Racial Differences in the Association between Socioeconomic Position and Mortality: Does Occupation Matter?

Introduction

Differential rates of mortality between blacks and whites persist in the United States. In 2004, the average life expectancy for black women was 4.5 years less than for white women and 6.2 years less for black versus white men (Arias, 2007). While the differences might not be entirely attributed to social factors, a recent study examining avoidable mortality (i.e. deaths that should not occur in the presence of quality medical care) in a national sample from 1980-2005, found that avoidable mortality accounted for nearly 70% of the absolute difference in all-cause mortality between blacks and whites (Macinko & Elo, 2009). It has been hypothesized that socioeconomic position (SEP), factors such as education, income and occupation, may be a crucial area of study, in order to understand differential rates of mortality between blacks and whites in the United States.

Studies are increasingly focusing on socioeconomic factors to help explain the inequality in rates of mortality between blacks and whites and although while overall they have shown statistically significant relationships between SEP and mortality, the results have varied. Most studies have found a substantial association between socioeconomic position (SEP), measured as income or education or occupation, or as a combination of these factors and mortality rates. However, how these measures of SEP should be collected and which factor contributes the most to explaining these differential mortality rates, is not conclusive and has been focus of rigorous research and debate. While education and income measures vary across studies, perhaps occupation is the most unstable measure of SEP, with studies using employed versus not-employed, professional versus non-professional or specific Census occupation codes to describe occupation and its affect on mortality.

The purpose of this study is to examine the association of SEP on mortality rate differentials between non-Hispanic white and non-Hispanic black adults, in a nationally representative sample, with an emphasis on occupational factors. National Health Interview Survey (NHIS) data from 1986 through1994 was matched with death certificate data from the National Death Index (NDI), from 1986 through 2002. Occupations (using Census occupation codes) were then matched to occupational level data in the Bureau of Labor Statistics (BLS) Occupational Information Network (O*NET) database to obtain occupation level psychosocial and physical risk factors. Survival analysis is used in our study to model the relationships between measures of SEP and mortality, stratified by gender.

Socio-Economic Position and Mortality

It is well established that factors of SEP, which can be measured by a number of factors such as education, occupation and financial resources, play distinct roles in mortality outcomes (Elo, 2009; Mackenbach, Stirbu, Roskam, Schaap, Menvielle, Leinsalu et al., 2008). The links between SEP and mortality risk are presumed to exist as indicators for various health related behaviors, variations in levels of physical risk factors at work and access to quality preventative and treatment medical care, all of which may hasten mortality. While it is reasonable to think that the socioeconomic indicators are closely connected, in a study of the National Longitudinal Mortality Study (NLMS) using data from 1979 through 1989, Johnson, Sorlie and Backlund (1999) found occupation, income and education to have independent effects on mortality after adjusting for age, race, and gender (Johnson, Sorlie, & Backlund, 1999).

Socio-Economic position Mortality and Race

Results examining SEP and mortality differentials by race have for the most part, found statistically significant associations between SEP and mortality. A 2006 study found that African-Americans had higher rates of mortality than other racial groups, even after controlling for SEP and demographics (Kposowa & Bideshi, 2006). In analyzing data from the Multiple Risk Factor Intervention Trial (MRFIT), rates of cardiovascular disease (CVD), researchers found that even for those with low levels of risk factors (e.g., smoking, cholesterol levels, and hypertension status), mortality rates for black men were higher than for white men, even when risk factors and income are adjusted (Thomas, Eberly, Davey Smith, Neaton, & Stamler, 2005). Using National Health Interview Survey (NHIS) data from 1986-1997, researchers found that even after controlling for education, income and occupation that non-Hispanic blacks had a 43% higher rate of mortality than non-Hispanic whites and that where white professionals had a lower risk of mortality than white non-professionals, this difference in mortality based on professional/non-professional designation seen in whites, did not hold for blacks, with professional and non-professional blacks having similar rates of mortality (Muntaner et al., 2004).

Measures of SEP

Although the link between SEP and mortality has been well established, measures collected and analyzed for SEP factors vary widely. Financial resources, which are often measured byincome or wealth, have been linked to poor health outcomes and mortality risk. These relationships are hypothesized to exist because those with fewer financial resources are less likely to have access to preventative health care and preventative actions against poor health

outcomes, and those with less accumulated wealth, may have less resources to deal with major health crises. Income measures vary in studies of mortality from household or family income (Sorlie, Backlund and Keller, 1995; Muntaner, Hadden and Kravets, 2004, Kposowa and Bideshi, 2006), income to needs ratios (Cubbin, LeClere and Smith, 2000), as percent of below or above poverty levels (Rehkopf, Berkman, Coull and Kreiger, 2008), or were not assessed (Iribarren et al, 2004). Each of these variables may capture a different picture of income.

