Widening Health Inequalities
Among U.S. Military Retirees Since 1974

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January 23, 2008

* Four anonymous referees provided valuable comments on an earlier draft of this paper. I am deeply indebted to Pete Zouras, ASA, Lee Giesecke, ASA, and Pete Rossi at the Office of the Actuary in the U.S. Department of Defense for providing access to the data and for offering helpful comments and insights. I am also grateful to the National Defense Research Institute at the RAND Corporation, to seminar participants at RAND, and to Ronald Lee, James Hosek, Carl Dahlman, Michael Schoenbaum, and Alair MacLean. All errors and opinions are those of the author alone and do not reflect the views of Queens College, the RAND Corporation, or the Department of Defense. I conducted this work while a postdoctoral fellow in the study of aging and population at RAND, were I was supported by NIH grants T32 AG000244 and T32 HD 07329.

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Abstract

I explore trends in mortality among U.S. military retirees using a new dataset of payroll records that include pay grade. Trends in mortality by pay grade reveal that health inequalities steadily widened between 1974 and 2004. Additive differentials in mortality rates remained stable, but since mortality declined exponentially, by a factor of about one third, proportional differentials in mortality and thus additive differentials in life expectancy have widened. The advantage in life expectancy enjoyed by retired officers grew roughly from 3 to 4 years. The sources of these trends remain unclear and are beyond the ability of the data to inform, but the results bear implications for trends in inequality and for policy.

KEY WORDS: differential mortality, social disparities, veterans' health

Health disparities are commonplace in industrial societies, a key fact of public health shown by Kitagawa and Hauser (1973) and the Whitehall studies (Marmot et al., 1984, 1997). Socioeconomic status, whether measured by education, income, wealth, or occupation, is inversely related to mortality. Less clear is whether these health disparities are widening, shrinking, or remaining unchanged over time, as the development of new health technologies continues to expand the envelope of attainable life span and to improve health, at least for those with access to such technologies. A number of influential studies within the past two decades have sought to measure the trends in population health disparities (Feldman et al., 1989; Duleep, 1989; Pappas et al., 1993; Preston and Elo, 1995; Schalick et al., 2000). But due primarily to the nature and limitations of the data, these contributions provide varying degrees of clarity and robustness of results. We also desire to know the causes of trends in health disparities, but before we can address those deeper and more difficult questions, we require a clear picture of the trends themselves.

In this paper, I examine a new dataset that measures mortality in a consistent manner between 1974 and 2004. The retired pay file of the Defense Manpower and Data Center (DMDC) of the U.S. Department of Defense (DOD) tracks individuals receiving retired pay, and the DOD strives to track attrition due to mortality in much the same way the Social Security Administration seeks to update its records. Actuaries at the DOD use mortality rates recovered from the retired pay file to project retirement pay and health benefits.

To be sure, military retirees are an extremely select group and are probably not representative of other populations. In order to serve in the military at all, individuals must meet certain physical, health, and education requirements. To become retirees with 20 good years of active duty service, they must have progressed upward instead of outward. That is, while not all military retirees were lieutenant colonels and general, essentially none remained privates. All U.S. military retirees are eligible for pensions, which now average around

$20,000 annually per retiree but vary by pay grade (U.S. Department of Defense, 2005), and they receive generous military health benefits (Schoenbaum et al., 2004).

But military retirees are a very interesting group to study vis-à-vis health despite the fact that results may not directly generalize. Because they are a highly select group, with good incomes and access to health care, I have essentially controlled for some of the vast heterogeneity in life conditions across the entire population. My results will thus offer some basic guidance regarding what must matter for health disparities, namely whatever is left, even if they cannot tell us about the entire universe of important influences. To be sure, exactly how my results may generalize to a much more heterogeneous, unselected population is far from clear. Since there are many other influences on health than we are likely to find within this selected subpopulation, general predictions should be avoided.

While this paper represents merely a first step, studying health disparities among military retirees will likely reveal new knowledge about the sources of health disparities. During periods of service, veterans are subject to an array of health treatments deriving from both internal and external factors, such as smoking behavior, the stress of operating in a rigid chain of command, and combat exposure. While some veterans serve for brief periods, military retirees are subject to these treatments for many years. Exactly which influences may be important for health differentials within this subpopulation is an answer for future research, using richer data, to explore. Here, I focus merely on a crucial first step: measuring the basic trends in health inequalities among military retirees.

This study draws from several literatures, including those on differential mortality and on the health and other characteristics of veterans, and the first section below presents a review. Then I describe the new dataset on the mortality of military retirees, and I construct mortality rates and life tables by pay grade. The data measure final pay grade in 24 categories, so I can examine how mortality risks change with the entire distribution of pay grades. It is also useful to compare two broad pay grades, officers versus enlisted men, since that cut of the data is both meaningful and also considerably more parsimonious. I find that proportional differentials in mortality and additive differentials in remaining life expectancy have widened significantly over the past several decades and show no signs of stabilizing. The final section discusses the implications of my results, speculates as to their sources, and places them in the context of earlier findings in the literature.

Background

Differential mortality among civilians

Poorer health and higher mortality are correlated with lower socioeconomic status across most human populations (Kitagawa and Hauser, 1973; Valkonen, 1989; Preston and Taubman, 1994; Mackenbach et al., 1999). But little is known about the causes of health disparities, and trends over time in health disparities are less clear than the level of health disparities at a point in time. Wilmoth and Dennis (2001) provide a useful overview of the literature on levels and trends in differential mortality.

A key problem is that few datasets measure health and individual characteristics in a consistent way over time. Previous studies on trends in health disparities thus typically infer patterns of change by comparing newer results to statistics published by Kitagawa and Hauser (1973) for the year 1960. Three examples include Feldman, et al. (1989), Duleep (1989), and Preston and Elo (1995), who measure differential mortality by education or by income and education in the late 1970s and early 1980s with three different datasets.

In these studies, the preferred measures of inequality over a distribution of characteristics are the slope index of inequality (SII), a measure of additive differences in mortality, and the relative index of inequality (RII), a proportional measure. Both are described by Wagstaff, et al. (1991), and both are revealing measures. I argue elsewhere (Edwards, 2007) that when the underlying characteristic is a mortality rate, which we know declines proportionally over time, the RII is a better measure of inequality. If the RII in mortality is stable, all mortality rates are declining at the same rate, and all life expectancies are increasing the same amount each year. That is, the SII in life expectancy is also stable.

