Study Members Area of the web site at: http://www.cscc.unc.edu/ARIC/search.php  ___X___ Yes  _____ No

10. What are the most related manuscript proposals in ARIC (authors are encouraged to contact lead authors of these proposals for comments on the new proposal or collaboration)?

11. a. Is this manuscript proposal associated with any ARIC ancillary studies or use any ancillary study data?  ____X___ Yes  ____ No
Ancillary Study #2004.05 “Socioeconomic characteristics of place of residence: impact on rates and trends in nonfatal and fatal CHD in the ARIC Surveillance Communities (ResCHD)” PI Rose, K and Heiss G

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)* geocoded addresses of hospitalized ARIC surveillance events _________)

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

12. Manuscript preparation is expected to be completed in one to three years. If a manuscript is not submitted for ARIC review at the end of the 3-years from the date of the approval, the manuscript proposal will expire.