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Occupational Career and Risk of Mortality among Union Army Veterans

Abstract

Previous studies have extended the traditional framework on occupational disparities in health by examining mortality differentials from a career perspective. Few studies, however, have examined the relation between career and mortality in a historical U.S. population. This study explores the relation between occupational career and risk of mortality in old age among 7,096 Union Army veterans who fought the American Civil War in the 1860s. Occupational mobility was commonplace among the veterans in the postbellum period, with 54 percent of them changing occupations from the time of enlistment to 1900. Among veterans who were farmers at enlistment, 46 percent of them changed to a non-farming occupation by the time of 1900. Results from the Cox Proportional Hazard analysis suggest that relative to the average mortality risk of the sample, being a farmer at enlistment or circa 1900 are both associated with a lower risk of mortality in old age, although the effect is more salient for veterans who were farmers at enlistment. Occupational immobility for manual labors poses a serious threat to chance of survival in old age. These findings still hold after adjusting for the effects of selected variables characterizing risk exposures during early life, wartime, and old age. The robustness of the survival advantage associated with being a farmer at enlistment highlights the importance of socioeconomic conditions early in life in chance of survival at older ages.

Keywords

Career; Occupational Mobility; Mortality; Union Army Veterans; USA

Introduction

It has been well established that higher occupational status is associated with lower mortality in adulthood (e.g. Kitagawa & Hauser, 1973; Gregorio, Walsh, & Paturzo, 1997). The validity of using occupational status to explain mortality differentials lies in the observation that occupation conveys copious health-related information regarding income, education, social prestige, life style, access to health care services, exposures to hazardous working conditions, and so forth. This feature of occupation makes it an ideal indicator of social status and life style (Moore & Hayward, 1990).

Several studies have extended the traditional framework on occupational disparities in health by examining mortality differentials from a career perspective (e.g. Moore & Hayward, 1990; Davey Smith et al. 1997; Cambois, 2004). Findings from these studies suggest that occupational status at a single time point is usually inadequate to capture the dynamic association between occupational status and health. One of the major advantages of using occupational career relative to using occupation at a particular time (e.g. current occupation) is that the former more comprehensively characterizes SES by delineating its changes over time. Incorporation of this longitudinal information in mortality studies thus allows an examination of the relation between social mobility and mortality and at the same time makes it possible to pinpoint the particular age period(s) in which disparities in occupational status

might lead to mortality differentials in later life. Moreover, information on career history also allows an assessment of the effect of the duration of having a certain occupation or the particular effect of switching to a different occupation and its timing on health and mortality afterwards.

Another compelling reason for examining mortality differentials from a career perspective lies in health-related mobility. In many occasions, sometimes involuntarily, people change or quit their jobs for health reasons. This is especially the case for historical populations where most people simply worked to the point when they were no longer able to work. Malnutrition, diseases, and disability can all cause job quits or changes. Depending on specific changes, occupational mobility can thus be suggestive of deterioration of health which can be more directly related to mortality differentials.

This study seeks to assess the relation between intragenerational occupational mobility and risk of mortality among Union Army veterans who fought the American Civil War in the 1860s. Specifically, it relates veterans' risk of mortality in the post-1900 period to their occupations prior to enlistment, circa 1900, and the mobility in between for veterans who survived to 1900. Thus, occupational mobility in this study refers to changes in occupation from the time of enlistment to 1900. These changes can be upward, downward (both of which will later be defined in the paper), or occupational changes that do not necessarily involve upward or downward mobility. By linking career history to mortality differentials, this study aims to identify the particular occupation or combination of occupations at different life stages that have contributed the most to veterans' differential chance of survival in old age.

Since the vast majority of Union Army soldiers were in their late teenage years or early twenties at the time of enlistment, occupations prior to enlistment are indicative of the socioeconomic background of their families where they spent early years in life. A review of empirical evidence on occupational mobility in nineteenth century U.S. cities suggests that son's career-entry occupation closely follows or resembles that of their fathers (Hazelrigg, 1974). Findings from this study are also expected to reveal the relative importance of SES early in life in mortality differentials at older ages. Extant literature on this topic has not yielded a consistent finding. Whereas results from several studies show that adjusting for SES in later life substantially attenuates or even abolishes the effects of early-life socioeconomic conditions on adulthood mortality (e.g. Ben-Shlomo & Davey-Smith, 1991; Hayward & Gorman, 2004), findings from some other studies document the significant impact of early-life SES on mortality at older ages even after SES in later life having been taken into account (e.g. Bengtsson & Lindström, 2003; Costa & Lahey, 2005).

The findings from this study and their implications will be scrutinized in the historical context of the nineteenth-century United States. Most of the Union Army veterans were born between 1825 and 1845, exposed to a far more adverse epidemiological environment all through their life as compared to today's Americans. The average number of chronic conditions per Union Army veteran at ages 50 to 54 is three, as compared to one for American males in the same age group in the 1990s (Fogel 2004, p.91). Given the unprecedented improvement in the epidemiological environment as well as transformations in occupational structure since the nineteenth century, it becomes meaningful to assess how mortality was related to occupational career in the past, and to what extent this relation has changed over time. Comparisons between findings from the Union Army sample and those from more recent cohorts can thus potentially shed light on the historical trends in the relation between career and mortality.