Feldman, et al. (1989) use the National Health and Nutrition Survey Epidemiologic Follow-Up Study and examine white men and white women by education, while Preston and Elo (1995) utilize the National Longitudinal Mortality Study and study white men and white women by level of education. Both studies conclude that both additive and proportional mortality differentials appear to have widened among white men while remaining the same or narrowing among white women. Duleep (1989) links Social Security death records to Current Population Survey data and examines white married men by education and income. Based on comparing mortality ratios at cardinal levels of education and inflation-adjusted income against those published by Kitagawa and Hauser, Duleep states that proportional mortality differentials among married men did not narrow.

Pappas, et al. (1993) examine proportional mortality differentials, similar to the RII, both by education and by income using data on deaths from the 1986 National Mortality Followback Survey (NMFS) and exposures in the 1986 National Health Interview Survey (NHIS). They find that compared to the results of Kitagawa and Hauser, these relative mortality differentials have widened for all four subgroups they consider: white men, white women, African American men, and African American women. In a related follow-up study, Schalick, et al. (2000) compare the 1986 data to more directly comparable observations constructed from the 1967 NMFS and 1967 NHIS. The uniformity of data brings mixed results that are sensitive to the particular measure of inequality: the SII decreased in magnitude during this period for all groups except African American women, while the RII increased for everyone. That is, absolute differences in mortality rates actually shrank while proportional differences widened during the same period. This may sound like an inconsistent result, but mathematically it is not. The apparent confusion highlights the salience of correctly interpreting whichever measure of inequality is chosen.

As I argue elsewhere (Edwards, 2007), our knowledge and interpretation of temporal trends in mortality suggest we should define health inequality as proportional differences in mortality rates, or the RII in mortality. Proportional differences in mortality translate into additive differences in life expectancy (Vaupel and Romo, 2003), which we more universally accept as health inequality. But since the choice of RII versus SII in mortality is hardly uniform, I will present my findings in this paper in terms of both.

Military service, health, and selection

Military service represents a treatment in several respects, and having served least 20 years active duty, military retirees are likely to exhibit any effects. We know that combat experience can affect psychological well-being and characteristics later in life (Davison et al., 2006; Jennings et al., 2006), and it is independently associated with decreased educational attainment, labor force participation, and earnings (MacLean, 2005; Lyons et al., 2006). Exposure and adaptation to the military command structure is surely a second treatment. We know that job control and psychosocial characteristics of hierarchical employment can affect adult health, even after accounting for smoking and other risk factors (Marmot et al., 1997). It is also possible that living within a rigid command structure encourages compliance with instructions and respect for authority. This could improve the delivery of medical care throughout life if ex-soldiers followed advice from doctors and dieticians more closely.

Other treatments likely to have beneficial impacts on health include post-service income and access to health care. As I stated earlier, military retirement pay is relatively generous. It can be drawn from an early age and concurrently with earnings from civilian employment following military retirement. Retired military who live near military bases have access to military treatment facilities, which are charged with serving retiree populations in order to maintain combat readiness, and other health benefits for retirees are generous as well (Schoenbaum et al., 2004).

We also suspect that military service can promote unhealthy behaviors like drinking and smoking. Bedard and Deschenes (2006) link poor adult health outcomes to military service during World War II and increased smoking, citing the inclusion of cigarettes in military rations among other evidence. Today, cigarettes sold at post exchanges are not taxed, and we know that cigarette prices affect utilization (Phelps, 1988).

To be sure, signing up for a job with periodic risks to life and limb reveals something about attitudes toward risk and time, and smoking certainly reflects those as well. One of the essential points of Bedard and Deschenes (2006) is not that veterans are smokers, which we suspect they are likely to be. It is that the drafting of men during World War II probably made smokers out of many men who would not otherwise have enlisted. Selection into military service is surely important; in their paper, the draft disproportionately exposed certain birth cohorts to smoking, providing identification.

But compared to the pool of all veterans, which includes draftees and volunteers, the subpopulation of military retirees may have remained more homogeneous over time. Military retirees must have chosen to serve 20 years active duty, and they must also have been retained by the military, which typically follows an “up or out” policy with clear financial disincentives to remain unless promoted. Not only must military retirees have exhibited basic aptitude for the job, as is now more universally required of the volunteer force, they must have excelled in order to be promoted and retained.

With veterans in general, notwithstanding the evidence on the World War II cohort revealed by Bedard and Deschenes (2006), the net impact on adult health from military service may not be significantly different from zero. Petersen, et al. (2000) examine heart attack treatments and outcomes among veterans at VA hospitals and nonveterans at other facilities, and they find that although veterans typically had more coexisting health conditions, there were basically no differences in heart attack treatment or in outcomes across the two groups. London and Wilmoth (2006) find little evidence in panel data collected since 1992 that military service affects mortality at all. This could be because it is pre-service characteristics that always explain mortality best, or it could be because the positive and negative effects associated with service would have mattered but cancel each other out.

It is unclear exactly which characteristics of veterans produce the choice to serve 20 years and the inherent value perceived by the military, and it is even less clear what they imply for health. Comparisons with other groups such as all civilians should therefore be drawn cautiously. But within-group analysis seems eminently reasonable for military retirees, since they should be a very homogeneous group, selected as they are along several dimensions.

An element largely missing from earlier research is how status within the military may be important for health. Researchers in other fields have revealed the relative hardships felt by enlisted veterans along other dimensions of well-being, but not health. Loughran (2002) finds significantly lower wages among retired enlisted men and warrant officers even after controlling for education. MacLean (2004) reports robust differences by rank in a wide array of later-life socioeconomic outcomes among a cohort of peacetime veterans. In a virtually uncited study, Keehn (1978) examines post-service mortality patterns in a cohort of World War II veterans who were enlisted men of various ranks. He finds higher mortality among veterans of lower final rank, which cannot be explained by differences in education, length of service, or incidence of service-related disability.

To be sure, final rank is an indicator of additional selection to some extent. But retirees with 20 years of service must all have found niches within the command structure that fit their characteristics, or else they would have left. Combat exposure, psychosocial stress, and other factors probably do vary by final rank, but we are still interested in comparing these otherwise similar military retirees whose health we believe ought to be similar. In the next section, I describe the data I use to examine health disparities among military retirees according to final rank. These data uncover interesting patterns that echo the findings of Keehn (1978), but they also reveal previously unseen and alarming trends.

The data

The retired pay file

In order to assess mortality among retired military populations, researchers in the Office of the Actuary in the U.S. Department of Defense (DOD) examine payroll records constructed from data collected by the Defense Financing and Accounting Service (DFAS) and maintained by the Defense Manpower and Data Center (DMDC). The retired pay file lists periodic disbursements of military retirement benefits to eligible individuals who are typically identified by Social Security number, age, sex, pay grade, branch of service, disability status, and a host of other technical descriptives associated with various transitions in status. The transitions include death as well as other types of changes in paid status. After consulting with DMDC, the DOD Actuary produced data extracts for 16 of the years since 1974: 1974–1976, 1982–1986, 1992–1995, and 2000–2004. These years were chosen in an ad hoc fashion in order to obtain the widest feasible time interval while minimizing coding efforts by DMDC. Table 1 displays characteristics of the sample for each year: the total number of military retirees, the share who were enlisted men, the total known deaths, the documented losses other than deaths, and the undocumented losses.

