Published in final edited form as:
Res Aging. 2008 November 1; 30(6): 672–700. doi:10.1177/0164027508322639.

Changes in Health between Ages 54 and 65: The Role of Job Characteristics and Socioeconomic Status*

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Abstract

We model the relationships between socioeconomic status (SES), the conditions of paid employment, and changes between ages 54 and 65 in a variety of health outcomes: self-reported overall health, musculoskeletal health, and depression. To what extent is SES associated with changes in these health outcomes net of the conditions of paid employment? At the same time, to what extent are the conditions of paid employment independently associated with these outcomes net of SES? To address these questions we use unique data collected from a single cohort of men and women to model changes in these health outcomes between ages 54 and 65. Although results vary across outcomes, it is clear that there are some circumstances in which associations between SES and changes in health can be (at least partly) attributed to working conditions, and that there are other circumstances in which associations between working conditions and changes in health can be (at least partly) attributed to SES. We conclude that the largely disconnected literatures on health disparities (in the social sciences and public health) and job design (in occupational stress and ergonomics) could and should be fruitfully connected.

Inverse relationships between socioeconomic status (SES) and health outcomes are well documented (e.g., Alder & Ostrove, 1999; House, 2002; Marmot, Ryff., Bumpass, Shipley, & Marks, 1997; Wilson, 2001). Evidence from a variety of academic—but generally social scientific or social epidemiological—disciplines makes clear that the incidence and prevalence of disease and health problems are higher for people with fewer socioeconomic resources. Below, we more carefully review evidence about the associations between socioeconomic status and self-reported overall health, musculoskeletal health, and depression. Debates about the nature of SES-health associations are complex. One issue concerns the direction of causality in those associations—that is, whether SES affects health, whether health affects SES through "indirect selection," or whether SES and health affect one another dynamically across the life course (Chandola, Bartley, Sacker, Jenkinson, & Marmot, 2002; Power, Matthews, & Manor, 1996). A second major issue concerns whether SES affects health solely through more proximal mechanisms that have yet to be completely elucidated or whether SES represents a "fundamental cause" (Link & Phelan, 1995; Lutfey & Freese, 2005) of health outcomes that cannot be reduce to a determinate set of more proximal mechanisms.

At the same time—and largely in a separate set of literatures—it is equally well-documented that various conditions of paid employment influence workers' health and well-being (e.g., Borg & Kristensen, 2000; Carayon & Smith, 2000; Jensen, Ryholt, Burr, WVilladsen, &

*Paper prepared for presentation at the 2005 meetings of the Gerontological Society of America.

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Chistensen, 2002; Michie & Williams, 2003; Smith & Carayon-Sainfort, 1989). To briefly summarize three broad research areas, the most health-relevant aspects of paid employment according to the job design, occupational stress and ergonomics literatures are: Psychosocial job characteristics: job content (e.g., variety, challenge), job control, job demands (e.g., workload volume, cognitive demands), job security, and the social and organizational aspects of work (e.g., social support); and Physical job characteristics: physical workload, ergonomics, and safety. Below, we more carefully review evidence about the associations between job characteristics and self-reported overall health, musculoskeletal health, and depression.

Although it is quite possible that both SES and the conditions of paid employment are independently and significantly associated with a variety of health outcomes, it is equally possible that one serves—in part or in full—as a proxy for the other. Individuals' educational attainment (to choose one measure of SES) and their conditions of paid employment are closely related to one another. For example, using data from 621 respondents to the Survey of Job Characteristic, Jencks, Perman, and Rainwater (1988) found that better educated respondents were less likely to get dirty at work and had less repetitive jobs. In the Wisconsin Longitudinal Study (WLS) sample of high school graduates, we find (in analyses not shown) that each additional year of respondents' education is associated (at the bivariate level) with a 26% decrease in the chances that their jobs at age 54 always or frequently involved physical effort; a 20% reduction in their chances of ever getting dirty on the job; and a 5% reduction in the chances that their jobs always required intense concentration or attention. This evidence is consistent with results from parallel analyses using data from the nationally-representative General Social Survey (GSS). In the GSS, we find (in analyses not shown) that individuals with exactly 12 years of schooling—as compared to those with more than 12 years of schooling—are more than twice as likely to say that their jobs always or often involved “hard physical work” and are 75% more likely to say that they were always or often exposed to “dangerous conditions” at work. All of this evidence pertains to relationships between education and the conditions of paid employment, but similar evidence exists for relationships involving income, occupational status, or other indicators of socioeconomic standing.

Because individuals' SES is associated with the physical and psychosocial conditions of their paid employment, it seems important to us to bring together the largely disparate literatures on the roles of SES and job conditions in determining health outcomes. It has been difficult for social scientists or social epidemiologists to explain socioeconomic disparities in health. Perhaps working conditions account for an important part of the association between SES and a variety of health outcomes? At the same time, perhaps the strong associations between working conditions and a variety of health outcomes noted by researchers in the job design, occupational stress and ergonomics fields can be (at least partly) attributed to socioeconomic factors?

Our goal in this paper is to understand the independent relationships between SES, the conditions of paid employment, changes with age in a variety of health outcomes: self-reported overall health, musculoskeletal health, and depression. To what extent is SES associated with changes in these health outcomes net of the conditions of paid employment? At the same time, to what extent are the conditions of paid employment associated with these outcomes net of SES? To address these questions we use unique data collected from a single cohort of men and women to model changes in these health outcomes between ages 54 and 65 as a function of SES, working conditions, and a series of control variables. We intend for our results to inform and supplement research that seeks to identify the mechanisms that link SES and health as well as the literatures that investigate the independent impact of working conditions on health. To date these two broad research areas have paid too little attention to the others' potential contributions.

Socioeconomic Status, Job Characteristics, and Self-Reported Overall Health

General (or overall) health is frequently measured using survey questions that ask something like, “Would you say your health is excellent, very good, good, fair, or poor?” Entirely subjective, self-assessed measures like these are highly correlated with a variety of more objective, concrete measures of morbidity and mortality (Idler & Benyamini, 1997; Marmot, Ryff., Bumpass et al., 1997; Mossey & Shapiro, 1982; Wilson, 2001).

Such measures are also associated with both SES and the conditions of paid employment. For example, Marmot et al. (1997) found that people with less than a high school degree were four or five times as likely as people with a four year college degree to say that their health was less than good; Miech and Hauser (2001) came to similar conclusions using the WLS data. At the same time, a number of studies have demonstrated relationships between job characteristics and subjective measures of general or overall health (e.g., Martikainen, Stansfeld, Hemingway, & Marmot, 1999). For example, Borg and colleagues (Borg & Kristensen, 2000; Lund & Borg, 1999) interviewed 5,001 Danish employees in 1990 and 1995, focusing on the impact of both psychosocial and physical job characteristics on self-rated health. They hypothesized that job characteristics measured in 1990 would predict changes in self-rated health over the 5-year period. In fact, repetitive work, high job demands, low social support, high job insecurity and high ergonomic exposures were all found to predict worsening of self-rated health over time. Although limited by the cross-sectional nature of their research designs, recent research using the WLS suggests that a substantial share of the association between socioeconomic status and health can be attributed to the conditions of paid employment (Brand, Warren, Hoonakker, & Carayon, 2007; Warren, Hoonakker, Carayon, & Brand, 2004). We intend to improve on this recent work by utilizing a longitudinal research design and by modeling changes over time in health, but we also hope to understand the extent to which associations between job conditions and self-reported overall health can be explained by SES.

