ARIC Manuscript Proposal # 864

PC Reviewed: 02/13/02   **Status: __A__**   **Priority: __2__**
SC Reviewed: 02/14/02   **Status: __A__**   **Priority: __2__**

1.a. Full Title: The effect of neighborhood characteristics on mortality in the ARIC cohort

  b.   **Abbreviated Title (Length 26 characters):**   Neighborhoods and mortality

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

      Lead: Luisa N. Borrell, Ana V. Diez Roux, Kathryn Rose, Diane Catelier

      Dr. Borrell from Columbia University will be working closely with Dr. Diez Roux on the analyses.

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3.   **Timeline:**

      Submit proposal to Publications Committee: December 2001

      Complete Analysis: May 2002

      Submit draft to Publications Committee: August 2002

4.   **Rationale:**

Several studies have documented the health consequences of living in areas or neighborhoods characterized by low socioeconomic conditions (1-5). These effects appear to be independent of the socioeconomic position of individuals (6-9). However, the extent to which these associations differ for different causes of death has been infrequently examined. The prospective follow up of the ARIC cohort affords the unique opportunity to investigate the relationship between neighborhood characteristics and mortality in the ARIC cohort before and after adjustment for individual-level socioeconomic indicators. All-cause mortality as well as mortality for major causes of death (CVD mortality and other major causes for which

sufficient deaths are available) will be investigated. The independent and interacting effects of neighborhood and individual-level socioeconomic indicators will also be explored. There has also been recent debate on whether the use of area based measures leads to under or over estimates on socioeconomic differences in health outcomes based on individual-level data (11-13). The availability of both types of measures in ARIC will also allow a direct comparison of the strength with which area and individual-level indicators are related to mortality.

5. Main Hypothesis/Study Questions:

Neighborhood disadvantage is associated with increased mortality after controlling for individual-level socioeconomic indicators.

Associations of neighborhood socioeconomic indicators with mortality are weaker than those observed for individual-level socioeconomic indicators and mortality.

6. Data (variables, time window, source, inclusions/exclusions, analysis):

Neighborhood socioeconomic indicators will be obtained from the 1990 US Census. These indicators will include variables representing the following dimensions: 1) wealth/income (median household income, median value of housing units, and percent of household receiving interest, dividends or net rental income); 2) education (percent adults with complete high school education and percent adults with complete college education); and 3) occupation (percent of persons in managerial or professional specialty occupations). The effect of each indicator will be explored separately as well as combined into a summary score based on previous work by Diez Roux et al (3). In addition, these indicators will be investigated and compared for two census-defined areas: census tracts and block groups.

Individual-level socioeconomic indicators will be obtained from the baseline and follow up visits of the ARIC cohort. All-cause mortality and mortality for major causes of death (CVD mortality and other major causes for which sufficient deaths are available) will be obtained from ARIC follow-up data.

Neighborhood and individual-level socioeconomic indicator categories will be constructed based on previous literature as well as on the distribution of the indicators in the ARIC cohort. Mortality will be presented by race/ethnicity adjusted for gender. Survival analysis

will be used to investigate the relation of the variables of interest to mortality. Three sets of analyses will be performed. The first set of analyses will focus on estimating associations of neighborhood characteristics with mortality before and after adjustment for individual-level socioeconomic indicators. The second set of analyses will examine interactions between neighborhood and individual-level indicators. Finally, the third set of analyses will compare the strength with which neighborhood and individual-level socioeconomic indicators are related to mortality. In order to allow a direct comparison of the effects of individual-level and area-based measures, categories based on area measures will be constructed to mimic the percentile distribution of the corresponding individual-level socioeconomic indicator. Whenever possible, categories based on identical absolute cutoffs will also be compared. All analyses will be repeated and compared for census tracts and block-groups. Residual correlation between outcomes within neighborhoods will be taken into account using appropriate statistical methods. Several options will be compared including SUDAAN and multilevel survival analysis methods, and results contrasted.

Preliminary analysis indicates that a total of 1470 deaths have occurred in the ARIC cohort up to 1998. The overall cumulative death rates in the ARIC cohort for blacks and whites over the available follow-up were 13.7 % and 7.7%. Power calculations below are for comparisons of top and bottom tertiles of neighborhood characteristics (i.e. based on 2/3 of the cohort and assuming two groups of equal size are compared) in blacks and whites (14). Power is shown for a range of possible death rates in the highest (or "better-off") neighborhood tertile.