Table 1 about here

The quality of these data should be similar to that of the Social Security mortality records used by Duleep (1989), since the method of collection is similar. Both the Social Security Administration and DOD have clear fiscal incentives to record mortality among pensioners as accurately as possible. But unlike Social Security data, the DMDC mortality data have not been formally tested for quality. I present the mortality data as they appear but with confidence intervals that capture several aspects of the underlying uncertainty, which I discuss below. The mortality rates I measure among nondisabled retired enlisted men are very similar to those derived from official statistics for all U.S. male civilians (Human Mortality Database, 2006), which provides some confidence about data quality. Further details are available from the author upon request.

A key variable on the retired pay file is the pay grade at which the individual retired. There are 24 distinct pay grades represented in the data, which correspond loosely to military rank. Several ranks may share a single pay grade, even though those ranks may be very different in terms of responsibilities and job-related stresses and risks to health. In Table 2, I list the 24 pay grades in the leftmost column from lowest to highest, with Army ranks associated with those pay grades in the second column. Pay grade is technically not the same as rank, but higher pay grades outrank lower pay grades within the same branch of the military. The third column shows the average distribution of retirees by pay grade during the sample period, while the fourth column lists individual retired pay for each pay grade as a percentage of the O-5 level. The fifth column presents an ordinal ranking by retired pay, where I have specified 8 groups that smooth population shares while maintaining the hierarchical pay structure. Later, I use these group rankings to calculate the slope and relative indexes of inequality in mortality and life expectancy.

Table 2 about here

Measuring mortality and uncertainty

The retired pay file registers individuals remaining in, leaving, or returning to paid status during a calendar year. Individuals who return represent incomplete data, so I drop them when calculating mortality in that year, and I omit them from Table 1. We know that individuals leave paid status either through death, through choice,[1] or through some other unknown channel. The retired pay file classifies all losses as either documented or undocumented depending on how much is known about the event, and the vast majority of losses are either deaths or otherwise documented, as shown in Table 1.

Undocumented losses, which are clearly problematic for studying mortality, were high in the 1970s and 1990s and low in the 1980s and 2000s. They occur when a social security number changes during the year or when reporting delays push loss records beyond the linking window, typically the fiscal year. During periods of military conflict, which are idiosyncratic, DMDC pay centers sometimes delay reporting loss records due to work overload. According to the DOD Actuary, some of the volatility in undocumented losses may also be linked to changes in the periodicity of the retired pay file, from annual to quarterly in the 1970s and then to monthly in the 1990s. Relative to total deaths, undocumented losses have followed a downward trend overall, but they were high in the 1970s and hence deserve special attention in a study of mortality trends.

I construct annual mortality rates for individuals of age x to x+n as

$$ {}_nM_x = \frac{deaths}{\exp osures} = \frac{{}_nD_x + s\ {}_n\Lambda_x^u}{{}_nK_x - \frac{1}{2}\left({}_nD_x + {}_n\Lambda_x^u + {}_n\Lambda_x^d\right)}, \qquad (1) $$

where ${}_nD_x$ are the losses known to be deaths within the interval, ${}_nK_x$ is the population at the beginning of the period, ${}_n\Lambda_x^u$ are the undocumented losses, and ${}_n\Lambda_x^d$ are the documented losses other than deaths.[2] An unknown share *s* of undocumented losses are deaths. A reasonable baseline for that parameter is the share of all documented losses that are known to be deaths. Another approach I use is modeling *s* as a random variable with some distribution. Since I am interested in mortality differentials by pay grade, I also examine whether variation in the unknown parameter *s* by pay grade could significantly change my results. The data reveal that undocumented loss is more common among enlisted retirees, but they cannot inform us about whether *s*, or the meaning of undocumented loss, actually varies by pay grade.

In addition to *s*, there are several other sources of uncertainty in the mortality rates. The number of measured deaths *D* out of a collection of Bernoulli trials *K* is a binomial random variable distributed approximately normal. This form of uncertainty is readily estimable. There may be other latent sources that are more problematic.[3] Little can be done other than remark that these potential shortcomings seem unlikely to bias our measurement of mortality differentials, which would only happen if errors were correlated with pay grade. Although not inconceivable, that particular type of systematic bias seems unlikely. In the next section, I explicitly account for uncertainty in *s*, which I model as uniformly distributed between 0 and 1, as well as uncertainty in the rate associated with the finite sample. Then I use Monte Carlo simulations to produce confidence intervals around mortality rates and functions of mortality rates, and I check how variation in *s* by pay grade could affect differential mortality.

I restrict my analysis to nondisabled men on the retired pay file. Combat-related disability is likely to be mechanically correlated with mortality and with pay grade. In addition, the share of military retirees with at least some disability rating on the retired pay file has declined monotonically during the sample period and would thus pollute analysis of trends.

Women do not yet constitute a large enough subpopulation of military retirees to produce consistent age-specific mortality rates, so I omit them from the analysis. These sample restrictions reduce the generalizability of my results but are warranted given the nature of the data.

Mortality among military retirees by pay grade

Age-specific mortality rates

I calculate age-specific mortality rates for five-year age groups starting with 40–44 and ending in a topcoded group at age 85.[4] Because their mortality experiences turn out to be so different, I plot data for retired officers and retired enlisted men separately. Each panel of Figure 1 depicts the median log mortality and 95% confidence interval for retired officers, shown by dashed lines, alongside the same for enlisted men, shown by dotted lines, in four representative years during the sample. In almost every year and at almost every age, retired officers enjoy significantly lower mortality rates than retired enlisted men, but the advantage dies out with age.

As is suggested by the visibly widening additive gap between officer and enlisted log mortality in Figure 1, retired officers indeed experienced faster rates of mortality decline during the sample period. Table 3 displays average annual rates of decline in age-specific mortality rates for the two groups measured between 1974 and 2004, the differences between them, and the standard errors of those differences. Mortality fell faster for retired officers at each age depicted, with the difference statistically significant at ages 45–49 and 55–74.

Undocumented loss was considerably more prevalent in the 1970s than in later years, which raises questions about robustness. The 95% confidence bands in Figure 1 and the standard errors in Table 3 explicitly account for idiosyncratic uncertainty in the share *s* of undocumented loss representing mortality, but if *s* varies with pay grade, which is unknown but plausible, my uncertainty bands may be too narrow. To examine this, I tested the impacts of polar assumptions about how *s* varies, first setting $s = 1$ for enlisted retirees and 0 for officers, and then the reverse. These extreme cases fit within my original 95% confidence bounds in virtually every instance, suggesting that the potential bias associated with undocumented loss is bounded.