Socioeconomic Status, Job Characteristics, and Musculoskeletal Health

The incidence and severity of musculoskeletal diseases are also stratified by SES (Brekke, Hjortdahl, & Kvien, 2002). Dionne et al. (2001), for example, reviewed sixty-four articles published between 1966 and 2000 and concluded that there is good evidence that well educated people are less likely to be affected by back pain. They noted that differences in occupational factors may be one mechanism responsible for this association. Vahatera et al. (1999) asked whether workplace factors play a role in generating socioeconomic gradients in sickness absence from work due to musculoskeletal disorders, and concluded that—particularly for men—workplace factors do partly account for socioeconomic gradients in health. In general, the extent to which associations between SES and musculoskeletal health can be attributed to differences in the conditions of paid employment remains unclear.

Musculoskeletal disorders are certainly more common in physically demanding jobs, but they are also more common in jobs with negative psychosocial characteristics such as high workload, work pressure, job future ambiguity, low job control, and low supervisory support (Carayon, Smith, & Haims, 1999; Cooper & Cox, 1985; Cooper & Marshall, 1976; Linton, 2000; Power, Frank, Hertzman, Schierhout, & Li, 2001; Smith, 1987). For example, Jensen et al. (2002) evaluated the associations between computer users' physical and psychosocial job characteristics and musculoskeletal symptoms in the neck, shoulder, and hand/wrist regions. They concluded that long hours of computer use may be associated with musculoskeletal symptoms because of physical factors such as repetitive movements, but they also concluded that psychosocial factors affect these symptoms independently of the duration of computer use. One theoretical model stipulates that psychosocial work factors (e.g., work pressure and lack of control)—which can cause stress—may also influence or be related to ergonomic factors, such as force, repetition, and posture, that have traditionally been identified as risk factors for

musculoskeletal disorders (Armstrong, Buckle, Fine, Hagberg, Jonsson, Kilbom et al., 1993; Hagberg, Morgenstern, & Kelsh, 1992; Putz-Anderson, 1988). However, it remains unclear how socioeconomic factors play into these relationships between working conditions and musculoskeletal health outcomes.

Socioeconomic Status, Job Characteristics, and Depression

Researchers have known for quite some time that there is a strong association between SES and depression, especially among women (Dohrenwend, Levav, Shrout, Schwartz, Naveh, Link et al., 1992; Goodman, 1999; Jarvis, 1855; Marmot, Shipley, Brunner, & Hemingway, 2001; Marmot, Ryff., Bumpass et al., 1997; Miech, Caspi, Moffitt, Wright, & Silva, 1999). For example, despite debate about the direction of causality in this relationship (Bruce, Takeuchi, & Leaf, 1991; Miech, Caspi, Moffitt et al., 1999; Wheaton, 1978), there is growing consensus that education does influence depression (Dohrenwend, Levav, Shrout et al., 1992) and there is increasing interest in assessing the mechanisms that link education and depression.

Prior research has demonstrated that job characteristics—particularly psychosocial job characteristics—impact psychological distress and depression (Michie & Williams, 2003; Niedhammer, Goldberg, Leclerc, Bugel, & David, 1998). For example, Link et al. (1993) found that individuals in occupations that involved “direction, control, and planning” were less likely to experience depression. Likewise, Niedhammer et al. (1998) found that psychosocial factors at work (including psychological demands, low levels of decision latitude and low levels of support at work) were significant predictors of subsequent depressive symptoms (as measured by the CES-D) in both men and women; interestingly, their results suggested that the precursors to depression varied significantly by gender.

To what extent can associations between SES and depression be accounted for by considering the conditions of paid employment? Link et al. (1993) considered characteristics of occupations —specifically, the extent to which they involve direction, control, and planning (DCP)—as mediators in the education-depression relationship, and concluded that DCP partially explains this association. Using data from Whitehall II, Marmot et al. (1997) incorporated Karasek's Job Strain model (Karasek, 1979) and measures of social support and perceived control in the workplace. They concluded that job control in the workplace—as measured by control over work, variety and use of skills, support at work, work pace, and job satisfaction—entirely accounts for the “social gradient” in rates of depression. However, we wonder whether these findings can be generalized beyond the sample of middle-aged, mostly male, London-based civil servants studied by Marmot et al. (1997; 1997). We believe that further investigation is necessary before strong conclusions can be made about the role of job control or other job attributes in the relationship between SES and depression.

SES and job characteristics are each associated with a variety of health outcomes. With a few exceptions noted above, the literature on the association between SES and health has ignored the potential mediating role of the conditions of paid employment. At the same time, the literatures on the connections between the conditions of paid employment and a variety of health outcomes have been relatively insensitive to the possibility that what they call “effects” of job characteristics may in fact be spurious owing to unmeasured (or at least poorly measured) socioeconomic factors. Our empirical goal is to understand the independent impacts of SES and the conditions of paid employment for changes between ages 54 and 65 in a variety of health outcomes. We hope that our results will advance research that seeks to identify the mechanisms that link SES and health as well as research that seeks to spell out the independent consequences of working conditions on health.

With these goals in mind, we contextualize our research within at least three interrelated theoretical issues. The first concerns theoretical debates about causal ordering. As described above there has been a great deal of debate the direction of causality in relationships between SES and health. Likewise, there is evidence that health may influence employment behaviors and job conditions at the same time that those behaviors and conditions influence health. Our work does not directly speak to these debates, but our analyses are certainly shaped by them. As described below, our empirical analyses consider changes between two points in time in health outcomes among people who differ at the initial time point with respect to SES and working conditions. We are thus prioritizing a perspective that views health as causally dependent on both SES and working conditions. However, although it is not formally included in our models, we recognize that individuals' SES and working conditions at the initial point in time are the result of dynamic interrelationships among SES, health, and working conditions across the life course.

A second theoretical backdrop to our analyses concerns whether SES affects health solely through more proximal (although not completely understood) mechanisms or whether SES represents a “fundamental cause” (Link & Phelan, 1995; Lutfey & Freese, 2005) of health outcomes that cannot easily be reduce to more proximal mechanisms. Our analyses—which in part focus on working conditions as a mediator in SES-health relationships—would seem to be more sympathetic with the former theoretical perspective. However, we are actually quite agnostic on this point. The theory of “fundamental cause” recognizes that there are proximal mechanisms (like working conditions) that mediate in SES-health relationships; the crux of “fundamental cause” theory concerns the social and economic processes that determine which proximal mechanisms will be most important at particular historical points in time and for which health outcomes. We fully recognize that our findings may be period (and indeed cohort) specific; as we argue below, however, the cohort that we study is an important one.

Finally, we place our research within the context of important gender differences in all of the important variables under consideration. First, as described below, men and women experience very different rates of some health outcomes. Second, women and men are very different in terms of their levels of SES on some measures (like occupational socioeconomic standing and earnings) and more similar on other measures (like educational attainment, at least in more recent cohorts). Given gender differences in patterns of labor force participation and the historically patriarchal nature of American society, the meaning of particular measures of SES differ between men and women. Third, we should not assume that the meaning of particular measures of working conditions—like job stress or levels of workplace pressures—is consistent for women and men. In the end we carry out gender-specific analyses because of marginal differences between men and women with respect to measures of SES, working condition, and health and because of gender differences in the very meaning of those measures.