Mortality from a Career Perspective: A Literature Review

Despite the vast literature on socioeconomic disparities in mortality, relatively few studies have examined mortality differentials from a career perspective. Even fewer studies have addressed

this topic using historical samples. I start my review below with a summary of previous findings on occupational disparities in health or mortality among Union Army veterans, followed by a brief review of relevant findings from several studies using data from more recent cohorts.

In an effort to account for the decline of chronic conditions among older men in the twentieth century, Costa (2000) examined the life-cycle correlates of several chronic conditions among Union Army veterans in the early twentieth century. In particular, Costa linked veterans' occupation at enlistment and circa 1900 to their risk of developing a series of chronic conditions including decreased breath or adventitious sounds, dullness of chest, joint or back problems, valvular health disease, congestive heart failure, and arteriosclerosis. The results indicate that veterans who were farmers and laborers at enlistment were more likely to suffer from respiratory difficulties, dullness of chest, decreased breath or adventitious sounds, valvular heart diseases, and joint or back problems than those who were professionals or proprietors at enlistment. For most of the chronic conditions considered, occupation circa 1900 does not show a significant effect. Costa concluded that both occupational shifts and the decreased prevalence of infectious diseases have contributed to the decline in chronic conditions in the United States in the twentieth century.

Using data from the Union Army sample, Lee (2003) assessed the relationship between prior exposure to diseases and health disparities among Union Army soldiers during the Civil War. The findings suggest that former farmers, rural residents, and native-born soldiers were healthier than others before enlistment, but after enlistment they were found to be more likely to contract and die from diseases. Lee attributed the health advantages associated with veterans who were non-farmers, foreign born and living in urban areas to their prior exposure to infectious diseases, which could have given them immunity to these diseases while in military service. This implies that in a harsh epidemiological environment such as a military camp, prior exposure to certain infectious diseases can sometimes benefit later survival due to the immunity it brings (Elo and Preston 1992). Lee's study did not target old-age mortality since most Union Army soldiers were younger than 30 years old at enlistment, but it underscores the necessity of tracing prior exposures and mortality selection when it comes to explaining mortality differentials in later life.

Based on the life histories of about 3,000 respondents who were sampled in the National Longitudinal Survey of Mature Men, Moore and Hayward (1990) related these men's occupational career prior to 1966 to their risk of mortality in the 17 years after 1966. They found that mortality associated with current or the last occupation differs substantially from that of the longest occupation, even after adjusting for the effects from education, income, health status and other variables. Another finding is that farmers and farm laborers exhibited very low mortality rates as compared to clerical workers.

Mare (1990) assessed the impact of occupational career prior to 1966 on mortality in the subsequent 17 years for about 5,000 U.S. men in the National Longitudinal Survey of Mature Men. The results indicate that after adjusting for educational and racial differences among occupations, men who are in laboring occupations at both the beginning and toward the ends of their working lives have mortality risks approximately 80 percent higher than those who are professionals or managers both early and late in their careers. The study also revealed that changing occupation from laborer to upper blue-collar or white-collar occupations can reduce approximately half of the disadvantage associated with a lifelong career as a laborer.

Cambois (2004) examined the relation between occupational mobility prior to 1975 and risk of mortality in the following five years among a large group of French men and women who were 30 to 84 years old in 1975. The findings suggest that for men, upward mobility is associated with a reduced risk of mortality, and downward mobility with an increased risk. It

was also found that in most cases, the mortality risks of the mobile are in between the risks in the class left and in the class joined.

Two converging findings stand out from the literature. First, relative to mortality risk associated with higher occupational status, long exposure to lower occupational status, for example, being a manual labor throughout career, is associated with an elevated risk of mortality. Second, relative to those who have no changes in their occupations, upward occupational mobility is associated with lower mortality, whereas downward mobility has been shown to be linked with higher mortality. Despite these findings, so far few studies have examined the extent to which these findings will hold in a historical population whose occupational structure and epidemiological environment are both distinctive from the current U.S. population. Studies by Costa and Lee have provided insights into occupational disparities in health or mortality among Union Army veterans, but they have not addressed mortality differentials in old age from a career perspective. As a result, little has been known about the relation between occupational mobility and mortality among the Union Army veterans, and the extent to which this relation has changed over time.

The Economic Context of Veterans' Postbellum Occupational Mobility

The period between 1865 and 1900 witnessed an unprecedented economic growth in the United States. Expansion of the rail and telegraph networks helped to create an increasingly unified national economy (Sundstrom & Rosenbloom, 1993). Concurrent with economic growth and industrialization, occupational structure also experienced a historical transformation. Among male Americans aged 10 years or older, the proportion employed in the agricultural sector declined from 52 percent in 1870 to 39 percent in 1900 (U.S. Bureau of the Census, 1975).