Table 3 about here

The implication of these differential rates of decline is that proportional differences in mortality rates between retired officers and enlisted men must have widened, and that is exactly what appears in the top panel in Figure 2. Differences in log age-specific mortality rates at four points in time show clear upward drift. Enlisted mortality rates at ages 60–64 rose from being about 25 percent higher than officer rates in 1974 to 45 percent higher in 1984, then to 70 percent and more by 1994 and thereafter. Meanwhile, the lower panel reveals that additive differences in mortality have remained stable except at advanced ages.

Indexes of inequality in mortality

Since the distribution of pay grades has changed over time, it is useful to calculate the slope and relative indexes of inequality using an array of groups identified by pay grade. The two-group results in the previous section suggest the SII, an index of additive mortality differentials, has probably not changed much while the RII will likely register increased inequality.

I calculate age-adjusted mortality rates for 8 groups identified by actual retirement pay as shown in the last column of Table 2. To obtain age-adjusted rates, I apply the average age structure for all groups combined over the entire sample period to each group's age-specific mortality schedule. Figure 3 plots age-adjusted average mortality rates in 1974, shown in circles, and in 2004, shown in triangles, for these 8 pay groups. The horizontal axis measures the midpoint percentile rank of each group in the distribution of pay. The slope of the weighted regression line through the points is the expected decline in mortality from the bottom of the pay distribution to the top, and it is also the SII. Any regression line is sensitive to outliers, but weighting by population share reduces the impact of any particular observation, including the very top and the very bottom of the distribution. The figure reveals that the SII appears to have remained roughly constant since 1974.

For a clearer look, Table 4 displays age-adjusted mortality rates and the SII in percentages, as well as the RII, which is equal to the SII divided by total age-adjusted mortality and is measured in whole numbers. An RII equal to –1 here means that mortality for the most well-off is lower than mortality for the least well-off by 100% of the average mortality. It also represents a threefold difference in mortality rates between top and bottom. Each sample year is shown separately, with the data further broken down into three panels showing subgroups by age. The leftmost panel focuses on all retirees 40 and older, while the other two panels examine groups younger and older than 65, in order to assist comparability to earlier studies.

Table 4 about here

The leftmost columns within each panel show that age-adjusted mortality declined overall for all ages during the period. For retirees over 40, shown in the leftmost panel, mortality fell from 2.12 percent in 1974 to 1.30 percent in 2004. Although the SII remained relatively steady and even shrank somewhat, dropping from –1.32 to –1.20, the RII worsened from –0.62 to –0.92 because overall mortality fell. Retirees at the top of the pay distribution enjoyed mortality rates that were consistently lower than those of retirees at the bottom by about 1.25 percentage points. In 1974, that represented a 62 percent lower mortality rate, but by 2004 it was lower by 92 percent.

Similar patterns can be seen in the two age subgroups examined in the middle and right-hand panels. The overall level of mortality is higher for older ages, and absolute inequality as measured by the SII is also higher. But relative inequality is worse at younger ages, since absolute differences, though lower, are a greater share of overall mortality before age 65. Across all age groups, additive differences have remained relatively stable or even narrowed, while relative differences seem to have widened. Precision in the SII and RII, not shown in Table 4, is low enough to preclude firm inferences about their trends, however.

Period life expectancy

Since multiplicative differences in mortality translate into additive differences in life expectancy (Vaupel and Romo, 2003), we would expect the widening proportional differentials in mortality by pay grade to translate into widening absolute differences in period life expectancy. Figure 4 shows precisely this dynamic between broadly defined groups of military retirees. The top panel depicts trends in e_{65}, period life expectancy at age 65, since 1974 among retired officers and retired enlisted men while the bottom panel plots e_{40}, period life expectancy at 40, for the same groups. Both panels tell the same story: retired officers have enjoyed significantly faster gains in life expectancy since 1974, and the additive gap between them and retired enlisted men is widening. As before, I checked robustness by allowing *s* to vary with pay grade, and I found that results fell within the reported confidence intervals.

A similar picture emerges if we examine changes in the distribution of life expectancies across multiple groups using the SII and the RII. Figure 5 plots e_{40} for the 8 pay groups I examined earlier against the midpoints of their pay percentiles in 1974 and 2004. We see an increase over time in the slope, which is the SII in e_{40}, suggesting that additive differentials in life expectancy across the distribution of pay groups have widened.

We can examine these patterns more clearly in Table 5, which lists e_{40} and e_{65} for all military retirees alongside the SII and RII for each year in the sample. Although noisy, the SII has increased considerably over time, from a 6.1 year spread in e_{40} and a 4.5 year spread in e_{65} in 1974 to a staggering 9.4 year gap in e_{40} and a 6.6 year divide in e_{65} by 2004. As before, there is enough noise in the SII coefficients, not shown in Table 5, to hamper statistical inference about the time trends. But differences in point estimates over time are certainly large: simple regressions reveal time trends of 0.07 in the case of the e_{40} SII and 0.08 for the e_{65} SII. Since e_{40} and e_{65} have risen overall during this period, at annual rates of about 0.18 and 0.09, the RII for either measure has remained essentially flat. While additive differences in subgroup life expectancies appear to have increased, their ratios have remained roughly constant.

Table 5 about here

Discussion

Although military retirees are a highly select group with good access to health care and income, this paper shows that there are large health disparities between them according to final rank. The rich payroll data I am able to examine also reveals that these health disparities have been widening over time, if we interpret proportional differences in mortality rates and additive differences in life expectancy as health inequalities. If instead one prefers either additive differences in mortality or proportional differences in life expectancy, then my evidence reveals basically no trend in health disparities. But I argue here and elsewhere (Edwards, 2007) that proportional differences in mortality are better measures of inequality because mortality rates are declining proportionally over time. That we find health disparities at all is somewhat striking and leads us to ask why.

Sources of health disparities

We know there are persistent racial disparities in health and mortality (Preston and Taubman, 1994), so a natural question is to what extent final rank and race may be correlated. Since I am unable to observe race in the payroll data, I cannot assess this issue directly. But indirect evidence suggests racial disparities are probably not central to the story of widening inequalities over time. Cross-sectional evidence in the 2003 Survey of Retired Military suggests that military retirees have become more African-American over time, with larger increases recently among retired officers than among retired enlisted men. That is, due to delayed integration of the officer corps (Janowitz, 1960), the share of retired officers who are African-American has increased more rapidly since 1974 than the share of retired enlisted men who are African-American. Because African Americans have higher mortality rates than whites, this should have reduced the officer advantage. But instead, we witnessed a widening of disparities by rank.

