

“Mortality Crossovers: The Effects of Socioeconomic Status and Race”

Jessica M. Sautter, Patricia A. Thomas, Linda K. George, and Matthew E. Dupre

Duke University

PAA extended abstract submission

## **Background**

One “puzzle” in the demographic literature is the existence of a Black-White mortality crossover. Throughout most of the life course, Blacks have higher mortality rates than Whites; in later life, at approximately 80 years old, the survival curves of Blacks and Whites cross, so that Blacks have lower mortality rates than Whites (Nam, Weatherby, & Ockay 1978; Manton, Poss, & Wing 1979; Wing, Manton, Stallard, Hames, & Tryoler 1985; Manton & Stallard 1997; Corti et al 1999; Johnson 2000; Dupre, Franzese, & Parrado 2006). Some have argued that the crossover is an artifact of poor data, specifically due to age misreporting that exaggerates age at death for Blacks (Coale & Kisker 1986; Preston, Elo, Rosenwaike, & Hill 1996; Hill, Preston, & Rosenwaike 2000). Others have found that a Black-White mortality crossover still exists when data is adjusted to correct for age misreporting, although the crossover is pushed back to later ages (Lynch, Brown, & Harmsen 2003). In general, most data point to the existence of a mortality crossover in varied time periods, parts of the world, and subgroups, although the effect may be somewhat exaggerated by age misreporting (Nam 1995; Elo & Preston 1997).

The explanation for Black-White mortality crossover is based on notions of selective survival, population heterogeneity, and frailty. The heterogeneity/frailty explanation suggests that within any subgroup of the population, members of that group will be heterogeneous in their susceptibility to mortality. Selective survival occurs when those high mortality rates affect the most frail members of the subgroup in early life, leaving more robust members to survive to old age. The subgroup’s mortality rates then decrease at older ages because the composition of the group has changed (Horiuchi & Wilmoth 1998; Lynch, Brown and Harmsen 2003). In the case

of the Black-White mortality crossover, Blacks face more adverse conditions and higher mortality rates than Whites throughout the early life course. The more frail members of the Black population will die first and the mortality rate for Blacks will subsequently decrease as the subgroup as a whole becomes more homogeneous with respect to robust survivors (Markides & Machalek 1984; Liu & Witten 1995). The White subgroup, on the other hand, will not have experienced the same degree of selective survival because living conditions support survival for most individuals; thus the composition of the White subgroup will not change as much over time and the Black subgroup will be more robust.

A recent study takes a novel approach to mortality crossover by comparing the Navajo subgroup with the rest of the U.S. population, finding evidence for a mortality crossover even after adjustment for age overstatement (Thornton 2004). This study emphasizes the difference between advantaged and disadvantaged groups as the basis for selective mortality that affects changing aggregate mortality rates of subgroups. We propose that this basis of advantage and disadvantage is central to understanding the Black-White mortality crossover, and that an analysis explicitly focusing on socioeconomic status is greatly needed.

### **Theoretical Focus**

A powerful perspective in medical sociology is that socioeconomic status is the fundamental cause of disease and health disparity (Link & Phelan 1995). In this study, we explore the “fundamental cause” of mortality crossover by examining the existence of a socioeconomic mortality crossover between subgroups that are relatively advantaged or disadvantaged on education. This approach is based on literature noting that socioeconomic status often drives racial differences in health and mortality in general (Williams & Collins 1995; Hayward, Crimmins, Miles, & Yang 2000), but that there are also interactive effects of race and

socioeconomic status on mortality (Menchik 1993). Other studies have noted the strong impact of education on health (House, Lepkowski, Kinney, Mero, Kessler, & Herzog 1994; Ross & Wu 1996; Beckett 2000)

We propose that examination of a socioeconomic mortality crossover is an important addition to the literature on Black-White mortality crossover. The heterogeneity/frailty explanation of the Black-White crossover has been widely accepted, but is largely descriptive. An analysis based on socioeconomic status would help to explain why racial differences in heterogeneity and frailty exist. Thus we examine two research questions in this study: (1) Does a socioeconomic mortality crossover exist in the US?; and (2) Does the effect of socioeconomic status on mortality vary by race?