MATERIALS AND METHODS

The WLS is a long-term study of a random sample of 10,317 men and women who graduated from Wisconsin high schools in 1957. Most respondents were born in 1939, and thus slightly pre-date the baby boom generation. The WLS provides an opportunity to study the life course, intergenerational transfers and relationships, family functioning, physical and mental health and well-being, and morbidity and mortality from late adolescence through late adulthood. WLS data also cover social background, youthful aspirations, schooling, military service, labor market experiences, family characteristics and events, social participation, psychological characteristics, and retirement. Survey data were collected from the original respondents or their parents by mail and/or telephone in 1957, 1964, 1975, 1993, and 2004; from a selected sibling in 1977, 1994, and 2005; from the spouse of the original respondent in 2005; from the

spouse of the selected sibling in 2005; and from widow(er)s of the graduates and siblings in 2005.

The WLS has unique strengths for our purposes, including the combination of an unusually wide array of measures of health, SES, and job characteristics for a large sample that is broadly representative of non-Hispanic white high school graduates and that has been followed for half a century with high rates of sample retention. Despite these unique strengths, the WLS data also have obvious limitations. Some strata of American society are not represented. Everyone in the primary sample graduated from high school, whereas Sewell and Hauser (1975) estimated that about 75% of Wisconsin youth graduated from high schools in the late 1950s. It is clearly a limitation that we do not observe members of this cohort who did not graduate from high school, particularly because they are likely to experience the least desirable health outcomes. What is more, there is only a handful of African American, Hispanic, or Asian persons in the WLS. Given the minuscule share of minorities in Wisconsin when the WLS began in 1957, there is no way to remedy this omission. About 19% of the WLS sample is of farm origin; this is consistent with national estimates in cohorts of the late 1930s. Finally, in each post-1957 survey wave about 70% of the sample has lived in Wisconsin

These limitations aside, research on the WLS cohort is important because of the cohort's unique historical place in time. WLS graduates—mostly born around 1939—have lived their lives in a period of unprecedented changes in family and labor market institutions. They were among the first cohorts to experience higher rates of marital dissolution, higher levels of labor force participation among women, and the impact of the shift from a manufacturing economy (and the frequent expectation of stable, career-long employment) to a service economy (characterized by new employment relationships). Compared to the cohorts that preceded them WLS graduates' life course experiences are quite heterogeneous. As such, analyses of data from the WLS graduate cohort can provide important insights into the factors that contribute to stratification in the health of more recent cohorts of older adults (including those of the baby-boom cohorts).

Our analyses utilize data from four surveys of the main sample of WLS graduate respondents: the 1993 telephone survey, the 1993 mail survey, the 2004 telephone survey, and the 2004 mail survey. We begin by restricting our analytic sample to the 6,875 individuals who responded to both the telephone and mail surveys in 1993. We then restrict this sample of 6,875 to the 5,939 individuals who either (1) died after they completed the 1993 surveys or (2) completed both the telephone and mail surveys in 2004. Next, we omit 10 anomalous cases from this sample of 5,939 in which the respondent was not born between 1937 and 1940. Finally, we omit the 1,434 respondents who were selected at random to not receive the telephone survey items on working conditions in 2004. This leaves 4,495 respondents—2,400 female, 2,095 male—in our analysis sample.

Table 1 presents descriptive statistics for each of our outcome measures; results are presented by gender and—where appropriate—for 1993 and 2004. First, 7.4% of women and 11.2% of men in the WLS sample died after completing the 1993 surveys. This is not a trivial fraction of respondents, so (as described below) our multivariate models account for the potential selectivity of the sample of 2004 survey respondents induced by respondent mortality.

In both 1993 and 2004 we measured respondents' self-reported overall health using a survey item that asked: “How would you rate your health at the present time?” Response options included “very poor,” “poor,” “fair,” “good,” and “excellent.” Given the distribution of these measures in both 1993 and 2004—about one in four respondents reported being in “excellent” health—we dichotomize the self-reported overall health measures such that 1 represents “excellent” health and 0 represents all other responses.

In the 1993 and 2004 WLS mail surveys, respondents were presented with a list of health symptoms and were then asked three questions about each symptom. First, they were asked, "In the past six months have you [experienced symptom]?" Respondents who answered affirmatively were then asked, "How often have you [experienced symptom]?" and "How much discomfort has [symptom] caused you in the past six months?" Next, respondents were presented with a list of medical conditions and were then asked to respond to the statement, "A medical professional says you have [medical condition]." This time, respondents who responded affirmatively were asked, "How much does your [medical condition] currently interfere with what you like to do?" To measure musculoskeletal health in 1993 and 2004 we use items that refer to the health symptoms "had aching muscles," "had stiff/swollen joints," and "had back pain or strain" and the medical condition "serious back trouble." We combine these four items in 1993 into a scale (with α=0.67). Likewise, we combine these four items in 2004 into a scale (with α=0.72). These α values are perhaps lower than we might hope for. We could certainly increase the value for the 2004 index by adding additional items, but to do so would introduce non-comparability between the 1993 and 2004 items. The musculoskeletal health measures for both 1993 and 2004 are arbitrarily scaled to range from 0 to 10, where 0 indicates that respondents experienced none of these four musculoskeletal health problems and 10 indicates that they experienced all three health symptoms daily, that all three health symptoms caused "a lot" of discomfort, and that they have been medically diagnosed with serious back trouble that interferes "a great deal" with what respondents like to do. As shown in Table 1, both men and women experienced slightly more musculoskeletal health problems in 2004 (at age 65) than they did in 1993 (at age 54).

In the 1993 and 2004 WLS mail survey, respondents were presented with 20 items that make up the CES-D depression scale. These include such items as, "On how many days during the past week did you feel you could not shake off the blues even with help from your family and friends?" As depicted in Table 1, the mean and variability of these scale scores (which are the metric of days) declined modestly for both men and women between 1993 and 2004.

Table 2 reports descriptive statistics for measures of health risk factors in 1993, childhood health (as measured retrospectively in 2004), socioeconomic status in 1993, and job characteristics in 1993 and 2004. Our measures of health risk factors include an indicator of whether respondents were covered by employer-provided health insurance in 1993 (from their own or their spouse's employer), whether respondents were regular smokers in 1993, how many alcoholic drinks per day respondents reported consuming in 1993, how many times per months respondents exercised vigorously in 1993, and respondents body mass index in 1993.

In 2004 respondents were asked a series of retrospective questions about their health when they were growing up (through age 16). First, they were asked, "Was your health as a child excellent, very good, good, fair, or poor?" Next, respondents were asked to indicate whether they had any of the following illnesses or treatments as a child or young adult: Asthma, frequent ear infections, removal of tonsils and/or adenoids, chronic bronchitis, whooping cough, polio, diphtheria, hepatitis, pneumonia, meningitis, and infectious mononucleosis. For our purposes, we construct a scale that indicates how many of these illnesses/treatments respondents had; as shown in Table 2, the typical respondent had about one of these illnesses or treatments. Finally, respondents were asked questions about whether health conditions up through age 16 caused them to miss school for a month or more, confined them to home or bed for a month or more, or limited their sports or physical activities for three months or more. Table 2 reports that about 12 percent of respondents were limited in at least one of these ways up through age 16.

We use three measures of socioeconomic status in 1993, when most respondents were 54. First, we operationalize education in terms of two dummy variables indicating whether respondents completed (1) between one and three years of college or (2) completed four or more years of

college; recall that all sample members completed high school. Second, we express respondents' 1993 earnings in terms of the log of the base hourly wage rate of their 1993 job (or the job they held most recently prior to 1993). For respondents who were not paid by the hour, base hourly wage rates have been computed based on information about salary, hours worked per week, weeks worked per year, and so forth. Third, we express the socioeconomic standing of respondents' current or most recent occupations in 1993 in the metric of Hauser and Warren's (1997) measure of occupational education. This measure—which is quite highly correlated with more traditional measures of occupational standing like occupational prestige or Duncan-style Socioeconomic Indexes—expresses the proportion of people in each occupation who have completed at least some college. Occupational education is a measure of the characteristics of occupations—specifically, how well-educated occupational incumbents tend to be—and is not a measure of respondents' own levels of education.