Disparities in education and income, which Preston and Taubman (1994) describe as primarily responsible for racial disparities in health, are probably also important for health disparities by rank. Pay grade indexes the level of pension, so we could interpret health disparities by pay grade as disparities by income. We also know that the level of education varies with rank; induction into the officer corps generally requires a college degree. The limitations of the payroll data preclude any deeper analysis, so it remains an open question whether disparities by rank are simply proxies for other more well-known disparities or are reflective of something deeper. Richer data could probe this issue directly, and efforts are currently underway to examine this issue.

The present dataset does facilitate a comparison between the mortality advantage for retired officers and the mortality advantage for a college degree reported by Elo and Preston (1996), which should give a rough idea whether the rank differential simply proxies for education. Elo and Preston report 22 to 25% lower mortality among college educated men compared to those with high school degrees between 1979 and 1985. The data in Figure 1 reveal differentials of 28 to 41% in 1984, growing larger in the years since then. These patterns are weakly suggestive of an additional effect of rank on mortality beyond just socioeconomic status, but the magnitudes are similar.

There are reasons to suspect that rank reflects much more than just differences in education and income. Higher rank enhances job control in an occupation where stresses even include risks to life and limb. If ever there were a group more continually exposed to acute psychosocial stress of a hierarchical command structure than military retirees, such a group might not have surviving members to study. Combat exposure, which we know matters for outcomes, is one component of differential stress according to rank, while job control more generally is another. Recent findings by Banks et al. (2006), who document and investigate the socioeconomic gradients in health in the U.S. and England, are consistent with a central role for social determinants of health and relative deprivation. Future efforts are needed to investigate what role those factors may play among military retirees and veterans, but my results appear to be suggestive of such a role.

It is also conceivable that rank tells us something about social groupings formally unrelated to socioeconomic status, and these social groupings may encourage or discourage unhealthy behavior. Smoking and drinking may relieve stress and could be a channel through which differential psychosocial stress affects health, but they are also social behaviors. How retired officers and retired enlisted men may behave differently as regards smoking and drinking is a question for future research using appropriate microdata.

In the search for an explanation, one must avoid undue focus on unhealthy behaviors or other adverse treatments, which might unfairly imply that one group is somehow at fault for its substandard health outcomes. Widening health inequalities could just as easily be driven by accelerated gains at the top, and here they appear to be. In unreported results, I compared mortality rates among military retirees to those among male civilians and found scant differences between retired enlisted men and the male population as a whole. This suggests that we should probably be searching for reasons why retired officers are increasingly so much healthier.

Selectivity

Selection into the elite group of military retirees is a potentially important issue that I can do little about given the constraints of the data, but I do not believe it is contaminating my results. The transition to an all-volunteer force following the Vietnam War surely increased self-selection into the military. But since military retirees must choose to serve 20 years on active duty, it seems likely that military retirees were always a highly select group probably dominated by volunteers. Still, it is unclear how minimum standards for career military set by authorities might have changed over time.

The bottom line on selectivity is that we do not know the extent to which it makes military retirees more or less healthy than other civilians. My results therefore do not generalize to other populations, a problem that is exacerbated by an inability to examine females due to small samples. But if selectivity into military retirement has indeed changed little over time, my finding of widening health disparities is broadly informative of trends. Whether the sources of these health disparities among such a homogeneously advantaged group, which remain unclear, ultimately generalize to other populations is an unresolved question for future research.

Policy implications

My findings bear several clearer implications for policy. First, the widening of health inequalities among a select group of veterans is troubling because it reveals disparities in a critical dimension of well-being among individuals who have uniformly sacrificed time and effort for their country.

Second, widening inequality in life expectancy also implies increasing inequality in post-service pensions, although the system does provide survivor benefits. That is, if high-earning officers live longer than low-earning enlisted retirees and if pensions are not actuarially adjusted for differential mortality risk, the richer group receives lifetime benefits that are much higher than those of the poorer group.

A third and closely related point is that differential mortality that increasingly favors retirees at higher pay grades is also increasingly bad for program finances. This result is true for pension systems more generally and is an interesting example of how adverse selection in survivorship can impact the sustainability even of universal insurance systems.

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[1]Individuals leave if they choose to return to active duty, choose to take VA benefits or civil service retirement benefits instead of DOD retirement benefits, change addresses without providing forwarding information, or purposefully refuse benefits for any reason.

[2]In subtracting half the exposure of ${}_n\Lambda_x^u$ and ${}_n\Lambda_x^d$ from the denominator, I am implicitly assuming that non-death losses could have resulted in death after the loss occurs, when we technically have no information about them.

[3] Noise as well as bias may stem from how deaths are registered, with type I, and more likely, type II errors. Also, the process of identifying deaths may have evolved over time, producing bias and error in intertemporal mortality comparisons. And if movement into and out of paid status is correlated with health status and mortality, such selection could produce bias and error.

[4]I experimented with several different age group specifications and found that this one best facilitated intertemporal comparisons. In earlier years in the sample, there are fewer exposures and deaths at advanced ages.

Table 1: Nondisabled Men over 40 on the Retired Pay File, 1974–2004

Year	**Population**	**Enlisted Share (%)**	**Deaths**	**Doc. Loss**	**Undoc. Loss**
1974	698,104	72.67	6,906	3,082	1,556
1975	749,395	73.24	7,743	2,484	771
1976	795,179	73.67	8,141	2,429	1,033
1982	985,315	74.44	12,387	2,936	385
1983	1,019,606	74.79	13,170	3,309	636
1984	1,036,616	74.78	14,385	3,641	145
1985	1,052,332	74.70	14,380	3,739	181
1986	1,065,408	74.64	15,056	4,114	149
1992	1,161,408	74.18	19,172	2,758	235
1993	1,185,622	74.06	18,473	4,548	1,222
1994	1,207,759	73.97	17,719	3,736	970
1995	1,229,411	73.89	16,961	4,412	1,279
2000	1,308,076	74.20	19,128	6,018	28
2001	1,315,546	74.30	20,686	5,222	18
2002	1,322,936	74.40	19,778	7,928	27
2003	1,319,516	74.46	19,486	9,316	0
2004	1,319,901	74.54	21,497	8,319	18

Notes: Data are DMDC retired pay file extracts provided by the DOD Actuary. The enlisted share is the proportion of the population at pay grades E-1 through E-9. Deaths are officially registered losses due to death. Doc. Loss are all documented losses other than death. Undoc. Loss are all undocumented losses.