Education has also been hypothesized to be related to poor health outcomes, in part because it is assumed to determine "occupational social class," an indicator of workplace status and aspects of the work environment that may increase mortality risk (Muntaner, Hadden, & Kravets, 2004). Education is the most stable of the SEP variables, generally measured as years of education (Sorlie, Backlund and Keller, 1995), or categorized into those less than, equal to or greater than a high school or college education (Cubbin, LeClere and Smith, 2000; Iribarren et al, 2004).

Occupation is also related to differential rates of mortality as well as other health outcomes, through access to care (job dependent health insurance), occupational exposures and abatement techniques that may or may not exist on their job, and through racial segregation of occupations with the worst of both access to health care and occupational exposures disproportionately affecting people of color (Cherniak, 1986; Chung-Bridges, Muntaner, Fleming, Lee, Arheart, LeBlanc et al., 2008; Lloyd, 1971; Michaels, 1983). Occupation is the one variable with both the most varied measures used, ranging from no occupational measures reported (Jemal et al, 2008; Thomas et al, 2005) to employment status (employed/not employed) (Sorlie, Backlund and Keller, 1995; Kposowa and Bideshi, 2006), broad categories (e.g., blue collar/white collar or professional/non-professional (Cubbin, LeClere and Smith, 2000), as a

score, combined with income and/or education (Gregorio, Walsh and Paturzo, 1997; Steenland, Hu and Walker, 2004), as specific Census occupational groups (Johnson, Sorlie and Backlund, 1999) or excluded entirely from studies examining SEP effect on mortality risk (Elo and Preston, 1996, Cooper et al, 2001, Thomas et al, 2005). The use of one, but not all major aspects of SEP (education, income and occupation) or a composite variable that sums up the effects of all three measures of SEP, may have missed or diluted the individual effects of SEP on mortality risk.

Limitations of previous research

The data used to examine the relationship between SEP and mortality risk have varied, using either one or two measures, combinations of measures or general categorical variables of all three measures, to measure individual's SEP. Recent literature has argued that when investigating the relationship between SEP and health outcomes, measures of financial resources, education and occupation cannot be used interchangeably as they appear to account for different aspects of SEP effect on health, and that all three aspects of SEP should be measured in order to better understand the relationship between mortality risk and SEP (Braverman et al 2005; Geyer et al 2005).

Additionally if occupational risk factors are to play a role in explaining the relationship of SEP to mortality, as it appears to be a promising variable from prior research, it seems necessary to address occupational exposures in a more detailed manner than has been done previously. Employment status, generalized descriptions of manual versus professional, may not fully capture the occupational hazards and risk factors that could affect differential rates of morbidity and mortality.

The purpose of this study is to examine the effect of multiple measures of SEP, measured by income, education and occupation, on rates of mortality, while also including specific physical and psychological occupational risk factors. Because the labor market is often experienced differently by gender, all analyses are stratified by gender. To our knowledge, there are have been no other studies utilizing job characteristics from O*NET data in studies of mortality in the United States. Alterman et al (2008) have linked O*NET data to both the National Health and Nutrition Examination Survey (NHANES III) and the National Health Interview Survey (NHIS 2001-2003) and found statistically significant associations between O*NET job characteristics and health risk behaviors, cardiovascular disease and depression(Alterman, Grosch, Chen, Chrislip, Petersen, Krieg et al., 2008).

The research questions this study is designed to answer are: Do occupational characteristics explain differentials in mortality risk between blacks and whites? If yes, what is the nature of these associations and does a general occupational grouping work as well as more detailed physical and psychosocial characteristics? We hypothesize that occupation will have a significant and independent effect on mortality, but that detailed occupational characteristics will be more predictive then general occupational grouping.

Methods:

We use data from nine years of the National Health Interview Survey (NHIS) public use files, from 1986 to 1994 (National Center for Health Statistics, 1987-1995). The 1986-1994 time frame was chosen because all years collected specific occupation data using three digit Census occupation codes. The NHIS is a continuous multistage area probability survey of the US non-institutionalized civilian population living in addressed households. During this period, each week a probability sample of households was interviewed by trained interviewers to obtain information about certain characteristics of each member of the dwelling. Households were chosen based on a multistage probability sampling strategy involving both stratification and clustering in order to provide a representative sample of US adults. For each year approximately 50,000 households were surveyed.