The rapid economic growth in the postbellum period, however, did not bring forth instant and steady improvement in health. Despite increases in per capita income, mean final height of white American males experienced a surprising decline from 1830 to 1890 (Fogel, 1986, 2004; Costa & Steckel, 1997). Explanations for the incongruence between economic growth and trend in stature include elevating inequality in income distribution, rapid urbanization without adequate public health and sanitation facilities, an increasing prevalence of infectious diseases, and a rise in the relative price of food (Murray, 1997; Haines, 2004). Similar discrepancies between economic growth and stature were also documented for several European countries in the eighteenth and nineteenth century (Fogel, 2004; Haines, 2004).

Such an economic context implies a mixed effect on veterans' well being in their postbellum life. The booming economy and the concurrent urbanization provided more employment opportunities for the veterans, which could help improve their living standards over time. Many of the veterans, particularly those who settled in urban areas, however, also had to confront the side effects of economic growth and industrialization. These include a rising cost of living, water and air pollution, more exposure to infectious diseases due to crowding and mobility, and so forth, all of which could presumably pose a threat to their health. For instance, Sanchez's study (2003) on the relation between migration and life expectancy among veterans in the postbellum period reveals that those who migrated were at higher risk of dying than those who did not migrate. Among those who migrated, moving to urban areas was associated with an even higher risk of mortality than those who migrated to rural areas.

Data and Methods

Data: The Union Army Sample

The data used in this study come from the Union Army sample (Fogel, 2000, 2001) that contains detailed records on major life events from childhood to death for roughly 36,000 Union Army

soldiers who fought the American Civil War. Analysis of possible sample selection bias indicates that the Union Army sample is generally representative of the population of white recruits into the Union Army. During the Civil War, approximately 95 percent of white males between ages 18 and 25 in the United States were examined and approximately 75 percent of the examinees were inducted (Fogel, Engerman, and Floud, 1983). Comparisons between the Union Army sample and the northern population in the same age group suggest that these two groups resemble each other in terms of wealth in 1850 and 1860 and in terms of mortality circa 1900 (Fogel et al., 2001).

The Union Army sample consists of three components or sub-samples. 1) Military records that contain comprehensive demographic information at enlistment such as age, height, city and state of residence, country of origin, occupation and so on; wartime experience such as battles participated in, wounds received, prisoner of war, wartime diseases and so forth; and pension application records for 35,570 veterans from 303 companies that were randomly selected from over 20,000 Union Army recruit companies; 2) Surgeon's Certificate Data that incorporate detailed medical records on postbellum physical examinations for about 17,700 veterans who are in the military records; 3) The census data that preserve socioeconomic information for those veterans who have been linked to the U.S. censuses from 1850 to 1910. These three sub-samples can be linked through a shared ID number that has been assigned to each of the veterans in the sample.

By integrating relevant information from the three sub-samples, I constructed life cycle records for 17,700 veterans in the Surgeon's Certificate Data covering three life stages including prior enlistment, wartime, and old age. Information on prior enlistment and wartime experience comes mainly from the military records. Since most of the information on socioeconomic conditions in old age comes from the 1900 Census, the working sample for this study includes 7,096 veterans who survived to 1900 and whose occupational information has been recorded both at the time of enlistment and in the 1900 Census.

It should be noted, however, that when the three sub-samples have been linked to construct the life cycle records for the veterans, linkage failures could potentially result in sample selection biases.¹ When linking the military records with the surgeon's certificate data, the primary cause of linkage failure is death before 1890, the year pension eligibility laws were relaxed to provide a pension for almost all Union Army veterans. Similar sample selection bias could also result from linking the military records with the 1900 Census. A comparison between veterans who had occupational information recorded in the 1900 Census and those otherwise suggests that these two groups resemble each other in terms of age in 1900, age at death, height at enlistment, percentage wounded during war, and occupational distribution at enlistment. However, veterans with occupation unknown in 1900 have a higher proportion of being born in a foreign country (Su, 2006). These biases in sample selection call for cautions in generalizing from the life cycle records of the UA sample to the contemporary U.S. general population.

Classifications of Occupations

Based on the Wilcox codes derived from studies of labor force distribution in the antebellum economy (Wilcox, 1992), occupation at enlistment has been classified into five categories: farmers, artisans, manual labors, professionals (including proprietors), and other. The farmer category includes both farmers and farm labors. In terms of the nature of work, farm labors resemble manual labors since both require substantial use of muscle power. However, since farm labors work in rural areas and most manual labors work in urban settings—two distinctive

¹A detailed introduction to these sample selection biases and their sources can be found at the website of the data collector/distributor The Center for Population Economics at the University of Chicago. <http://www.cpe.uchicago.edu/unionarmy/unionarmy.html>.

epidemiological environments in the nineteenth century U.S.—I still classify farm labors to the farmer category. The artisan category includes a wide variety of skilled workers such as carpenters, metal workers, foundry workers, brewers, bakers, sausage makers, and so forth. Manual laborers are those who essentially rely on their physical strength and muscle power such as miners and sailors. Professionals refer to those who owned a business or with certification or substantial expertise in their career, such as lawyers, doctors, professors and teachers, landlords, dealers, and so forth. Finally, all the rest have been classified into ‘other’ category, which includes servants, the unemployed, and those with occupations unclassifiable or unidentifiable. Similarly, occupations from the 1900 Census were also classified into the same five categories.