## **Data**

We analyze data from the Duke Established Populations for Epidemiologic Studies of the Elderly (EPESE). This dataset is ideal for examining mortality crossovers because 1) the focus on older adults and oversample of Blacks provides statistical power to detect interaction effects implicated in a crossover, and 2) the four wave panel design provides time-varying covariates and enhances confidence in age reporting.

The Duke EPESE includes data from a stratified probability sample of 5 counties in North Carolina. A baseline sample of 4,162 individuals were interviewed in 1986/7, 1989, 1992, and 1996, with response rates above 90%. Full details of the Duke EPESE are reported by Coroni-Huntley and colleagues (1993).

Measures include socioeconomic indicators of education (1-7 years, 8-11 years, 12+ years) and income (measured in quartiles). Race is measured dichotomously (Black and White). We also test covariates that may mediate the effect of socioeconomic status on mortality

crossover. Health indicators include cigarette smoking (pack years), BMI (dichotomous indicators of obesity and underweight), alcohol consumption (dichotomous indicator of heavy use), functional impairment (dichotomized Rosow-Breslau), self-reported health (dichotomized), and health index of chronic conditions. Resource indicators include perceived social support and marital status. We also include gender and religious attendance (three dichotomous indicators of once a week or more, infrequently, and never attend/only attend once or twice per year). All indicators are time-varying when possible.

## **Methods**

We adopt the analytical framework of Dupre, Franzese, and Parrado (2006) to examine how a social factor that varies by race (socioeconomic status) moderates the Black-White mortality crossover. First, we establish the Black-White crossover. Second, we include socioeconomic indicators of education and income. Third, we include interaction terms of socioeconomic status and race as well as age. Fourth, we include factors that mediate the relationship between socioeconomic status and health: health status (self-rated health, functional impairments, health index), health risks (smoking, drinking, BMI), and health resources (marital status, perceived social support, and religious attendance).

## **Expected Findings**

First, we expect to find a Black-White mortality crossover at later ages. Second, we expect to find a socioeconomic mortality crossover at later ages. Both of these effects would be evidenced by Disadvantaged-Advantaged risk ratios greater than 1.0 at earlier ages, then “crossing” to less than 1.0 at older ages. In regards to the joint effects of race and SES, we do not expect that SES will fully explain away the Black-White mortality crossover. Instead, we expect to find an interactive effect, with the effect of SES varying by race.

## References

- Beckett, Megan. 2000. "Converging Health Inequalities in Later Life-An Artifact of Mortality Selection?" *Journal of Health and Social Behavior* 41:106-119.
- Coale, Ansley J., and Ellen E. Kisker. 1986. "Mortality Crossovers: Reality or Bad Data?" *Population Studies* 40:389-401.
- Coroni-Huntley, J., A.M. Ostfeld, J.O. Taylor, R.B. Wallace, D. Blazer, L.F. Berkman, D.A. Evans, F.J. Kohout, J.H. Lemke, P.A. Scherr, and S.P. Korper. 1993. "Established Populations for Epidemiologic Studies of the Elderly—Study Design and Methodology." *Aging-Clinical and Experimental Research*, 5(1): 27-37.
- Corti, Maria-Chiara, Jack M. Guralnik, Luigi Ferrucci, Grant Izmirlian, Suzanne G. Leveille, Marco Pahor, Harvey J. Cohen, Carl Pieper, and Richard J. Havlik. 1999. "Evidence for a Black-White Crossover in All-Cause and Coronary Heart Disease Mortality in an Older Population: The North Carolina EPESE." *American Journal of Public Health* 89:308-314.
- Dupre, Matthew E., Alexis T. Franzese, and Emilio A. Parrado. 2006. Religious Attendance and Mortality: Implications for the Black-White Mortality Crossover. *Demography* 43(1): 141-164.
- Elo, Irma T., and Samuel H. Preston. 1997. Racial and Ethnic Differences in Mortality at Older Ages. Chapter 2, pp. 10-42 in Martin & Soldo (Eds) *Racial and Ethnic Differences in the Health of Older Americans*. Washington D.C.: National Academy Press.
- Hayward, Mark D., Eileen M. Crimmins, Toni P. Miles, and Yu Yang. 2000. "The Significance of Socioeconomic Status in Explaining the Racial Gap in Chronic Health Conditions." *American Sociological Review* 65:910-930.
- Hill, Mark E., Samuel H. Preston, and Ira Rosenwaike. 2000. "Age Reporting among White Americans Ages 85+: Results of a Record Linkage Study." *Demography* 37:175-186.
- Horiuchi, Shiro and John R. Wilmoth. 1998. Deceleration in the Age Pattern of Mortality at Older Ages. *Demography* 35(4): 391-412.
- House, James S., Paula M. Lantz, & Pamela Herd. 2005. Continuity and Change in the Social Stratification of Aging and Health over the Life Course: Evidence from a Nationally Representative Longitudinal Study from 1986 to 2001/2002 (Americans' Changing Lives Study). *Journals of Gerontology* 60B(Special Issue II): 15-26.
- House, James S., James M. Lepkowski, Ann M. Kinney, Richard P. Mero, Ronald C. Kessler, and A. Regula Herzog. 1994. "The Social Stratification of Aging and Health." *Journal of Health and Social Behavior* 35:213-234.
- Johnson, Nan E. 2000. "The Racial Crossover in Comorbidity, Disability, and Mortality." *Demography* 37:267-283.
- Link, Bruce G., & Jo Phelan. 1995. "Social Conditions as Fundamental Causes of Disease." *Journal of Health & Social Behavior* 80-94.
- Liu, Xian, and Matthew Witten. 1995. "A Biologically Based Explanation for Mortality Crossover in Human Populations." *The Gerontologist* 35:609-615.
- Lynch, Scott M., J. Scott Brown, and Katherine G. Harmsen. 2003. "Black-White Differences in Mortality Compression and Deceleration and the Mortality Crossover Reconsidered." *Research on Aging* 25:456-483.