NHIS data were matched to death certificate data using the National Death Index (NDI) public use files (data available on deaths occurring 1986-2002). The NDI data is maintained by the National Center for Health Statistics (NCHS). The NDI is an indexed database of death certificates submitted by State vital statistics offices and is updated annually. Mortality is ascertained primarily by using a probabilistic match between NHIS and NDI death certificate records. Analyses were restricted to non-Hispanic white and non-Hispanic men and women between the ages of 25-64, who were working in the labor force at the time of the NHIS survey.

There were 512,674 records from the NHIS for the period 1986-1994, for the sample of working adults (aged 25-64). Exclusion criteria for our analysis included those missing mortality status (n=10,775), those who were other than non-Hispanic black or white (n=63,420), not being

in the labor force at the time of the survey (n=96,138), missing education information (n=1,189), and those missing marital status or income (n=7,132) leaving 334,020 records for our analysis.

Occupational characteristics

The Bureau of Labor Statistics recently replaced their Dictionary of Occupational Titles (DOT), which categorized occupations by some measure of risk, with a more detailed set of data job and worker specific characteristics located in the Occupational Information Network (O*NET). The O*NET is a large, continually updated database that groups occupations in terms of common work and worker characteristics. The O*NET provides a comprehensive standardized mechanism from which to evaluate the psychosocial, physical and worker characteristics by occupation. O*NET job classifications are based on the Standard Occupational Classification (SOC) system, which is used by insurance/actuarial firms, industry and regulatory agencies to define occupations. O*NET was developed by and is being maintained by the US Department of Labor/Employment and Training Administration (USDOL/ETA) through a grant to the North Carolina Employment Security Commission. O*NET provides physical, chemical, biological and psychosocial importance scores to hundreds of Standard Occupational Classification (SOC) codes. (http://www.onetcenter.org/ overview.html).

Occupational variables from O*NET:

Work Values

Support. It is expressed on a scale of 1 to 7 (1 being low, 7 being high) as the extent to which this job requires management support, defined as: "…supportive management that stands behind employees. Corresponding needs are Company Policies, Supervision: Human Relations and

Supervision: Technical." Data were categorized based on the 50th and 75th percentiles, into three dummy variables for analysis.

Working conditions. It is measuredby the same scale as support, 1 to 7 with 1 being low and 7 being high. Working conditions are defined as: as occupations that offer job security and good working conditions. Data were categorized based on the 50th and 75th percentiles, into three dummy variables for analysis.

Security. It is a measure of how likely workers on this job have steady employment, security was also standardized as a percent of importance (0-100%).

Work Context

Described by the O*NET system as data that include "global aspects of work composed of specific needs that are important to person's satisfaction. Occupational Reinforcer Patterns (ORPs) are based on the Theory of Work Adjustment (Dawis & Lofquist, 1984)." (O*NET http://www.onetcenter.org/dl_files/ ContentModel_DetailedDesc.pdf).

Work Activities

Performing General Physical Activities: It is defined as "Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling of materials. This data were categorized based on the 50th and 75th percentile which created three dummy variables. Performing General Physical Activities was expressed as the level required to do the job on a scale from 0 to 7, with 0 being not at all required. Data were categorized based on the 50th and 75th percentile and three dummy variables were created.

Work Context/Physical work conditions - This category describes the work context as it relates to the interactions between the worker and the physical job environment

Exposed to contaminants: It is defined as "How often does this job require working exposed to contaminants (such as pollutants, gases, dust or odors)?" Using a scale of 0 to 5, with 0 being never exposed to contaminants. Data were categorized based on the 50^{th} and 75^{th} percentile and three dummy variables were created.

Exposed to Hazardous Equipment: It is defined as "How often does this job require exposure to hazardous equipment?" Using a scale of 0 to 5, with 0 being never exposed to hazardous equipment.

Exposed to Hazardous Conditions: It is defined as "How often does this job require exposure to hazardous conditions?" Using a scale of 0 to 5, with 0 being never exposed to hazardous conditions.

Wear Common Personal Protective Equipment (PPE): It is defined as "How much does this job require wearing common protective or safety equipment such as safety shoes, glasses, gloves, hard hats or life jackets?"