Factor analyses of measures of respondents' job characteristics in 1993 and separately in 2004 led us to construct four distinct indexes of job characteristics in each year: physical job characteristics, ergonomic job characteristics, job control, and job pressures. In 1993 all measures pertain to respondents' current or most recent jobs. In 2004 all measures pertain to never-retired respondents' current or most recent jobs; for ever-retired respondent, the 2004 measures pertain to the job respondents held before they retired for the first time.

Our measures of the physical characteristics of respondents' jobs are derived from a series of three items asked in the 1993 and 2004 telephone surveys. Respondents were asked how frequently their jobs require lots of physical effort, how frequently they get dirty on their jobs, and whether they are exposed to any dangerous conditions on their jobs. The physical job characteristics indexes had α reliability coefficients of 0.66 in both 1993 and 2004, and were rescaled to equal 0 for jobs that are not at all physically demanding and 10 for jobs that are maximally physically demanding.

Our measures of the ergonomic characteristics of respondents' jobs are derived from two 1993 and 2004 telephone survey items that asked how many hours per week they spend dealing with their hands, tools, or equipment and how many hours per week they spend doing the same things over and over. The ergonomic job characteristics indexes had α reliability coefficients of 0.63 and 0.76 in 1993 and 2004, respectively, and were also rescaled to equal 0 for jobs that are not at all ergonomically demanding and 10 for jobs that are maximally demanding.

Our measures of the psychosocial characteristics of respondents' jobs in 1993 and 2004 consist of two groups of items. First, we constructed “job control” indexes for each year on the basis of responses to questions about whether respondents supervise other people on their jobs, whether they themselves are supervised, and whether they can decide when to come to work and when to leave. The “job control” indexes had α reliability coefficients of 0.48 and 0.38 in 1993 and 2004, respectively, and were rescaled to equal 0 for jobs in which respondents have a great deal of control and 10 for jobs in which they have no such control. Second, we constructed “job pressures” indexes on the basis of responses to questions about whether respondents' jobs require intense concentration or attention and how frequently respondents work under the pressure of time. The “job pressures” indexes had α reliability coefficients of 0.49 and 0.54 in 1993 and 2004, respectively, and were rescaled to equal 0 for jobs that involve no such pressures and 10 for jobs that involve a great deal of pressure.

There is typically very little missing data on the variables employed in our analyses. In general we are missing only 1 or 2 percent of the cases for particular variables (except that data are always missing for 2004 measures when respondents died after 1993). Although we do not believe it appropriate to simply exclude the small percentage of cases with any missing data in our multivariate analyses, we also do not believe it worth the effort to perform exceptionally

sophisticated missing data imputation routines. Instead, we have used STATA's “impute” procedure, which replaces missing values on a variable on the basis of a regression of that variable on all other variables in the analysis. We have performed these imputations for each of the variables in Table 2 and on the 1993 measures of health described in Table 1. In the end our multivariate models are performed using the cases that have no missing data on the 2004 measures of health; because we model each health outcome separately, the sample size varies slightly across health outcomes (from a low of 4,000 cases in models for depression to a high of 4,058 in models for self-reported overall health).

Analysis Strategy

For each health outcome—self-reported overall health, musculoskeletal health, and depression—we estimate a series of four models. Because of evidence that the relationships between job characteristics, socioeconomic status, and health differ for women and men in the WLS (Brand, Warren, Hoonakker et al., 2007; Warren, Hoonakker, Carayon et al., 2004), all models are estimates separately by gender. The first model expresses the 2004 health measure as a function of its parallel health measure in 1993, of the series of 1993 health risk factors, and of indicators of childhood health. The second model adds the covariates expressing respondents' socioeconomic circumstances in 1993. This model reflects the independent association between socioeconomic status in 1993 and changes in health net of health risk factors and childhood health. By comparing the second model to the baseline model we can make inferences about whether SES adds to our ability to predict changes in health between ages 1993 and 2004. The third model begins with the baseline model and adds covariates for respondents' job characteristics in 1993 and for changes in those job characteristics between 1993 and 2004. This model reflects the independent association between job characteristics and changes in health net of health risk factors and childhood health. By comparing the third model to the baseline model we can make inferences about whether job characteristics add to our ability to predict changes in health between ages 1993 and 2004. Finally, the fourth model begins with the baseline model and adds each of the socioeconomic and job characteristic covariates. By comparing this fourth model to the second model we can infer whether job characteristics add to the predictive power of the model that only includes SES. Likewise, by comparing this fourth model to the third model we can infer whether SES adds to the predictive power of the model that only includes job characteristics. It is these model comparisons that will form the basis of our most important substantive conclusions. Are the physical and psychosocial conditions of paid employment independently associated with changes in health net of SES? Is SES independently associated with changes in health net of the physical and psychosocial conditions of paid employment?

Our models of self-reported overall health (again, expressed as a dichotomous variable) consist of a series of logistic regression models, whereas our models of musculoskeletal health and depression consist of a series of OLS regression models. For the logistic regressions, model comparisons are performed using likelihood ratio χ^2 tests. For the OLS models, these comparisons are performed using *F* tests.

Because it is likely that respondents who died between 1993 and 2004 were not a random cross-section of all WLS respondents, models of changes in health that ignore selective mortality may produce biased parameter estimates. If, for example, those who died tended to have low socioeconomic statuses and highly demanding job conditions in 1993, then our models would likely misstate the relationships between SES, job characteristics, and changes in health. Consequently, our models of changes in self-reported overall health, musculoskeletal health, and depression utilize procedures developed by Heckman (1979). Heckman's two-stage selection model begins by modeling mortality as a function of a set of covariates, some of which do not appear in the model for changes in health. In our case, we modeled mortality as

a function of respondents' self-reported overall health in 1993, musculoskeletal health in 1993, depression in 1993, educational attainment, and measures of respondents' mothers' and fathers' health at the time of the respondents' 1993 survey. In particular, the parental health measures indicate whether each parent was (1) in excellent or good health in 1993; (2) in fair, poor, or very poor health in 1993; or (3) deceased in 1993. The idea is that parental longevity will be related to respondent mortality, but will not necessarily be related to changes in respondents' health. After estimating this selection equation, we compute the Inverse Mills Ratio for each case. Then, in each of the models for changes in self-reported overall health, musculoskeletal health, and depression we include the Inverse Mills Ratio as an additional covariate that attempts to account for the sample selectivity induced by non-random patterns of mortality.

RESULTS

Table 3 presents results for models of self-reported overall health. For both women and men, Model 1 indicates that self-reported overall health in 2004 is significantly and positively associated with self-reported overall health in 1993; results (not shown) also indicate that changes in self-reported overall health are significantly associated with a variety of measures of health risk factors and with childhood health. Model 2 adds measures of respondents' SES to the baseline model. For both men and women, elements of SES are independently associated with changes in self-reported overall health net of health risk factors and childhood health; this is indicated both by the statistical significance of individual regression coefficients and by the likelihood ratio χ^2 tests that indicate that the set of SES measures adds to the predictive power of the baseline model. Model 3 adds measures of job characteristics to the baseline model. Again, and for both men and women, job characteristics are independently associated with changes in self-reported overall health net of health risk factors and childhood health. Women with greater job control and more job pressures in 1993 tend to have experienced improved overall health, while men with greater ergonomic demands in 1993 experienced declining overall health.