Table 2: Pay Grades, Ranks, Population Shares, and Relative Pay

Pay Grade	**Army Rank**	**Population Share (%)**	**Pay Share vs. O-5 (%)**	**Pay Group**
E-1	Private	0.01	17.4	1
E-2	Private E-2	0.01	19.4	1
E-3	Private First Class	0.06	23.5	1
E-4	Corporal, Specialist	0.50	28.0	1
E-5	Sergeant	6.40	34.9	1
E-6	Staff Sergeant	20.91	41.2	2
E-7	Sergeant First Class	30.04	47.4	3
E-8	Master Sergeant/ First Sergeant	11.00	53.8	4
E-9	Sergeant Major/ Command Sgt. Major/ Sgt. Major of the Army	5.22	61.5	5
W-1	Warrant Officer 1	0.20	52.9	4
W-2	Chief Warrant Officer 2	1.10	57.1	5
W-3	Chief Warrant Officer 3	1.27	63.8	5
W-4	Chief Warrant Officer 4	1.10	72.6	6
W-5	Chief Warrant Officer 5	0.01	80.8	6
O-1	Second Lieutenant	0.05	49.0	4
O-2	First Lieutenant	0.36	59.8	5
O-3	Captain	1.84	75.8	6
O-4	Major	6.20	86.7	6
O-5	Lieutenant Colonel	8.76	100.0	7
O-6	Colonel	4.62	111.3	8
O-7	Brigadier General	0.12	144.1	8
O-8	Major General	0.15	158.9	8
O-9	Lieutenant General	0.05	166.6	8
O-10	General/ Army Chief of Staff	0.01	183.2	8

Notes: The first column lists pay grades in ascending order, while the second column lists the corresponding Army ranks, taken from http://www.defenselink.mil/specials/insignias/. The third column shows the average distribution of nondisabled male military retirees by pay grade over the 16 years in the retired pay file sample as described in the text. The fourth column measures each pay grade's pay as a percentage of the pay of the O-5 pay grade, averaged over the 16 years. Pay data are available from DFAS online. The fifth column presents an ordering of the pay grades into 8 groups. This grouping is used to calculate the SII and RII indexes of inequality in mortality and life expectancy.

Table 3: Rates of Mortality Decline for Military Retirees, 1974-2004

	Average Annual Percentage Declines			
Age	**Officers**	**Enlisted**	**Δ**	**Std. Error**
40–44	−4.5	−4.3	−0.3	2.2
45–49	−5.2	−3.2	−2.0*	0.9
50–54	−3.8	−3.2	−0.6	0.6
55–59	−4.1	−2.4	−1.7*	0.6
60–64	−3.1	−1.9	−1.1*	0.4
65–69	−2.7	−1.6	−1.1*	0.3
70–74	−1.9	−1.1	−0.8*	0.3
75–79	−1.3	−0.9	−0.3	0.4
80–85	−0.9	−0.3	−0.6	0.4
85+	−0.9	−0.1	−0.8	0.5

Notes: Mortality rates for military retirees are estimated using DMDC payroll data from 1974 and 2004. An asterisk denotes a statistically significant difference in the rate of mortality decline between retired officers and retired enlisted men. Standard errors are estimated through Monte Carlo techniques as described in the text. Human Mortality Database (2006).

Table 4: Mortality and Slope and Relative Indexes of Inequality Among Military Retirees since 1974

	Ages 40+			**Ages 40–64**			**Ages 65+**		
Year	**Mx**	**SII**	**RII**	**Mx**	**SII**	**RII**	**Mx**	**SII**	**RII**
1974	2.12	−1.32	−0.62	1.10	−0.79	−0.72	5.42	−3.31	−0.61
1975	2.07	−1.38	−0.67	1.02	−0.93	−0.92	5.48	−3.12	−0.57
1976	2.05	−1.36	−0.66	1.00	−0.91	−0.91	5.47	−3.02	−0.55
1982	1.91	−1.39	−0.73	0.93	−0.95	−1.02	5.07	−3.01	−0.59
1983	1.93	−1.51	−0.78	0.94	−0.95	−1.01	5.11	−3.25	−0.64
1984	1.94	−1.42	−0.73	0.94	−0.90	−0.96	5.20	−3.44	−0.66
1985	1.82	−1.31	−0.72	0.90	−0.88	−0.98	4.83	−2.87	−0.59
1986	1.78	−1.31	−0.74	0.86	−0.83	−0.96	4.76	−2.79	−0.59
1992	1.61	−1.38	−0.85	0.74	−0.77	−1.05	4.45	−3.36	−0.75
1993	1.53	−1.20	−0.79	0.68	−0.73	−1.08	4.29	−2.79	−0.65
1994	1.38	−1.10	−0.80	0.60	−0.70	−1.16	3.90	−2.53	−0.65
1995	1.27	−1.01	−0.80	0.55	−0.62	−1.12	3.59	−2.39	−0.67
2000	1.44	−1.34	−0.93	0.57	−0.69	−1.21	4.26	−3.54	−0.83
2001	1.40	−1.27	−0.91	0.54	−0.65	−1.19	4.18	−3.37	−0.81
2002	1.41	−1.31	−0.93	0.57	−0.72	−1.27	4.13	−3.31	−0.80
2003	1.32	−1.21	−0.92	0.50	−0.63	−1.26	3.97	−3.13	−0.79
2004	1.30	−1.20	−0.92	0.49	−0.61	−1.24	3.92	−3.15	−0.80