Wearing Specialized PPE: It is defined as "How much does this job require wearing specialized protective or safety equipment such as breathing apparatus, safety harness, full protection suits, or radiation protection?"

Cramped Work Space, Awkward Positions: It is defined as "How often does this job require working in cramped work spaces that requires getting into awkward positions?" on a scale of 0 to 5 with 0 indicating the job never requires working in cramped spaces or awkward positions.

Bending and Twisting: It is defined as "How much does this job require bending or twisting your body?"

Pace set by machines: It is defined as "How important is it to this job that the pace is determined by the speed of equipment or machinery? (This does not refer to keeping busy at all times on this job.)"

Automation: It is defined as "How automated is the job?"

Freedom to make decisions: It is defined as "How much decision making freedom, without supervision, does the job offer?"

Time pressure: It is defined as "How often does this job require the worker to meet strict deadlines?"

Manual/non-manual occupations

To test whether simple dichotomous occupational categories work as well in describing occupational effect on mortality, manual/non-manual (1,0) was created. Using SOC 2000 codes, 22 major occupational groups (first two digits of SOC codes) were used to determine whether the major group was primarily manual or non-manual work. Manual work is described as non-desk jobs, where heavy lifting, high hand force or high exertion is combined with potential awkward postures as a regular occurrence in daily work. The 22 major groups and their manual/non-manual designation are presented in Table 1.

(Table 1 about here)

Major SOC Group aggregation:

The SOC 2k groups all occupations into 22 major groups, Table 2 shows 22 of these groups (military occupations were excluded from this study, 2-digit SOC code 55). These groups were then aggregated into 5 general categories, Table 2.

(Table 2 about here)

Demographics

Age at time of survey was collected as a continuous variable measured in years. Education was categorized into 'less than high school education,' 'high school graduate,' 'some college,' and '4 or more years of college.' Income was categorized into 'less than $25,000,' '$25,000-$50,000' and 'more than $50,000' per year in household income. Family size was categorized 'less than 3 people,' '3 to 4 people' and '5 or more people.' Self-rated health was categorized as 'poor,' 'fair/good' and 'excellent.'

Marital status was categorized as 'married,' 'never married,' 'widowed/divorced' or 'unknown.' For race/ethnicity, we restrict our analytic sample to non-Hispanic black and non-Hispanic white.

*Linking occupational specific data from O*NET to NHIS*

The O*NET descriptors are categorized by occupation using the SOC 2000 coding scheme. NHIS uses census occupation codes. From 1986 through 1991, the NHIS used census 1980 codes and from 1991 through 1994 they used census 1990 codes. There is no one-to-one match from the census 1990 occupation codes to the SOC 2000 occupation codes. In order to link O*NET occupation descriptors to NHIS a three step recoding process of NHIS occupation codes was performed using existing methods.

1. Occupations prior to 1991 were re-coded using methods from the University of Miami Occupational Research Group (http://www.rsmas.miami.edu/groups/niehs/niosh/documentation/recode_stat.htm, accessed 1/28/2010).

2. Occupations in NHIS (now all coded using 1990 census occupations) were then matched to 2000 census occupations, using a crosswalk developed by the U.S. Census Bureau (Scopp, 2003). See table 1 for an example of the crosswalk.
3. NHIS occupation codes were then matched to SOC 2000 occupation codes using the O*NET database (version 14.0), and NHIS data were linked to O*NET occupation descriptors and used for analysis. Table 1 also contains the proportion of jobs (based on 1990 occupational distributions) that were coded into the census 2000 occupations for each 1990 occupation code. This proportion was used to weight the O*NET data for this analysis. For example for those in 1990 census occupation classification 004, 77% went to 2000 census occupation 001, so for those in our sample who were 004 in the 1990 census, their O*NET scores were weighted by 0.77, and for those who were 005 in the 1990 census, their O*NET scores were weighted by 0.15, see table 1 for these proportions. The entire crosswalk can be downloaded at http://www.census.gov/hhes/www/ioindex/pdfio/techpaper2000.pdf

Statistical Analysis

Descriptive statistics were compiled and stratified by gender. Spearman correlations were calculated for all potential covariates to identify the most explanatory set of variables to include in the models. Crude hazard ratios were then calculated for all covariates during the follow-up period, in quarters, as the dependent variable. As mentioned above, all models were stratified by gender and age and race were forced into all models. Survival analysis using the SAS PHREG procedure was used for Cox Proportional Hazards Models. All analyses were conducted using SAS version 9.1.