A relevant question here concerns defining upward and downward mobility among the veterans. Based on available information from the 1860 census, Figure 1 shows occupational differences in real estate and personal property value in 1860 for about 750 relatively older veterans, most of whom were already married in 1860. Professionals were the wealthiest among all occupations, followed by farmers, with manual labors at the bottom of this hierarchy. For analytical purpose, I define upward mobility as changing occupation from non-professionals to professionals and downward mobility as changing occupation from non manual labors to manual labors.

Methods

I adopted six Cox proportional hazard (CPH) models to examine the relation between veterans’ occupational career and their relative risk of mortality in the post-1900 period. The dependent variable is the hazard rate of dying at any time after 1900 given that a veteran had survived to 1900, which has been modeled as a function of age in 1900 and one of three groups of occupational categories: occupation at enlistment, occupation circa 1900, and the mobility in between. This gives rise to the first three CPH models.

On the basis of these CPH models, I incorporated three more CPH models by adding other explanatory variables characterizing veterans’ risk exposures prior to enlistment, during war, and circa 1900. The purpose of such a design is to examine the relation between occupational career and mortality risk with and without adjusting for the effects of other explanatory variables that have been selected. Risk exposures prior to enlistment have been characterized by six variables: birth season, birth country, region of residence, whether or not coming from big cities, height, and occupation at enlistment. Veterans’ wartime experience includes information on rank at enlistment, war injury, prisoner of war, and exposure to higher than average casualty. Information on socioeconomic conditions circa 1900 is based on six variables including whether living in big cities, region of residence, occupation circa 1900, marital status, literacy, and house ownership status.

An important assumption of the CPH analysis is the proportionality of hazard, that is, the effect of changing values for a certain explanatory variable on the hazard rate is constant, independent of time. This assumption was tested for all occupational categories by plotting Schoenfeld residuals against time. The results indicate that the assumption largely holds for these explanatory variables.

Deviation contrast was applied to all the occupational categories. As a result, the hazard ratio for each occupational category in the CPH models reflects how much its effect deviates from the average mortality in the whole sample. To differentiate the two sets of CPH models, in my discussion later, the three CPH models with only age and occupational categories incorporated will be termed partial models and the other three full models.

Results

A Description of the Study Population

Figure 2 delineates the life course of an average Union Army veteran in the sample. He joined the army at age 23 and spent about two years in military service before he was discharged from the army. He was 61 years old in 1900 when information on his occupation and other socioeconomic variables was collected from the 1900 Census. After 1900, he lived about 15 years and died at age 76. As Figure 2 illustrates, occupational mobility for Union Army veterans in this study refers to changes in their occupations from the time of enlistment to 1900, which will later be used to explain disparities in risk of mortality in the post-1900 period.

The Union Army sample preserves copious records on veterans' life experience, as indicated by the variables listed in Table 1 where the means or the percentage distributions have been presented. In terms of country of origin, about 85 percent of the veterans were native-born with the rest coming mainly from Germany, Ireland, Britain, and Canada. About six percent of the veterans came from one of the 25 largest cities in 1860, with a minimum population of 37,000. Height at enlistment shows a considerable variation with the tallest third about 5.4 inches taller than the shortest third, after age at enlistment has been adjusted.

Veterans' wartime experience from enlistment to discharge has also been well recorded. The average age at enlistment is about 23 years old, with about 64 percent of the veterans joining the army at age 23 or younger. Almost 92 percent of the veterans enlisted as privates. The high casualty rates are indicative of the brutality of the Civil War to which the veterans were exposed. About 33 percent of the veterans were injured during the war, and the average death rate among all recruit companies was 15 percent. Nearly nine percent of the veterans were once prisoners of war.

About 90 percent of the veterans in the working sample can be linked to the 1900 Census where information on their socioeconomic conditions circa 1900 can be found. The geographic distribution of residential regions in 1900 largely follows the antebellum distribution, with over 90 percent of the sample coming from North Central and North Atlantic regions. About 18 percent of the veterans lived in big cities that had a minimum of 100,000 residents in 1900, as compared to only six percent coming from big cities at the time of enlistment. In terms of marital status, 86 percent of the veterans were married in 1900 and 9.3 percent of the veterans survived their wives by then. The sample also showed a considerable variation in homeownership. Sixty four percent of the veterans reported living in their own houses, while 25.9 percent reported renting houses or apartments. But this information is missing for 9.9 percent of the sample due to failure in linking to the 1900 Census.

A comparison between occupational distributions circa 1900 and prior to enlistment indicates a remarkable transformation in occupational structure among the veterans in the postbellum period. The proportion of farmers declined from 59.9 percent at enlistment to 41.6 percent circa 1900, whereas the proportion of professionals and 'other' both experienced a considerable increase. Since most of the non-farming jobs were in urban areas, such a change in occupational structure implies that many veterans could have left their rural residence and moved to urban areas for new jobs.