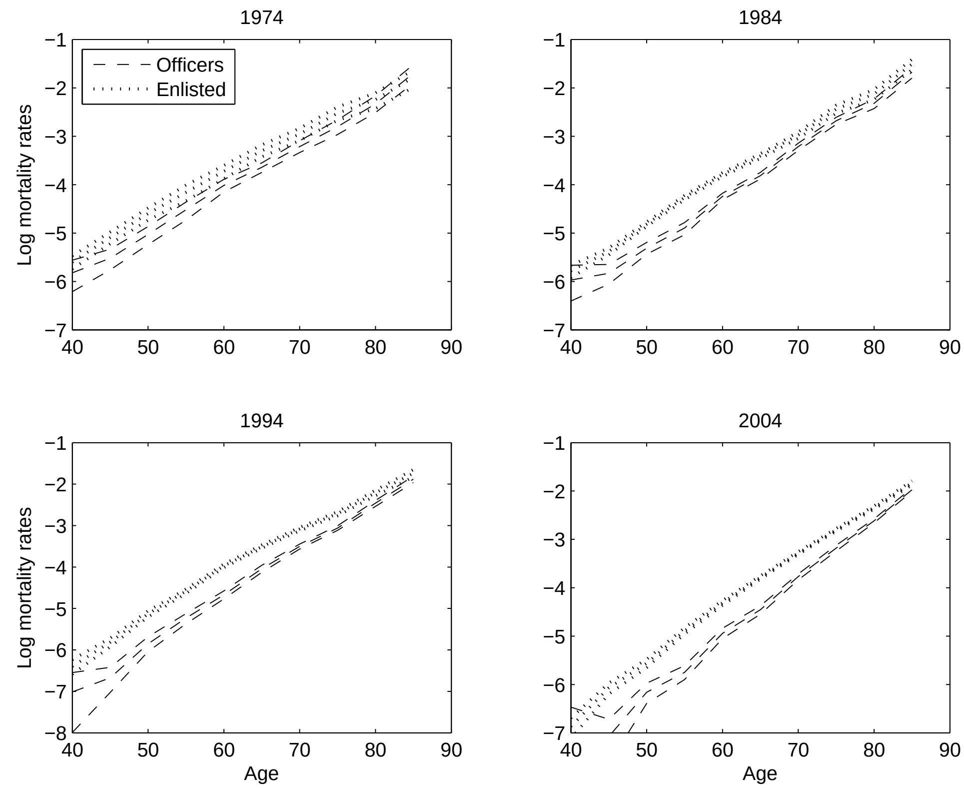
Notes: The Mx columns show age-adjusted mortality rates per 100 exposures for military retirees. The SII columns list the slope index of inequality in mortality for military retirees, which is the slope of a weighted regression line through a locus of points that plot groups' age-adjusted mortality rates against the midpoint of groups' percentile rankings in status. My status ranking is actual retirement pay, and I create 8 pay groups based on pay grade, shown in Table 2. The RII columns show the relative index of inequality in mortality, which is the SII divided by the Mx. I calculate age-adjusted mortality for all groups using a single age structure, the average over the sample period for all military retirees. Mortality rates are estimated using DMDC payroll data for the years shown.

Table 5: Period Life Expectancy and Slope and Relative Indexes of Inequality Among Military Retirees since 1974

	Ages 40+			Ages 65+		
Year	e_{40}	**SII**	**RII**	e_{65}	**SII**	**RII**
1974	33.9	6.1	0.18	14.6	4.5	0.31
1975	34.2	8.5	0.25	14.5	4.7	0.33
1976	34.3	7.7	0.22	14.5	4.0	0.27
1982	35.3	8.3	0.24	15.2	4.0	0.27
1983	35.2	9.2	0.26	15.1	5.2	0.35
1984	34.8	8.6	0.25	14.7	4.8	0.33
1985	35.6	8.1	0.23	15.3	4.1	0.26
1986	35.6	7.6	0.21	15.3	3.8	0.25
1992	36.8	9.7	0.26	15.9	6.2	0.39
1993	37.0	8.5	0.23	15.9	4.9	0.31
1994	37.0	8.6	0.23	15.8	5.0	0.31
1995	37.6	8.1	0.21	16.3	4.8	0.30
2000	38.3	9.7	0.25	16.5	6.6	0.40
2001	38.6	9.4	0.24	16.7	6.5	0.39
2002	38.6	9.8	0.25	16.8	6.4	0.38
2003	39.2	9.4	0.24	17.1	6.4	0.38
2004	39.4	9.4	0.24	17.2	6.6	0.38

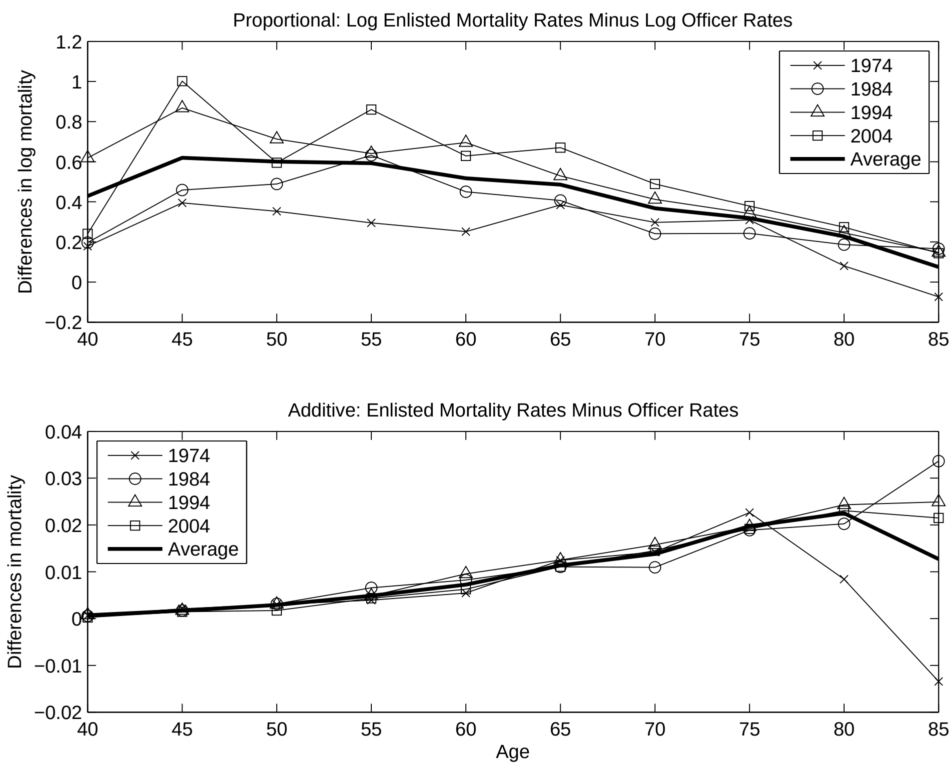
Notes: The e_{40} and e_{65} columns show remaining life expectancies for all military retirees in each year. The SII columns list the slope index of inequality in life expectancy for military retirees, which is the slope of a weighted regression line through a locus of points that plot groups' life expectancy against the midpoint of groups' percentile rankings in status. My status ranking is actual retirement pay, and I create 8 pay groups based on pay grade, shown in Table 2. The RII columns show the relative index of inequality in life expectancy, which is the SII divided by the e_x. Life expectancies are constructed from mortality rates estimated using DMDC payroll data for the years shown.