Results

Descriptive statistics, stratified by gender are provided in Table 3.

(Table 3 about here)

Due to the large size of our sample most differences between men and women for descriptive analyses are statistically significant. Of note, women were less likely (33.9% versus 54.0%) to work in manual jobs and were more likely (44.2% versus 28.3%) to work in Sales and Office Occupations. Women were also more likely to work in jobs with lower expectations of good working conditions. As expected there were a higher proportion of men than women (6.8% versus 4.1% deceased), and there was a higher proportion of men with college degrees than women (27.9% and 23.7%, respectively).

In multivariate survival analysis, stratified by gender, education, income, marital status and being non-Hispanic black, were all statistically significantly related to mortality for both men and women.

(Table 4 about here)

(Table 5 about here)

When the general occupational descriptor of manual versus non-manual job is included into the model, occupation adds a statistically significant although small risk for mortality, with men in manual jobs have a 3.5% increased risk of mortality and women in manual jobs a higher, 10% risk of mortality, than those in non-manual jobs. When manual/non-manual occupation is replaced by a more specific code, the high-level Standard Occupational Classification (SOC) codes, additional occupational related risk is seen for both men and women, with women in

Service Occupations having a 20% higher risk of mortality than women in Management, Professional and Related Occupations.

When specific job characteristics from the Occupational Descriptor dataset O*NET replaced the SOC codes in the models, for women, jobs that frequently require specialized personal protective equipment (PPE), were 26% more like to be deceased than women who never had to use special PPE. Specialized PPE was also a greater indicator of mortality for women than having a high school education or earning less than $25,000.

(Table 6 about here)

Although many of the occupational risk factors that were looked at in this study had small effects on mortality, the inclusion of occupational variables from either very general (manual jobs versus non-manual jobs), to very specific job characteristics (inclusion of O*NET data), occupation clearly affects mortality outcomes. In addition, the risk to non-Hispanic black men and women changes, depending on a) the inclusion of occupational variables, and b) the level of detail for different occupational variables, lending weight to the argument for including occupation in models for mortality outcomes.

Discussion

Our study shows the distinct contributions of education, income and occupation on the risk of mortality in a nationally representative sample of employed people in the United States. Occupational factors of low levels of what are considered good working conditions and the likelihood needing specialized PPE on the job, appear to increase the risk of mortality in this sample. Lower levels of education and income were also statistically significant, although these effects varied depending on whether or not occupation was included, and again depending on the

level of specificity for occupation. These results are similar to previous research [cite] although our hazard ratios were not as large as those of Steenland, Hu and Walker (2004).

O*NET is a relatively new tool for researchers who are interested in examining specific occupational exposures with outcomes such as morbidity and mortality, specifically in datasets where occupational risk factors are lacking. A recent analysis by Gardner, et al (2010), [add to references], specific upper extremity risk factors (pinch, grip, movement) from self-report and observed reports were compared to specific O*NET descriptors and were found to have moderate to good validity. Occupationally related job descriptors from the O*NET have not previously been used to explore job specific characteristics in relation to mortality risk, more research is needed using this method over longer time periods and testing additional O*NET descriptors.

Occupation is clearly worth studying in relation to mortality outcomes, specifically in the differences between non-Hispanic white and non-Hispanic black populations. If we are to reduce the disparity in mortality risk between these two populations, an understanding of and usage of relevant occupational exposures should be included in analyses.

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Table 1. 22 Major Occupational Groups from the 2000 Standard Occupational Classification system: Manual/non-Manual designation

2-digit SOC major group	Major Occupational Group (MOG)	Occupational category
11	Management Occupational	non-manual
13	Business and Financial Operations Occupations	non-manual
15	Computer and Mathematical Occupations	non-manual
17	Architecture and Engineering Occupations	non-manual
19	Life, Physical, and Social Science Occupations	non-manual
21	Community and Social Service Occupations	non-manual
23	Legal Occupations	non-manual
25	Education, Training, and Library Occupations	non-manual
27	Arts, Design, Entertainment, Sports, and Media Occupations	non-manual
29	Healthcare Practitioners and Technical Occupations	non-manual
31	Healthcare Support Occupations	manual
33	Protective Service Occupations	manual
35	Food Preparation and Service Related Occupations	manual
37	Building and Grounds Cleaning and Maintenance Occupations	manual
39	Personal Care and Service Occupations	manual
41	Sales and Related Occupations	non-manual
43	Office and Administrative Support Occupations	non-manual
45	Farming, Fishing, and Forestry Occupations	manual
47	Construction and Extraction Occupations	manual
49	Installation, Maintenance, and Repair Occupations	manual
51	Production Occupations	manual
53	Transportation and Material Moving Occupations	manual