Patterns of Occupational Mobility among Union Army Veterans

Occupational mobility was commonplace among Union Army veterans in the postbellum period, as indicated by the frequency distribution in Table 2. Given that occupation at enlistment and circa 1900 both have five categories, altogether there are 25 possible mobility categories. Fifty-four percent of the veterans changed their occupations between the time of enlistment and 1900. The chance of occupation change, however, turns out to be closely related

to the particular occupation at enlistment. Relative to other occupations at enlistment, farmers were least likely to change their occupations with 54 percent of them still being farmers in 1900, followed by professionals with 46 percent of immobility. By contrast, those who were manual labors or in 'other' occupation at enlistment were most likely to experience change of occupation, with 72 and 79 percent changing their occupations between enlistment and 1900 respectively.

In terms of upward or downward mobility, veterans who were professionals or artisans at the time of enlistment were least likely to move downwardly, with about eight percent experiencing downward mobility; those who were in 'other' occupation at enlistment had the highest risk of downward mobility with 17 percent becoming manual labors in 1900. As for upward mobility, those in 'other' occupation at enlistment had the best chance (28 percent), whereas manual labor had the least chance (13 percent). It thus appears that veterans in 'other' occupation are pretty heterogeneous.

Occupational Career and Risk of Mortality in the Post-1900 Period

The hazard ratios as well as their 95 percent confidence intervals for each of the occupational categories have been summarized in Table 3. These hazard ratios come from six CPH models, with the first hazard ratio for each occupational category adapted from the three partial models and the second hazard ratio from the three full models. Since each hazard ratio reflects the effect of a particular occupational category on risk of mortality relative to the average risk of mortality in the sample, it becomes easier to compare directly across occupational categories in terms of their effects on risk of mortality.

A detailed reading of Table 3 yields several observations. First, being a farmer at enlistment is associated with a significant survival advantage in old age. The average risk of mortality for veterans who were farmers at enlistment is 12 percent lower than the sample average in the partial model. This advantage reduces to nine percent in the full model where effects of other explanatory variables have been taken into account. The farmer advantage in survival becomes even more salient for veterans who worked as farmers both prior to enlistment and circa 1900, as reflected by a reduced risk of mortality of 15 percent and 11 percent in the partial and full models respectively. The farmer advantage, however, becomes insignificant for veterans who changed their occupations from farmers to manual labors and for those who changed from farmers to 'other', though the estimated risk of mortality for these two groups is still below the sample average.

The survival advantage of being a farmer at enlistment can also be illustrated by mortality disparities among veterans who were artisans or professionals circa 1900. Among all veterans who were artisans in 1900, the estimated average risk of mortality is two percent above the sample average; however, for those artisans who were farmers at the time of enlistment, the corresponding risk is 17 percent below the sample average. Similar survival advantage can also be observed for professionals in 1900 who used to be farmers at the time of enlistment.

Second, the farmer advantage in survival still remains when occupation circa 1900 has been used to examine occupational disparities in mortality. Being a farmer circa 1900 is associated with a reduced risk of mortality ranging from six to nine percent. The results also suggest that changing occupation from non-farmers to farmers is related to a reduced level of mortality risk. For instance, the estimated average risk of mortality for all veterans who were professionals at enlistment is four percent below the sample average, but for those who changed their occupation from professionals to farmers the corresponding risk of mortality becomes 18 percent lower. Similar changes in risk of mortality can also be observed for veterans who changed their occupation from artisan, manual labor, and 'other' to farmers, though these effects are not statistically significant.

Third, occupational immobility for manual labors and to a less extent for those in ‘other’ occupation, poses a threat to chance of survival in old age. On average being a manual labor prior to enlistment is associated with an elevated risk of mortality ranging from three to five percent compared to the sample average. The corresponding elevated risk of mortality associated with being a manual labor in 1900 ranges from four to seven percent. However, for those veterans who were manual labors at both life stages, the elevated risk of mortality becomes 20 to 27 percent and the effect is statistically significant. Even after adjusting for the effects of other explanatory variables considered in this study, remaining manual labor is still associated with an elevated mortality risk of 20 percent in the full model. Such a finding highlights that the most serious threat to survival in old age does not come from being a manual labor at the beginning or the end of veterans’ career but from staying in manual labor throughout career.

Fourth, upward or downward mobility as previously defined does not make a significant difference in risk of mortality among the veterans. For artisans and manual labors, changing occupation to professionals seems to be associated with a reduced level of risk of mortality based on the sizes of the hazard ratios, but these effects are not statistically significant. Similarly, changing occupation from non manual labor to manual labor does not result in a significantly elevated risk of mortality among the veterans.

Finally, a comparison between the hazard ratios from the partial models and those from the full models suggests that the relation between occupational career and risk of mortality is in general robust irrespective of whether or not taking into account the effects of selected explanatory variables characterizing the three life stages of the veterans. While adjusting for the effects of these variables slightly mitigates the effects of occupation or occupational mobility, it does not alter the basic pattern detailed above. Since many of these explanatory variables such as country of origin, region of residence, coming from big cities, war traumas, and so forth can presumably influence veterans’ health in the postbellum period, the robustness of the occupational effects on mortality as revealed here has implications to the literature on health-related mobility and its role in occupational differentials in mortality. I will come back to this issue in the next section.