Figure 1: Mortality Among Retired Officers and Among Retired Enlisted Men



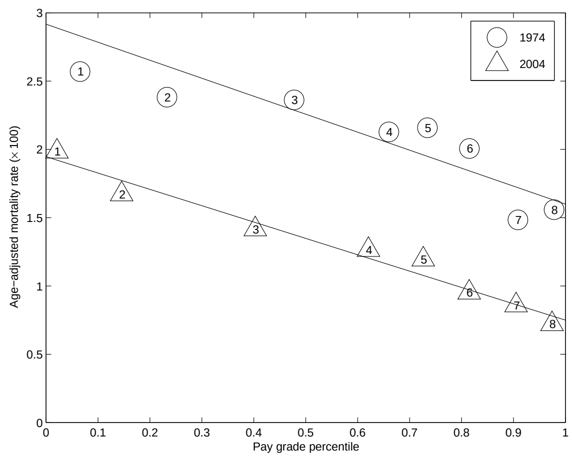
Notes: Each of the four panels shows data for the year specified in its title. In each panel, the three dashed lines depict the 2.5 percentile, median, and 97.5 percentile of the distribution of log mortality rates for retired male officers, while the three dotted lines depict the same centiles for retired enlisted men. Mortality rates are estimated using DMDC payroll data from 1974, 1984, 1994, and 2004 as described in the text. The distributions of age-specific mortality rates are generated using Monte Carlo simulations of 1,000 independent draws for each rate, constructed as described in the text.

Figure 2: Proportional and Additive Differences in Mortality Between Retired Officers and Enlisted Men



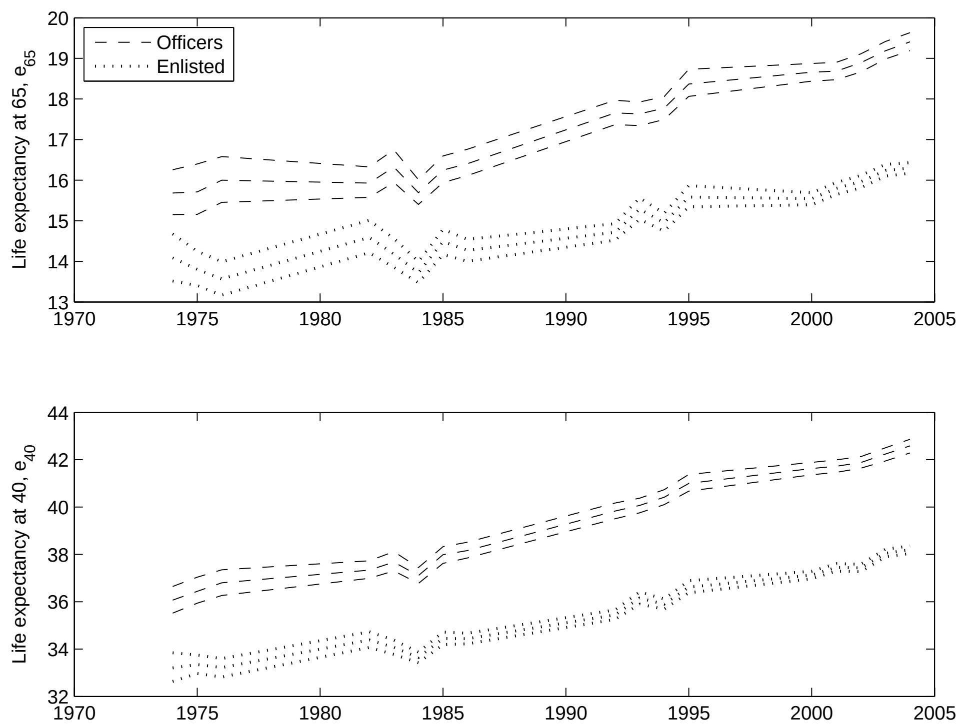
Notes: The top panel shows differences in log mortality rates between retired enlisted men retired officers in 1974, 1984, 1994, and 2004. A positive number represents a higher mortality rate among enlisted retirees by that percentage. The bottom panel shows level differences in mortality rates between the two groups. In each panel, the thick black line depicts the average over all years in the sample. Military retiree rates are estimated by the author using DMDC payroll data.

Figure 3: Age-Adjusted Mortality Rates Among Military Retirees by Pay Percentile in 1974 and 2004



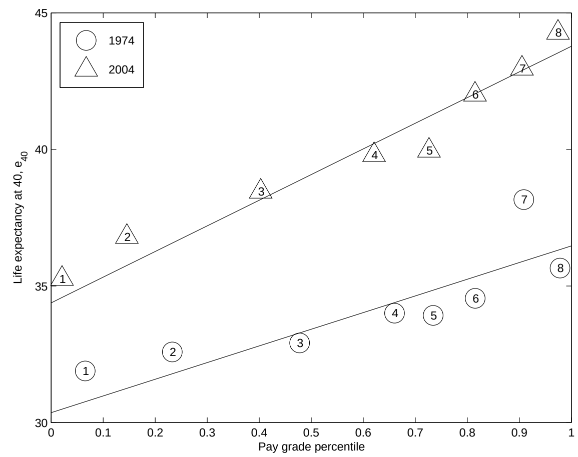
Notes: The data are age-adjusted mortality rates (y-axis) plotted against midpoints of group' percentile rankings in the pay distribution. Groups are listed in Table 2 and are composed as follows: (1) E-1 through E-5; (2) E-6; (3) E-7; (4) O-1, W-1, and E-8; (5) O-2, W-2, E-9, and W-3; (6) W-4, O-3, W-5, and O-4; (7) O-5; and (8) O-6 through O-10. Pay grades are grouped according to their pay after 20 years, as shown in Table 2. The SII is the slope of a weighted regression line through points, with population shares as the weights. I construct age-standardized mortality rates for each group by applying the average age structure for all groups combined over the entire sample period to each group's age-specific mortality rates.

Figure 4: Period Life Expectancy Among Military Retirees by Rank and since 1974



Notes: In each panel of the figure, the set of 3 thin dashed lines show the median and 95 percent confidence intervals around life expectancy for retired officers, while the set of 3 dotted lines show the equivalent for retired enlisted men. Life expectancies for military retirees are constructed from mortality rates estimated using DMDC payroll data for 1974–1976, 1982–1986, 1992–1995, and 2000–2004. Confidence intervals are constructed using Monte Carlo techniques, Bernoulli uncertainty, and uniformly distributed uncertainty about whether undocumented losses are deaths.

Figure 5: Period Life Expectancy at 40 Among Military Retirees by Pay Percentile in 1974 and 2004



Notes: The data are period life expectancy at 40 (y-axis) plotted against midpoints of group' percentile rankings in the pay grade distribution. Groups are listed in Table 2 and are composed as follows: (1) E-1 through E-5; (2) E-6; (3) E-7; (4) O-1, W-1, and E-8; (5) O-2, W-2, E-9, and W-3; (6) W-4, O-3, W-5, and O-4; (7) O-5; and (8) O-6 through O-10. Pay grades are grouped according to their pay after 20 years, as shown in Table 2. The SII is the slope of a weighted regression line through points, with population shares as the weights.