Table 2. High-level Aggregation of Standard Occupational Categories (version 2000)

2-digit SOC major groups	High-level Aggregation
11-29-0000	Management, Professional, and Related Occupations
31-39-0000	Service Occupations
45-49-0000	Natural Resources, Construction, and Maintenance Occupations
51-53-0000	Production, Transportation, and Material Moving Occupations

Table 3. Descriptive Statistics of the Variables by Gender

Variables	Men n (%)	Women n (%)
Education		
Less than high school	23401 (13.2)	16196 (10.3)
High school	66747 (37.7)	66745 (42.4)
Some college	37274 (21.1)	37022 (23.5)
College degree	49378 (27.9)	37257 (23.7)
Non-Hispanic black	20107 (11.4)	25221 (16.0)
Self-rated health		
Poor	10243 (5.8)	10669 (6.8)
Fair/Good	37284 (21.1)	39311 (25.0)
Excellent	128872 (72.9)	106859 (67.9)
Family income		
Less than $25,000	39256 (22.2)	42734 (24.2)
Between $25,000 - 49,999	68766 (38.9)	57591 (32.6)
$50,000 or greater	45989 (26.0)	36497 (20.6)
Marital status		
Single	22207 (12.6)	18696 (11.9)
Divorced/widowed	13345 (7.5)	25872 (16.5)
Married	141248 (79.9)	112652 (71.6)
Occupational variables 1		
Manual jobs	95529 (54.0)	53422 (33.9)
Occupational variables 2		
Management, Professional, and Related Occupations	31162 (17.6)	34255 (21.8)
Service Occupations	11905 (6.7)	26243 (16.7)
Sales and Office Occupations	50109 (28.3)	69543 (44.2)
Natural Resources, Construction, and Maintenance Occupations	25771 (14.6)	3925 (2.5)
Production, Transportation, and Material Moving Occupations	55613 (31.5)	20484 (13.0)
O*NET Occupational characteristics		
How much decision making freedom, without supervision, does the job offer?		
A little	74622 (42.2)	52338 (33.3)
Some	35762 (20.2)	28306 (18.0)
Quite a bit	34662 (19.6)	29153 (18.5)
How automated is the job?		
Low	75253 (42.6)	52323 (33.3)
Med	32999 (18.7)	30163 (19.2)
High	36794 (20.8)	27311 (17.4)
How often are you required to wear personal protective equipment (PPE)?		
Never	73670 (41.7)	53496 (34.0)
Somewhat	29388 (16.6)	35027 (22.3)
Most likely	41988 (23.7)	21274 (13.5)
How often does this job require working in cramped work spaces that requires getting into awkward positions?		
Never	73464 (41.5)	52873 (33.6)
Somewhat	31596 (17.9)	31362 (19.9)
Most likely	39986 (22.6)	25562 (16.3)

How often does this job require exposure to hazardous conditions?		
Never	75157 (42.5	52277 (33.2)
Somewhat	29121 (16.5	37750 (24.0)
Most likely	40768 (23.1)	19770 (12.6)
How important is it to this job that the pace is determined by the speed of equipment or machinery? (This does not refer to keeping busy at all times on this job.)		
Little	74955 (42.4)	53073 (33.8)
Somewhat	27997 (15.8)	32054 (20.4)
Very	42094 (23.8)	24670 (15.7)
How much does this job require making repetitive motions?		
Little	75921 (42.9)	53136 (33.8)
Somewhat	28347 (16.0)	33567 (21.3)
Very	40778 (23.1)	23094 (14.7)
How often does this job require you to wear specialized PPE?		
Never	74522 (42.2)	53750 (34.2)
Somewhat	30836 (17.4)	32911 (20.9)
Most likely	39688 (22.4)	23136 (14.7)
Occupations that satisfy this work value offer supportive management that stands behind employees.		
Low	76229 (43.1)	54836 (34.9)
Med	26882 (15.2)	34363 (21.8)
High	43617 (24.7)	26409 (16.8)
Workers on this job have good working conditions.		
Low	37426 (21.2)	49471 (31.5)
Med	56733 (32.1)	45872 (29.2)
High	82641 (46.7)	61877 (39.4)
Performing physical activities that require considerable use of your arms and legs and moving your whole body, such as climbing, lifting, balancing, walking, stooping, and handling of materials.		
Low	74244 (41.9)	53992 (34.3)
Med	28161 (15.9)	31759 (20.2)
High	42641 (24.1)	24046 (15.3)
How much does this job require bending or twisting your body?		
Low	74722 (42.3)	53178 (33.8)
Med	30675 (17.3)	30423 (19.3)
High	39649 (22.4)	26196 (16.7)
How often does this job require the worker to meet strict deadlines?		
Low	64958 (36.7)	45697 (29.1)
Med	32471 (18.4)	31099 (19.8)
High	47617 (26.9)	33001 (20.9)