Discussion

The finding that being a farmer is associated with lower mortality risk in old age among Union Army veterans has also been documented in several other studies (e. g. Costa, 2003; Costa & Lahey, 2005; Su, 2005). This study complements previous studies by showing that not only being a farmer matters, but the timing and duration of being a farmer also matters as far as risk of mortality is concerned. Despite the finding that being a farmer at enlistment or circa 1900 are both associated with a lower than the average risk of mortality, the survival advantage becomes more salient for veterans who were farmers at enlistment than for those who were farmers circa 1900. The results also indicate that being a farmer throughout career is usually associated with a better chance of survival in old age than changing from farming to other occupations.

The long lasting impact of being a farmer at enlistment on old-age survival to some extent underscores the importance of socioeconomic conditions early in life in mortality disparities at older ages. For most Union Army veterans, their occupations at enlistment are suggestive of the economic background of their families where they grew up. The robustness of the effect of being a farmer at enlistment in the face of statistical control for socioeconomic conditions circa 1900 further suggests that veterans’ SES early in life makes a difference in their chance of survival in old age and this impact generally holds with or without adjusting for the effects of their SES circa 1900.

The farmer advantage in survival revealed in this study is consistent with the well documented rural-urban distinction in health and mortality in the nineteenth century U.S. (e.g. Preston & Haines, 1991; Haines, 2001; Lee, 2003; Fogel, 2004). Higher population density in urban areas means more hosts for communicable diseases and easier transmission of water and airborne diseases. Crowded housing is a major contributing factor to the prevalence of tuberculosis in nineteenth-century Western Europe (Riley, 2001). Moreover, inadequacy in understanding the disease process seriously hampered endeavors by public health agencies to combat communicable diseases in the nineteenth century. Speculations on the linkage between bacteria and infectious diseases began prior to the nineteenth century, but the science of microbiology did not take shape until the late nineteenth century.

In an era without modern refrigeration and transportation, rural residence was usually associated with a more stable supply of fresh milk, vegetables, meat, and fruits, which could have contributed to the survival advantage of farmers. A study by Craig, Goodwin, and Grennes (2004) found that the widespread use of mechanical refrigeration in the processing, shipping, and storing of perishable commodities in the United States began only in the 1890s. The study concluded that the adoption of refrigeration in the late-nineteenth-century United States increased dairy consumption by 1.7% and overall protein intake by 1.25% annually after the 1890s, which significantly contributed to the increase in height in the twentieth century.

Mortality selection during the Civil War could also have contributed to the farmer advantage in old-age survival. If Union Army soldiers who used to be farmers were more likely to contract and die from infectious diseases during wartime than those from most other occupations due to their no or limited immunity to the viruses in a military camp (Lee, 2003), those farmers who survived the Civil War are presumably more robust than those from other occupations since a higher proportion of frail farmers could have been removed from the sample by the end of the war.

Another potential explanation for the farmer advantage in survival is health-related mobility, that is, those relatively healthier veterans had been disproportionately selected to become farmers. Farming in the nineteenth century was physically intensive. Given the high prevalence of chronic conditions among the veterans (Fogel, 2004), some of them could have left farming work in case their health conditions failed to meet the demand. If this is the case, it makes sense that quitting farming is associated with higher mortality risk, whereas changing jobs from non-farming to farming is related to lower mortality risk, as suggested by the analytical results in this study. Similar findings have been reported in the study by Moore and Hayward (1990) on occupational differentials in mortality among Americans in the 1960s, which suggests that farmers and farm labors exhibited very low mortality rates compared to clerical workers. The explanation for the farmer advantage, according to Moore and Hayward, is that the physical and environmental demands of farming work may have pushed those physically unqualified out of the occupation, rather than the farming work itself being more beneficial for health than other occupations.

While findings from this study cannot completely rule out such an explanation, they provide little support for it. If health-related mobility is behind the farmer advantage in survival, adjusting for the effects of early life and wartime experience should have substantially diminished or even eliminated the farmer effect. This is because variables like country of origin, region of residence, coming from big cities, height, and war traumas could presumably influence veterans' health in the postbellum period. The finding that the farmer advantage in survival generally persists after adjusting for the effects of these variables is not in good congruence with the health selection hypothesis.

It should be noted, however, that the survival advantage in old age associated with being a farmer at enlistment does not necessarily imply a reduced risk of developing certain chronic conditions in old age for veterans who used to be farmers. There has been evidence suggesting that veterans who were farmers at enlistment on average had a higher risk of developing joint or back problems, respiratory difficulties, and valvular health disease than those from most other occupations (Costa, 2000). This implies that occupational disparities in morbidity and mortality might not always be consistent with each other, partially depending on the specific diseases that have been selected for analysis.