As reviewed above, SES and the attributes of jobs are associated with one another. Could the apparent effects of SES in Model 2 simply be explained by the fact that people with higher socioeconomic standing also tend to have more favorable job conditions, such that job conditions are the primary causal actor? Conversely, could the apparent effects of job conditions in Model 3 simply be explained by the fact that people with more favorable job characteristics also tend to enjoy greater socioeconomic standing, such that socioeconomic status is the primary causal actor? Model 4 in Table 3 adds covariates for both SES and job characteristics to the baseline model. Here, the χ^2 tests comparing the full model to Model 2 (which included covariates for SES but not for job characteristics) indicate that Model 4 fits no better than Model 2 for men. Among women, greater job control in 1993 is associated with improvements in overall health even net of SES and other covariates. The full model fits better than Model 3 (which included covariates for job characteristics but not for socioeconomic status) for both women and men. That is, SES is independently associated with changes in overall health net of job characteristics and the other covariates in the model.

Taken together, Table 3 shows that job characteristics are associated with changes in women's (but not men's) self-assessed overall health net of SES. For both women and men, SES is independently associated with changes in self-rated overall health net of job characteristics.

Results for models of changes in musculoskeletal health appear in Table 4. As expected, musculoskeletal health in 2004 is closely related to musculoskeletal health in 1993 and (in results not shown) to health risk factors and childhood health. However, SES is not independently associated with changes in musculoskeletal health for either women or men. What is more, the χ^2 test comparing Model 2 to Model 1 suggests that the model that includes

the series of socioeconomic covariates does not improve the predictive power of the model relative to the baseline model. In contrast, for both men and women Table 4 suggests that job characteristics are associated with changes in musculoskeletal health even net of health risk factors and childhood health; the χ^2 statistic comparing Model 3 to Model 1 is statistically significant for both men and women. In particular, women with more physically demanding jobs in 1993 and women who face more job pressures in 1993 experience greater declines in musculoskeletal health; men with more job control in 1993 experience fewer declines in musculoskeletal health. Model 4 in Table 4 adds covariates for both SES and job characteristics to the baseline model. Here, the χ^2 tests comparing the full model to Model 2 (which included covariates for SES but not for job characteristics) indicate that Model 4 fits better than Model 2 for women; the χ^2 test for men is not statistically significant. That is, among women the model with job characteristic *and* SES measures fits better than the model with only the SES measures. The full model fits no better than Model 3 (which included covariates for job characteristics but not for SES), indicating that adding SES covariates does not add to the predictive power of Model 3.

To summarize, job characteristics are significantly associated with changes in women's and men's musculoskeletal health, even after adjusting for health risk factors, childhood health, and SES. Conversely, SES is not significantly associated with changes in musculoskeletal health, even before adjusting for job characteristics. Results of χ^2 tests comparing Model 4 to Model 3 indicate that the full model—which includes both job characteristics and SES measures—fits no better than the more parsimonious model that only includes the job characteristic covariates. Whereas SES is significantly related to changes in overall health even net of health risk factors, childhood health, and job conditions, the same is not true for musculoskeletal health outcomes.

Results for models of changes in depression—shown in Table 5—differ by gender. Again, depression in 2004 is closely related to depression in 1993 and (in results not shown) to health risk factors and childhood health. Among women, the addition of the SES variables to the baseline model (comparing Model 2 to Model 1) or to the model that includes job characteristics (comparing Model 4 to Model 3) does not improve the predictive power of the model in either case. Nonetheless, we observe in the full model that women who have completed college experienced declines in depression. On the other hand, among women job characteristics are related to changes in depression, even net of socioeconomic status, health risk factors, and childhood health. Women with more physically demanding jobs in 1993 and whose jobs became more demanding between 1993 and 2004 experienced increases in levels of depression. For women, job characteristics are independently related to changes in depression.

Among men, SES is significantly related to changes in depression, but only before adjusting for job characteristics. Likewise among men, job characteristics are significantly related to changes in depression, but only before adjusting for SES. In the end there is little compelling evidence that SES or job characteristics are independently related to changes in men's depression net of health risk factors and childhood health.

DISCUSSION

Our goal has been to better understand the relationships between SES, the conditions of paid employment, and self-reported overall health, musculoskeletal health, and depression. We asked about the extent to which SES is independently related to these health outcomes net of the conditions of paid employment, and we also asked about the extent to which the conditions of paid employment are independently related to these outcomes net of SES. To address these questions we used unique data collected from a single cohort of men and women to model

changes in these health outcomes between ages 54 and 65 as a function of SES, working conditions, and a series of control variables.

Not unexpectedly—and like prior work using the WLS (Brand, Warren, Hoonakker, & Carayon, Forthcoming; Warren, Hoonakker, Carayon et al., 2004)—we found that our results varied by gender and by the health outcome under consideration. Aspects of women's working conditions are independently related to changes in their self-rated overall health, to changes in their musculoskeletal health, and to changes in their levels of depression, even net of health risk factors, childhood health, and SES. Aspects of men's working conditions are independently related to changes in their self-rated overall health and to changes in their musculoskeletal health; working conditions are not related to changes in men's levels of depression. In general this suggests that working conditions are significantly and independently related to changes in health between ages 54 and 65. This is true despite the relatively low reliabilities of the alpha coefficients for our scales of physical and psychosocial working conditions; were those reliabilities higher, we might find ever stronger evidence that working conditions play a substantial and independent role in stratifying health outcomes.

SES—and specifically college completion—is independently related to changes in women's depression, even net of health risk factors, childhood health, and working conditions. On the other hand, SES is only significantly related to changes in men's self-assessed overall health after adjusting for these covariates. Overall this suggests that SES is significantly related to changes in some health outcomes, but that these relationships vary in important ways by sex.

SES is independently associated with changes in health net of the conditions of paid employment and other covariates. However, the extent to which this is true varies by sex and by the health outcome under consideration. Likewise, the conditions of paid employment are independently associated with changes in health net of SES and other covariates. But again, the extent to which this is true varies by sex and across health outcomes. Our results imply that attention to the conditions of paid employment could help to mitigate declines in health outcomes among older adults, and that working conditions may serve as an important mediating factor between SES and a variety of health outcomes.

It is important to recognize the several limitations of our findings. First, we must recognize that our results can only be safely generalized to non-Latino whites high school graduates (a description that only characterized about two-thirds of the U.S. population in that birth cohort). Second, despite our efforts to deal with issues of selective mortality, it is possible that our results—and perhaps particularly our results pertaining to musculoskeletal health outcomes—are influenced by this form of bias. Third, while our basic research design is well-suited to teasing out the independent effects of SES and working conditions on changes in several health outcomes, we have done relatively little in this paper to acknowledge that the relationships between SES, working conditions, and health are quite dynamic and recursive.

We view the contribution of our work as the act of synthesizing two broad research literatures. Social scientists, social epidemiologists, and public health researchers spend a great deal of time seeking mechanisms that link SES to health. These researchers should and could profitably consider the role of working conditions and job characteristics as an important set of intervening mechanisms. At the same time, and in separate literatures, researchers in occupational engineering, ergonomics, and job design spend a great deal of time considering the effects of working conditions and job characteristics on health. These researchers could and should consider the fact that associations between job characteristics and health may be spurious owing to SES. In short, we feel that both broad literatures can benefit from one another's efforts.