- Manton, Kenneth G., Sharon Sandomirsky Poss, and Steven Wing. 1979. The Black/White Mortality Crossover: Investigation from the Perspective of the Components of Aging. *The Gerontologist* 19(3): 291-300.
- Manton, Kenneth G., and Eric Stallard. 1981. Methods for Evaluating the Heterogeneity of Aging Processes in Human Populations Using Vital Statistics Data: Explaining the Black/White Mortality Crossover by a Model of Mortality Selection. *Human Biology* 53(1): 47-67.
- Manton, Kenneth G., and Eric Stallard. 1997. Health and Disability Differences Among Racial and Ethnic Groups. Chapter 3, pp. 43-105 in in Martin & Soldo (Eds) *Racial and Ethnic Differences in the Health of Older Americans*. Washington D.C.: National Academy Press.
- Manton, Kenneth G., Eric Stallard, and Steve Wing. 1991. Analyses of Black and White Differentials in the Age Trajectory of Mortality in Two Closed Cohort Studies. *Statistics in Medicine* 10: 1043-1059.
- Menchik, Paul L. 1993. Economic Status as a Determinant of Mortality among Black and White Older Men: Does Poverty Kill? *Population Studies* 47(3): 427-36.
- Nam, Charles B. 1995. Another Look at Mortality Crossovers. *Social Biology* 42(1-2): 133-142.
- Nam, Charles B., Norman L. Weatherby, & Kathleen A. Ockay. 1978. Causes of Death Which Contribute to the Mortality Crossover Effect. *Social Biology* 25(4): 306-314.
- Preston, Samuel H., Irma T. Elo, Ira Rosenwaike, and Mark E. Hill. 1996. "African-American Mortality at Older Ages: Results of a Matching Study." *Demography* 33:193-209.
- Ross, Catherine E., and Chia-Ling Wu. 1996. "Education, Age, and the Cumulative Advantage in Health." *Journal of Health and Social Behavior* 37:104-120.
- Thornton, Russell. 2004. "The Navajo-U.S. Population Mortality Crossover since the Mid-20th Century." *Population Research and Policy Review* 23:291-308.
- Williams, David R., and Chiquita Collins. 1995. "US Socioeconomic and Racial Differences in Health: Patterns and Explanations." *Annual Review of Sociology* 21:349-386.
- Wing, Steve, Kenneth G. Manton, Eric Stallard, Curtis G. Hames, and H.A. Tryoler. 1985. The Black/White Mortality Crossover: Investigation in a Community-Based Study. *Journal of Gerontology* 40(1): 78-84.