Another major finding from this study is that occupational immobility for manual labors poses a serious threat to veterans' chance of survival in old age. The much elevated risk of mortality for veterans who were manual labors both at enlistment and circa 1900 resonates well with the cumulative disadvantage hypothesis, which has also been termed as the 'accumulation of risk model' by Kuh and Ben-Shlomo (2004) who described the model as:

"... the 'accumulation of risk model' assumes that risks to health gradually accumulate over the life course although this does not preclude factors acting at sensitive developmental periods having a greater impact. As the number, duration, and severity of exposures increase, there is cumulative damage to biological systems (p. 9–10)."

According to this model, at each life stage exposure to socioeconomic hardship will have an additive, adverse effect on health in the future. Manual labors were at a disadvantageous position even before they took part in the Civil War, a good indication of which is the far below average value of real estate and personal property they owned in 1860 as illustrated in Figure 1. The misery can become aggravated if they remain in their antebellum occupation throughout their career.

What this study has been able to reveal, however, is that the survival disadvantage associated with occupational immobility for manual labors could be more severe than a simple summation of risks of mortality associated with manual labors at enlistment and circa 1900. The negative effect associated with immobility for manual labors cannot be adequately captured by occupation at either enlistment or circa 1900. In this sense, the survival disadvantage associated with occupational immobility for manual labors provides an example of the additional insights a career perspective can bring to studies of mortality disparities.

The finding that neither upward nor downward occupational mobility has been significantly associated with risk of mortality among the veterans stands in contrast with corresponding findings from more recent cohorts (e.g. Mare, 1990; Cambois, 2004). A plausible explanation is that among Union Army veterans, the beneficial effect of material well-being on health for professionals could have been severely offset by a higher chance of exposure to a series of public health hazards including crowding, air and water pollution, spread of infectious diseases, and so forth that have been associated with living in urban areas in the nineteenth century U.S. Over time, when the epidemiological environment of urban areas got improved during the course of the twentieth century, the significance of occupational mobility in mortality disparities eventually became more pronounced.

Limitations of the Study

Despite occupational information collected at enlistment and circa 1900, little has been known about occupational changes in between such as when veterans changed their occupations, how many times they changed, and how long they spent in each occupation. The timing of job changes can make a significant difference in risk of mortality (Pavalco, Elder, & Clipp, 1993). There is also evidence suggesting that it is important to differentiate the effects of current

occupation from that of the longest occupation, since mortality associated with each differs substantially (Moore & Hayward, 1990). Future studies can better characterize veterans' occupational career by incorporating relevant information from other census data from 1860 to 1910. A potential problem is that the linkage rate might not be good for some of the censuses, which could eventually shrink the sample size.

Another limitation of this study is that, in assessing occupational disparities in mortality, the effect of mortality selection prior 1900 has not been considered. The current estimates of survival disadvantages for manual labors will likely be conservative if it can be confirmed that mortality selection prior 1900 had disproportionately removed more manual labors from the sample. A look into this problem requires information on mortality rates by occupation prior 1900. This information in the current Union Army sample, however, could be potentially biased due to pension laws and their changes. The U.S. Congress originally established the basic system of pension laws, called the General Law, and limited the benefit to those who could prove their disabilities were a result of the war. Later, in 1890, the Disability Act was approved, marking the beginning of a more universal pension program that only required pensioners to have served in the military for 90 days. This implies that holding other factors constant, veterans who died before 1890 on average had a lower chance of being selected into the Union Army sample than those who died after 1890.

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Figure 1. Occupational Differences in Wealth in 1860

Source: The Union Army Sample.

Figure 2. The Life Course for an Average Union Army Veteran
Source: The Union Army Sample.

Table 1

Description of Variables Used in the Analysis

Early Life (Birth to Enlistment)	Mean or %	Old Age (Circa 1900)	Mean or %
Birth Season		Age in 1900	60.6
Spring	26.3	Living in Big Cities in 1900	
Summer	23.5	In Big Cities	18.3
Autumn	24.3	Not in Big Cities	81.4
Winter	25.9	Unknown	0.3
Birth Country		Residential Area in 1900	
United States	84.8	North Atlantic	30.5
Britain	2.6	South Atlantic	1.7
Canada	2.6	North Central	60.5
Germany	5.4	South Central	2.6
Ireland	3.1	Western States	3.7
Other Countries	1.6	Unknown	1.1
Coming from Big Cities	6.1	Occupation in 1900	
Residential Regions		Farmer	41.6
North Atlantic	31.0	Artisan	14.2
South Atlantic	1.6	Manual Labor	12.7
North Central	60.2	Professional	18.2
South Central	2.0	Other	13.3
Other	5.2	Marital Status in 1900	
Height at Enlistment (inches) ¹		Married	85.9
Shortest One Third	64.9	Single	3.9
Middle One Third	67.6	Widowed	9.3
Tallest One Third	70.3	Divorced	0.7
Occupation at Enlistment		Unknown	0.3
Farmer	59.9	Literacy in 1900	
Artisan	17.8	Able to Read	95.6
Manual Labor	11.7	Unable to Read	3.9
Professional	6.0	Unknown	0.5
Other	4.6	Own or Rent House in 1900	
Wartime (Enlistment to Discharge)		Own	64.1
Enlisted as a Private	91.5	Rent	25.9
Injured during War	32.7	Unknown	9.9
Prisoner of War	9.3	Age at Death	76.0
Exposed to Higher than Average Casualty ²	52.0		

Source: The Union Army Sample (N=7,096).