Acknowledgments

This research uses data from the Wisconsin Longitudinal Study (WLS) of the University of Wisconsin-Madison. Since 1991, the WLS has been supported principally by the National Institute on Aging (AG-9775 and AG-21079), with additional support from the Vilas Estate Trust, the National Science Foundation, the Spencer Foundation, and the Graduate School of the University of Wisconsin-Madison. A public use file of data from the Wisconsin Longitudinal Study is available from the Data and Program Library Service, University of Wisconsin-Madison, 1180 Observatory Drive, Madison, Wisconsin 53706 and at http://dpls.dacc.wisc.edu/WLS/wlsarch.htm. The opinions expressed herein are those of the authors.

REFERENCES

Alder, NE.; Ostrove, JM. Socioeconomic Status and Health: What We Know and What We Don't. In: Adler, NE.; Marmot, M.; McEwen, BS.; Stewart, J., editors. Socioeconomic Status and Health in Industrialized Nations. Annals of the New York Academy of Sciences; 1999. p. 96-115.

Armstrong TJ, Buckle P, Fine LJ, Hagberg M, Jonsson B, Kilbom A, Kuorinka IAA, Silverstein BA, Sjogaard G, Viikari-Juntura ERA. A conceptual model for work-related neck and upper-limp musculosceletal disorders. Scandinavian Journal of Work and Environmental Health 1993;19:73–84.

Borg V, Kristensen TS. Social class and self-rated health: can the gradient be explained by differences in life style or work environment? Social Science & Medicine 2000;51:1019–1030. [PubMed: 11005390]

Brand J, Warren JR, Hoonakker P, Carayon P. Do Job Characteristics Mediate the Relationship between SES and Health?: Evidence from Sibling Models. Social Science Research 2007;36:222–253.

Brand J, Warren JR, Hoonakker P, Carayon P. Do Job Characteristics Mediate the Relationship between SES and Health?: Evidence from Sibling Models. Social Science Research. Forthcoming.

Brekke M, Hjortdahl P, Kvien T. Severity of Musculoskeletal Pain: Relations to Socioeconomic Inequality. Social Science & Medicine 2002;54:221–228. [PubMed: 11824927]

Bruce ML, Takeuchi DT, Leaf PJ. Poverty and Psychiatric Status. Archives of General Psychiatry 1991;48:470–474. [PubMed: 2021300]

Carayon P, Smith MJ, Haims MC. Work organization, job stress, and work - related musculoskeletal disorders. Human Factors 1999;41(4):644–663. [PubMed: 10774134]

Carayon P, Smith MJ. Work organization and ergonomics. Applied Ergonomics 2000;31:649–662. [PubMed: 11132049]

Chandola T, Bartley M, Sacker A, Jenkinson C, Marmot M. Health Selection in the Whitehall II Study, UK. Social Science & Medicine 2002;56:2059–2072. [PubMed: 12697197]

Cooper CL, Marshall J. Occupational sources: a review of the literature relating to coronary heart disease and mental ill health. Journal of Occupational Health Psychology 1976;49:11–28.

Cooper CL, Cox A. Occupational stress among word process operators. Stress Medicine 1985;1:87–92.

Dionne C, Von Korff M, Koepsell T, Deyo R, Barlow W, Checkoway H. Formal Education and Back Pain: A Review. Journal of Epidemiology and Community Health 2001;55:455–468. [PubMed: 11413174]

Dohrenwend BP, Levav I, Shrout PE, Schwartz S, Naveh G, Link BG, Skodol AE, Stueve A. Socioeconomic Status and Psychiatric Disorders: The Causation-Selection Issue. Science 1992;255:946–952. [PubMed: 1546291]

Goodman E. The role of socioeconomic status gradients in explaining differences in US adolescents' health. American Journal of Public Health 1999;89:1522–1528. [PubMed: 10511834]

Hagberg M, Morgenstern H, Kelsh M. Impact of occupations and job tasks on the prevalence of carpal tunnel syndrome. Scandinavian Journal of Work Environment and Health 1992;18:337–345.

Hauser, RM.; Warren, JR. Socioeconomic Indexes of Occupational Status: A Review, Update, and Critique. In: Raftery, A., editor. Sociological Methodology 1997. Blackwell Publishers; Cambridge: 1997. p. 177-298.

Heckman J. Sample Selection Bias as a Specification Error. Econometrica 1979;47:153–161.

House JH. Understanding Social Factors and Inequalities in Health: 20th Century Progress and 21st Century Prospects. Journal of Health and Social Behavior 2002;43:125–142. [PubMed: 12096695]

Idler EL, Benyamini Y. Self-rated health and mortality: A review of twenty-sevent community studies. Journal of Health and Social Behaviour 1997;38:21–37.

Jarvis, E. Insanity and Idiocy in Massachusetts: Report of the Commission on Lunacy. Harvard University Press; Cambridge: 1855.

Jencks CS, Perman L, Rainwater L. What is a Good Job? A New Measure of Labor Market Success. American Journal of Sociology 1988;93(6):1322–1357.

Jensen C, Ryholt CU, Burr H, WVilladsen E, Chistensen H. Work-related psychosocial, physical, and individual factors associated with musculoskeletal symptoms in computer users. Work and Stress 2002;16:107–120.

Karasek, RA. Job characteristics and mental strain. Cornell University; 1979. Job demands, decision latitude, and Mental Strain: Implications for Job design.

Link BG, Lennon MC, Dohrenwend BP. Socioeconomic Status and Depression: The Role of Occupations Involving Direction, Control, and Planning. American Journal of Sociology 1993;98:1351–1387.

Link BG, Phelan JC. Social Conditions as Fundamental Causes of Disease. Journal of Health and Social Behavior 1995;35:80–94. [PubMed: 7560851]

Linton SJ. A review of psychosocial risk factors in back and neck pain. Spine 2000;25:1148–1156. [PubMed: 10788861]

Lund T, Borg V. Work environment and self-rated health as predictors of remaining in work 5 years later among danish employees 35–59 years of age. Experimental Aging Research 1999;25(429–434)

Lutfey K, Freese J. Toward some Fundamentals of Fundamental Causality: Socioeconomic Status and Health in the Routine Clinic Visit for Diabetes. American Journal of Sociology 2005;110:1326–1372.

Marmot M, Shipley M, Brunner E, Hemingway H. Relative contribution of early life and adult socioeconomic factors to adult morbidity in the Whitehall II study. Journal of Epidemiology and Community Health 2001;55:301–307. [PubMed: 11297647]

Marmot MG, Bosma H, Hemingway H, Brunner E, Stansfeld S. Contribution of job control and other risk factors to social variations in coronary heart disease incidence. Lancet 1997;350:235–239. [PubMed: 9242799]

Marmot MG, Ryff CD, Bumpass LL, Shipley M, Marks N. Social Inequalities in Health: Next Questions and Converging Evidence. Social Science & Medicine 1997;44:901–910. [PubMed: 9080570]

Martikainen P, Stansfeld S, Hemingway H, Marmot M. Determinants of socioeconomic differences in change in physical and mental functioning. Social Science & Medicine 1999;49(4):499–507. [PubMed: 10414809]

Michie S, Williams S. Reducing work related psychological ill health and sickness absence: a systematic literature review. Occupational and Environmental Medicine 2003;60:3–9. [PubMed: 12499449]

Miech RA, Caspi A, Moffitt T, Wright BRE, Silva PA. Low Socioeconomic Status and Mental Disorders: A longitudinal Study of Selection and Causation during Young Adulthood. American Journal of Sociology 1999;104:1096–1131.