Blacks (n=4,266)

Cumulative Death rate in the Unexposed	RR		
	1.25	1.5	1.75
13.7 [*]	0.6575	0.9923	0.99999 [†]
10.2	0.5268	0.9618	0.9995
8.1	0.4397	0.9124	0.9962
5.1	0.3078	0.7560	0.9578
3.4	0.2320	0.6013	0.8662

[*] Power calculations applied to 2/3 of this cohort (n=2,858)
[†] Power approaches 100%

Whites (n=11,478)

Cumulative Death rate in the Unexposed	RR		
	1.25	1.5	1.75
7.7 [*]	0.5683	0.9745	0.9998
5.8	0.4597	0.9248	0.9972
4.6	0.3854	0.8604	0.9883
2.9	0.2744	0.6930	0.9268
1.9	0.2086	0.5406	0.8125

[*]Power calculations applied to 2/3 of this cohort (n=7,690)

Calculations show that we will have sufficient power to detect RR of 1.75 even in situations where the cumulative death rates in the unexposed is as low as 3.4% in blacks and 1.9 % in whites (i.e. 25% of the overall death rate observed in each cohort).

References

1.   Smith GD, Hart C, Watt G, Hole D, Hawthorne V. Individual social class, area-based deprivation, cardiovascular disease risk factors, and mortality: the Renfrew and Paisley Study. Journal of Epidemiology & Community Health 1998 Jun;52(6):399-405.
2.   Diez-Roux AV, Nieto FJ, Muntaner C, Tyroler HA, Comstock GW, Shahar E, et al. Neighborhood environments and coronary heart disease: a multilevel analysis. American Journal of Epidemiology 1997 Jul 1;146(1):48-63.
3.   Diez Roux AV, Merkin SS, Arnett D, Chambless L, Massing M, Nieto FJ, et al. Neighborhood of residence and incidence of coronary heart disease. [see comments]. New England Journal of Medicine 2001 Jul 12;345(2):99-106.
4.   Robert SA. Community-level socioeconomic status effects on adult health. Journal of Health & Social Behavior 1998 Mar;39(1):18-37.
5.   Yen IH, Kaplan GA. Poverty area residence and changes in depression and perceived health status: evidence from the Alameda County Study. International Journal of Epidemiology 1999 Feb;28(1):90-4.
6.   Anderson RT, Sorlie P, Backlund E, Johnson N, Kaplan GA. Mortality effects of community socioeconomic status. Epidemiology 1997 Jan;8(1):42-7.
7.   Waitzman NJ, Smith KR. Phantom of the area: poverty-area residence and mortality in the United States. [erratum appears in Am J Public Health 1998 Jul;88(7):1122]. American Journal of Public Health 1998 Jun;88(6):973-6.
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9.   Bosma H, van de Mheen HD, Borsboom GJ, Mackenbach JP. Neighborhood socioeconomic status and all-cause mortality. American Journal of Epidemiology 2001 Feb 15;153(4):363-71.
10.   Wing S, Barnett E, Casper M, Tyroler HA. Geographic and socioeconomic variation in the onset of decline of coronary heart disease mortality in white women. American Journal of Public Health 1992 Feb;82(2):204-9.
11.   Geronimus AT, Bound J.   Use of census-based aggregate variables to proxy for socioeconomic group: evidence from national samples. Am J Epidemiology 1998;148:475-86.
12.   Krieger N, Gordon G.   Use of census-based aggregate variables to proxy for socioeconomic group: evidence from national samples [Letter] Am J Epidemiology 1999;150:892-894.
13.   Davey-Smith G, Ben-Schlomo Y, Hart C. Use of census-based aggregate variables to proxy for socioeconomic group: evidence from national samples [Letter] Am J Epidemiology 1999;150:996-997.
14.   Dupont WD and Plummer WD: PS power and sample size program available for free on the Internet. Controlled Clin Trials 1997;18:274.

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   ____ 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/cscc/ARIC/stdy/studymem.html

   ___x___ Yes   _____ No