Note:

¹ Height at enlistment has been adjusted for age at enlistment. For each age group, veterans were ranked into one of the tritiles based on their height at enlistment.

²During the Civil War the average death rate among Union Army recruit companies was 15 percent, with about half of all surviving veterans in the working sample exposed to this average level of casualty or higher.

Table 2
Occupational Mobility from Enlistment to 1900 among Union Army Veterans

Occupation at Enlistment		Occupation Circa 1900				
		Farmer	Artisan	Manual Labor	Professional	Other
Farmer		2,298	339	479	649	484
%		0.54	0.08	0.11	0.15	0.11
Artisan		245	481	102	244	188
%		0.19	0.38	0.08	0.19	0.15
Manual Labor		263	103	230	110	127
%		0.32	0.12	0.28	0.13	0.15
Professional		73	49	35	194	74
%		0.17	0.12	0.08	0.46	0.17
Other		72	38	56	93	70
%		0.22	0.12	0.17	0.28	0.21

Source: The Union Army Sample (N=7,096).

Table 3

Occupational Mobility and Relative Risk of Mortality: Union Army Veterans

	Occupation Circa 1900				
	Farmer	Artisan	Manual Labor	Professional	Other
Farmer	0.85*** (0.81, 0.90)	0.83** (0.75, 0.93)	0.94 (0.85, 1.03)	0.89** (0.82, 0.97)	0.94 (0.85, 1.03)
					0.88*** (0.85, 0.92)
Artisan	0.89*** (0.84, 0.94)	0.85** (0.76, 0.96)	0.94 (0.85, 1.04)	0.92* (0.84, 1.00)	0.96 (0.87, 1.06)
					0.91*** (0.87, 0.95)
Manual Labor	0.95 (0.84, 1.08)	1.08 (0.98, 1.19)	1.00 (0.83, 1.21)	0.91 (0.81, 1.04)	1.10 (0.96, 1.27)
					1.02 (0.96, 1.08)
	1.02 (0.90, 1.16)	1.07 (0.98, 1.18)	1.02 (0.84, 1.24)	0.90 (0.79, 1.04)	1.12 (0.97, 1.30)
					1.03 (0.98, 1.10)
Professional	0.93 (0.82, 1.05)	1.01 (0.84, 1.22)	1.27*** (1.12, 1.45)	0.96 (0.82, 1.16)	1.05 (0.88, 1.25)
					1.05 (0.98, 1.12)
	0.95 (0.84, 1.08)	0.99 (0.81, 1.20)	1.20* (1.04, 1.38)	0.96 (0.79, 1.16)	1.03 (0.86, 1.23)
					1.03 (0.96, 1.10)
Other	0.82 (0.66, 1.02)	1.09 (0.83, 1.42)	1.02 (0.74, 1.40)	0.97 (0.84, 1.12)	0.93 (0.74, 1.16)
					0.96 (0.88, 1.04)
	0.85 (0.67, 1.07)	1.03 (0.77, 1.37)	0.96 (0.69, 1.34)	0.94 (0.81, 1.09)	0.88 (0.70, 1.11)
					0.93 (0.85, 1.01)
	0.99 (0.79, 1.24)	1.18 (0.87, 1.60)	1.13 (0.87, 1.45)	1.07 (0.88, 1.30)	1.26* (1.01, 1.59)
					1.11* (1.02, 1.22)
Total	0.99 (0.78, 1.25)	1.36 (0.99, 1.87)	1.06 (0.82, 1.38)	1.05 (0.86, 1.30)	1.22 (0.97, 1.55)
					1.11* (1.01, 1.22)
	0.91*** (0.87, 0.94)	1.02 (0.97, 1.08)	1.07* (1.01, 1.13)	0.97 (0.92, 1.02)	1.04 (0.98, 1.10)
					1.00 (ref.)
	0.94** (0.90, 0.98)	1.02 (0.96, 1.08)	1.04 (0.98, 1.11)	0.96 (0.91, 1.01)	1.04 (0.98, 1.10)
					1.00 (ref.)

Source: The Union Army Sample (N=7,096).

Notes:

* p<.05;

** p<.01;

*** p<.001.

The first hazard ratio for each occupational or occupational mobility category was only adjusted for the effect of age in 1900, while the second hazard ratio was adjusted for the effects of age in 1900 and the variables characterizing the three life stages of Union Army veterans including birth season, birth country, coming from big cities at enlistment, residential regions at enlistment, occupation at enlistment, enlisted as a private, war injury, prisoner of war, exposure to higher casualty, living in big cities in 1900, residential areas in 1900, occupation in 1900, marital status in 1900, literacy in 1900, and house ownership in 1900.