Miech RA, Hauser RM. Socioeconomic Status (SES) and Health at Midlife: A Comparison of Educational Attainment with Occupation-Based Indicators. Annals of Epidemiology 2001;11:75–84. [PubMed: 11164123]

Mossey JM, Shapiro E. Self-rated health: A predictor of mortality among the elderly. American Journal of Public Health 1982;72:800–808. [PubMed: 7091475]

Niedhammer I, Goldberg M, Leclerc A, Bugel I, David S. Psychosocial factors at work and subsequent depressive symptoms in the Gazel cohort. Scandinavian Journal of Work Environment & Health 1998;24:197–205.

Power C, Matthews S, Manor O. Inequalities in Self Rated Health in the 1958 Birth Cohort: Lifetime Social Circumstances or Social Mobility? British Medical Journal 1996;313:449–453. [PubMed: 8776310]

Power C, Frank J, Hertzman C, Schierhout G, Li L. Predictors of low back pain onset in a prospective British study. American Journal of Public Health 2001;91:1671–1678. [PubMed: 11574334]

Putz-Anderson, V. Cumulative Trauma Disorders - A Manual for Musculoskeletal Disease of the Upper Limbs. Taylor & Francis; London: 1988.

Sewell, WH.; Hauser, RM. Education, Occupation, and Earnings: Achievement in the Early Career. Academic Press; New York: 1975.

Smith MJ. Mental and physical strain at VDT workstations. Behaviour and Information Technology 1987;6(3):243–255.

Smith MJ, Carayon-Sainfort P. A balance theory of job design for stress reduction. International Journal of Industrial Ergonomics 1989;4:67–79.

Vahtera J, Virtanen P, Kivimaki M, Pentti J. Workplace as an Origin of Health Inequalities. Journal of Epidemiology and Community Health 1999;53:399–407. [PubMed: 10492732]

Warren JR, Hoonakker PLT, Carayon P, Brand J. Job Characteristics as Mediators in SES-Health Relationships. Social Science & Medicine 2004;59:1367–1378. [PubMed: 15246167]

Wheaton B. The Sociogenesis of Psychological Disorder: Reexamining the Causal Issues with Longitudinal Data. American Sociological Review 1978;43:383–403. [PubMed: 686537]

Wilson SE. Socioeconomic status and the prevalence of health problems among married couples in late midlife. American Journal of Public Health 2001;91

Table 1

Descriptive Statistics for Health Variables

	FULL SAMPLE (n=4,495)		WOMEN (n=2,400)		MEN (n=2,095)	
Variables	**Mean or Pct.**	**Std. Dev.**	**Mean or Pct.**	**Std. Dev.**	**Mean or Pct.**	**Std. Dev.**
Died After 1993 Survey	9.2% (n=412)		7.4% (n=178)		11.2% (n=234)	
Overall Health in 1993: Less than Excellent	70.9%		70.1%		71.9%	
Overall Health in 1993: Excellent	29.1%		29.9%		28.1%	
Overall Health in 2004: Less than Excellent	78.5%		78.5%		78.4%	
Overall Health in 2004: Excellent	21.5%		21.5%		21.6%	
Musculoskeletal Health Scale: 1993	0.83	(1.66)	0.99	(1.86)	0.64	(1.38)
Musculoskeletal Health Scale: 2004	1.23	(2.00)	1.47	(2.17)	0.96	(1.73)
Depression Scale: 1993	16.30	(15.52)	17.47	(16.93)	14.97	(13.61)
Depression Scale: 2004	13.57	(13.69)	14.84	(14.75)	12.05	(12.15)

Note: Sample restricted to cases in which the WLS graduate (1) responded to the 1993 telephone and mail surveys; (2) either died after 1993 or responded to both the 2004 mail and telephone surveys; and (3) was randomly selected to be asked the job characteristics questions in 2004 (if alive). See text for more complete descriptions of variables.

Res Aging. Author manuscript; available in PMC 2010 September 28.

Table 2

Descriptive Statistics for Independent Variables

	FULL SAMPLE (n=4,495)		WOMEN (n=2,400)		MEN (n=2,095)	
Variables	**Mean or Pct.**	**Std. Dev.**	**Mean or Pct.**	**Std. Dev.**	**Mean or Pct.**	**Std. Dev.**
1993 Health Risk Factors						
Has Employer-Provided Health Insurance	92.7%		92.8%		92.5%	
Currently Smokes	17.8%		18.3%		17.1%	
Mean Number of Drinks per Day	0.3	(0.7)	0.2	(0.4)	0.4	(0.8)
Frequency of Physical Exercise per Month	3.4	(4.1)	3.0	(3.9)	3.9	(4.3)
Body Mass Index	26.0	(6.4)	25.0	(7.4)	27.2	(4.8)
Retrospective Measures of Childhood Health (2004)						
Childhood Health: Poor	0.5%		0.5%		0.4%	
Childhood Health: Fair	3.1%		3.6%		2.5%	
Childhood Health: Good	13.2%		14.0%		12.2%	
Childhood Health: Very Good	34.0%		32.9%		35.2%	
Childhood Health: Excellent	49.3%		48.9%		49.7%	
Number of Childhood Illnesses (out of 11)	1.1	(1.0)	1.2	(1.1)	1.0	(1.0)
Childhood Health Limited Activities	12.6%		12.0%		13.4%	
Socioeconomic Status (1993)						
Completed 0 to 3 Years of College	15.6%		15.7%		15.5%	
Completed 4 or more Years of College	29.0%		23.1%		35.8%	
Base Hourly Wage Rate (Logged)	1.9	(2.2)	1.3	(2.4)	2.5	(1.8)
Occupational Standing (Occupational Education)	59.6	(26.6)	57.4	(27.1)	62.1	(25.9)
Physical and Psychosocial Job Characteristics						
Physical Job Characteristics Index: 1993	3.3	(2.5)	3.1	(2.3)	3.5	(2.7)
Ergonomics Job Characteristics Index: 1993	3.6	(2.3)	3.7	(2.2)	3.4	(2.4)
Job Control Index: 1993	4.4	(3.2)	3.7	(3.0)	5.1	(3.4)
Job Pressures Index: 1993	7.8	(1.7)	7.8	(1.8)	7.7	(1.6)
Physical Job Characteristics Index: 2004	3.1	(2.4)	2.8	(2.2)	3.5	(2.6)
Ergonomics Job Characteristics Index: 2004	3.2	(2.1)	3.4	(2.0)	2.9	(2.2)
Job Control Index: 2004	3.7	(2.7)	3.2	(2.5)	4.2	(2.8)
Job Pressures Index: 2004	7.2	(1.8)	7.1	(1.9)	7.2	(1.8)

Note: Sample restricted to cases in which the WLS graduate (1) responded to the 1993 telephone and mail surveys; (2) either died after 1993 or responded to both the 2004 mail and telephone surveys; and (3) was randomly selected to be asked the job characteristics questions in 2004 (if alive). See text for more complete descriptions of variables.