Table 4. Cox Models for Mortality Risk among Men (N=176,800)

Variable	Model 1			Model 2			Model 3		
	Estimate	HR	SE	Estimate	HR	SE	Estimate	HR	SE
Age, in years	0.084	1.087	0.000	0.084	1.087	0.000	0.084	1.088	0.000
Age*age	0.000	1.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000
Education (College)									
Less than high school	0.583	1.792	0.001	0.562	1.755	0.001	0.563	1.756	0.001
High school	0.381	1.463	0.001	0.365	1.440	0.001	0.363	1.438	0.001
Some college	0.339	1.403	0.001	0.330	1.390	0.001	0.325	1.385	0.001
Non-Hispanic black (Non-Hispanic white)	0.319	1.375	0.001	0.315	1.371	0.001	0.307	1.359	0.001
Family income ($50,000)									
Less than $25,000	0.290	1.336	0.001	0.285	1.330	0.001	0.284	1.329	0.001
$25,000-$49,999	0.075	1.077	0.000	0.072	1.075	0.000	0.072	1.074	0.000
Family size (No children)									
1-3 children	-0.013	0.987	0.000	-0.014	0.987	0.000	-0.014	0.986	0.000
More than 3 children	-0.001	0.999	0.001	-0.003	0.997	0.001	-0.002	0.998	0.001
Marital status (Married)									
Single	0.543	1.721	0.001	0.542	1.719	0.001	0.539	1.714	0.001
Divorced	0.277	1.320	0.001	0.277	1.319	0.001	0.273	1.313	0.001
Occupational group (Non-manual work)									
Manual work				0.033	1.034	0.000			
Standard Occupational Codes (SOC) High level groups									
Management, Professional, and Related Occupations (Ref.)									
Service Occupations							0.138	1.147	0.001
Sales and Office Occupations							0.020	1.020	0.001
Natural Resources, Construction, and Maintenance Occupations							-0.021	0.979	0.001
Production, Transportation, and Material Moving Occupations							0.062	1.064	0.001

Note: The categories in parentheses are reference categories.

Table 5. Cox Models for Mortality Risk among Women (N=157,220)

Variable	Model 1			Model 2			Model 3		
	Estimate	HR	SE	Estimate	HR	SE	Estimate	HR	SE
Age, in years	0.111	1.117	0.000	0.111	1.118	0.000	0.112	1.118	0.000
Age*age	0.000	1.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000
Education (College)									
Less than high school	0.507	1.661	0.001	0.455	1.576	0.001	0.419	1.520	0.001
High school	0.305	1.357	0.001	0.281	1.325	0.001	0.247	1.280	0.001
Some college	0.204	1.226	0.001	0.194	1.214	0.001	0.168	1.183	0.001
Non-Hispanic black	0.274	1.316	0.001	0.258	1.294	0.001	0.256	1.292	0.001
Family income ($50,000+)									
Less than $25,000	0.217	1.242	0.001	0.203	1.225	0.001	0.197	1.218	0.001
$25,000-$49,999	0.031	1.032	0.001	0.029	1.029	0.001	0.030	1.030	0.001
Family size (No children)									
1-3 children	-0.072	0.931	0.001	-0.074	0.928	0.001	-0.075	0.928	0.001
More than 3 children	0.026	1.027	0.001	0.020	1.021	0.001	0.019	1.019	0.001
Marital status (Married)									
Single	0.249	1.283	0.001	0.250	1.283	0.001	0.252	1.286	0.001
Divorced	0.197	1.218	0.001	0.198	1.219	0.001	0.200	1.222	0.001
Occupational group (Non-manual work)									
Manual work				0.096	1.101	0.001			
Standard Occupational Codes (SOC) High level groups									
Management, Professional, and Related Occupations (Ref.)									
Service Occupations							0.180	1.197	0.001
Sales and Office Occupations							0.080	1.083	0.001
Natural Resources, Construction, and Maintenance Occupations							0.263	1.300	0.002
Production, Transportation, and Material Moving Occupations							0.140	1.150	0.001

Note: The categories in parentheses are reference categories.

Table 6. Cox Models for Mortality Risk with Job Characteristics

Variables	Men (n=176,800)				Women (n=157,220)			
	Estimate	SE	HR	95% CI	Estimate	SE	HR	95% CI
Age (in years)	0.085	0.000	1.09	(1.088, 1.089)	0.113	0.000	1.12	(1.119, 1.12)
Age*age	0.000	0.000	1.00	(1.00, 1.00)	0.000	0.000	1.00	(1.00, 1.00)
Education								
Less than high school	0.536	0.001	1.71	(1.706, 1.711)	0.425	0.001	1.53	(1.526, 1.532)
High school	0.345	0.001	1.41	(1.411, 1.414)	0.249	0.001	1.28	(1.281, 1.285)
Some college	0.321	0.001	1.38	(1.376, 1.38)	0.172	0.001	1.19	(1.185, 1.19)
Non-Hispanic Black	0.300	0.001	1.35	(1.349, 1.352)	0.265	0.001	1.30	(1.302, 1.305)
Family income								
Less than $25,000	0.268	0.001	1.31	(1.307, 1.309)	0.198	0.001	1.22	(1.217, 1.221)
Between $25,000 - $49,999	0.067	0.000	1.07	(1.069, 1.071)	0.028	0.001	1.03	(1.027, 1.03)
$50,000 +			1.00				1.00	
Family size								
No children			1.00				1.00	
1 to 3 children	-0.017	0.000	0.98	(0.983, 0.984)	-0.079	0.001	0.92	(0.923, 0.926)
More than 3 children	-0.006	0.001	0.99	(0.992, 0.995)	0.015	0.001	1.02	(1.014, 1.018)
Marital status								
Married								
Single	0.527	0.001	1.70	(1.692, 1.697)	0.248	0.001	1.28	(1.278, 1.284)
Divorced/widowed	0.272	0.001	1.31	(1.311, 1.314)	0.198	0.001	1.22	(1.217, 1.22)
<u>O*NET job characteristics</u>								
Freedom to make own decisions								
A little	0.050	0.002	1.05	(1.047, 1.055)	-0.087	0.002	0.92	(0.912, 0.92)
Some	0.003	0.001	1.00	(1.001, 1.004)	-0.054	0.002	0.95	(0.944, 0.95)
Quite a bit			1.00				1.00	
How often does this job require you to wear specialized PPE?								
Never			1.00				1.00	
Somewhat	0.191	0.002	1.21	(1.205, 1.216)	0.179	0.002	1.20	(1.191, 1.201)
Most likely	0.167	0.003	1.18	(1.176, 1.187)	0.229	0.003	1.26	(1.252, 1.264)
Occupations that satisfy this work value offer supportive management that stands behind employees.								
Low	-0.063	0.002	0.94	(0.936, 0.943)	0.138	0.002	1.15	(1.143, 1.152)
Med	-0.055	0.002	0.95	(0.945, 0.949)	0.072	0.001	1.08	(1.073, 1.077)
High								
Workers on this job have good working conditions.								
Low	0.148	0.001	1.16	(1.158, 1.161)	0.143	0.001	1.15	(1.152, 1.155)
Med	0.079	0.001	1.08	(1.082, 1.084)	0.036	0.001	1.04	(1.035, 1.039)
High			1.00				1.00	

How much does this job require bending or twisting your body?								
Low			1.00				1.00	
Med	-0.224	0.002	0.80	(0.796, 0.803)	0.011	0.003	1.01	(1.006, 1.017)
High	-0.324	0.003	0.72	(0.72, 0.727)	0.029	0.003	1.03	(1.023, 1.036)
How often does this job require the worker to meet strict deadlines?								
Low			1.00				1.00	
Med	0.034	0.001	1.04	(1.033, 1.037)	-0.121	0.002	0.89	(0.883, 0.888)
High	0.147	0.002	1.16	(1.154, 1.162)	-0.186	0.002	0.83	(0.827, 0.835)

Note: All of the coefficients are significant at p<.001.