Table 3

Logisitc Regressions of Changes in Self-Reported Overall Health on Health Risk Factors, Childhood Health, SES, and Job Characteristics, by Gender

	WOMEN (n=2,209)								MEN (n=1,849)							
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)
Overall Health in 1993: Excellent	1.66	(0.14)**	1.65	(0.14)**	1.67	(0.14)**	1.66	(0.15)**	1.95	(0.17)**	1.91	(0.17)**	1.92	(0.17)**	1.91	(0.17)**
Completed 0 to 3 Years of College		—	0.26	(0.16)		—	0.25	(0.17)		—	0.46	(0.20)*		—	0.44	(0.20)*
Completed 4 or more Years of College		—	0.28	(0.15)		—	0.29	(0.16)		—	0.68	(0.19)**		—	0.57	(0.19)**
Base Hourly Wage Rate (Logged)		—	0.02	(0.03)		—	0.04	(0.03)		—	0.06	(0.04)		—	0.05	(0.04)
Occupational Standing (Occupational Education)		—	0.01	(0.00)*		—	0.00	(0.00)		—	0.00	(0.00)		—	−0.01	(0.00)
Physical Job Characteristics Index: 1993		—		—	−0.02	(0.03)	−0.01	(0.03)		—		—	−0.01	(0.03)	0.00	(0.04)
Change in Physical Job Characteristics, 1993–2004		—		—	−0.05	(0.03)	−0.05	(0.03)		—		—	−0.07	(0.04)	−0.06	(0.04)
Ergonomics Job Characteristics Index: 1993		—		—	−0.07	(0.04)	−0.01	(0.04)		—		—	−0.11	(0.04)*	−0.08	(0.05)
Change in Ergonomics Job Characteristics, 1993–2004		—		—	−0.02	(0.04)	0.00	(0.04)		—		—	−0.09	(0.04)*	−0.08	(0.05)
Job Control Index: 1993		—		—	0.09	(0.03)**	0.09	(0.03)**		—		—	0.00	(0.03)	0.01	(0.03)
Change in Job Control, 1993–2004		—		—	0.04	(0.03)	0.05	(0.03)		—		—	−0.02	(0.03)	−0.01	(0.03)
Job Pressures Index: 1993		—		—	0.12	(0.04)**	0.07	(0.04)		—		—	0.01	(0.05)	0.00	(0.05)
Change in Job Pressures, 1993–2004		—		—	0.02	(0.03)	0.00	(0.04)		—		—	0.06	(0.04)	0.05	(0.04)
Inverse Mills Ratio	0.64	(0.35)	0.43	(0.36)	0.48	(0.36)	0.40	(0.36)	0.51	(0.44)	0.41	(0.44)	0.46	(0.44)	0.41	(0.44)
Constant	−2.85	(0.72)**	−2.89	(0.73)**	−3.47	(0.80)**	−3.55	(0.80)**	−1.49	(0.93)	−1.66	(0.94)	−1.14	(0.99)	−1.26	(1.02)
χ^2 (df)	406.9	(13)	432.3	(17)	441.3	(21)	451.6	(25)	434.9	(13)	455.1	(17)	452.8	(21)	464.4	(25)
Change in χ^2: Model 2 vs Model 1 (df)		—	25.4	(4)**		—		—		—	20.2	(4)**		—		—
Change in χ^2: Model 3 vs Model 1 (df)		—		—	34.3	(8)**		—		—		—	17.9	(8)*		—
Change in χ^2: Model 4 vs Model 2 (df)		—		—		—	19.3	(8)*		—		—		—	9.3	(8)

	WOMEN (n=2,209)								MEN (n=1,849)							
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)
Change in χ^2: Model 4 vs Model 3 (df)		—		—		—	10.3	(4)*		—		—		—	11.6	(4)*

Note: Sample restricted to cases in which the WLS graduate responded to the 1993 telephone and mail surveys and either (1) died after 1993 or (2) responded to both the 2004 mail and telephone surveys. See text for more complete descriptions of variables. For the analyses in this table, missing data were replace with multiply imputed data. Models also include covariates for health risk factors and childhood health, as described in Table 2.

* = $p < 0.05$

** = $p < 0.01$

Table 4

OLS Regressions of Changes in Musculoskeletal Health on Health Risk Factors, Childhood Health, SES, and Job Characteristics, by Gender

	WOMEN (n=2,210)								MEN (n=1,840)							
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)
Musculoskeletal Health Scale: 1993	0.51	(0.02)**	0.51	(0.02)**	0.50	(0.02)**	0.50	(0.02)**	0.57	(0.03)**	0.56	(0.03)**	0.55	(0.03)**	0.55	(0.03)**
Completed 0 to 3 Years of College		—	0.07	(0.12)		—	0.08	(0.12)		—	−0.13	(0.11)		—	−0.11	(0.11)
Completed 4 or more Years of College		—	−0.12	(0.11)		—	−0.17	(0.12)		—	0.01	(0.10)		—	0.06	(0.10)
Base Hourly Wage Rate (Logged)		—	−0.01	(0.02)		—	−0.02	(0.02)		—	0.00	(0.02)		—	−0.01	(0.02)
Occupational Standing (Occupational Education)		—	0.00	(0.00)		—	0.00	(0.00)		—	0.00	(0.00)		—	0.00	(0.00)
Physical Job Characteristics Index: 1993		—		—	0.07	(0.02)**	0.08	(0.02)**		—		—	0.03	(0.02)	0.04	(0.02)
Change in Physical Job Characteristics, 1993–2004		—		—	0.05	(0.02)	0.05	(0.02)*		—		—	0.02	(0.02)	0.03	(0.02)
Ergonomics Job Characteristics Index: 1993		—		—	−0.01	(0.03)	−0.02	(0.03)		—		—	0.00	(0.02)	0.00	(0.02)
Change in Ergonomics Job Characteristics, 1993–2004		—		—	0.01	(0.02)	0.01	(0.02)		—		—	0.02	(0.02)	0.03	(0.02)
Job Control Index: 1993		—		—	0.01	(0.02)	0.00	(0.02)		—		—	−0.03	(0.01)*	−0.03	(0.01)*
Change in Job Control, 1993–2004		—		—	0.01	(0.02)	0.01	(0.02)		—		—	−0.02	(0.02)	−0.02	(0.02)
Job Pressures Index: 1993		—		—	0.06	(0.03)*	0.06	(0.03)		—		—	0.01	(0.02)	0.01	(0.03)
Change in Job Pressures, 1993–2004		—		—	0.03	(0.02)	0.03	(0.02)		—		—	0.00	(0.02)	0.00	(0.02)
Inverse Mills Ratio	−1.14	(0.18)**	−1.13	(0.19)**	−1.15	(0.19)**	−1.13	(0.19)**	−0.74	(0.17)**	−0.70	(0.17)**	−0.66	(0.17)**	−0.67	(0.17)**
Constant	2.43	(0.42)**	2.35	(0.43)**	1.88	(0.48)**	1.78	(0.48)**	1.11	(0.43)**	1.22	(0.43)**	0.93	(0.47)*	0.91	(0.49)
R2 (predictors)	0.234	(13)	0.235	(17)	0.240	(21)	0.241	(25)	0.224	(13)	0.226	(17)	0.231	(21)	0.232	(25)
F Test Comparing Model 2 to Model 1		—		0.573		—		—		—		1.236		—		—
F Test Comparing Model 3 to Model 1		—		—		2.122*		—		—		—		2.008*		—
F Test Comparing Model 4 to Model 2		—		—		—		2.374*		—		—		—		1.652

	WOMEN (n=2,210)								MEN (n=1,840)							
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)
F Test Comparing Model 4 to Model 3		—		—		—		1.079		—		—		—		0.531

Note: Sample restricted to cases in which the WLS graduate responded to the 1993 telephone and mail surveys and either (1) died after 1993 or (2) responded to both the 2004 mail and telephone surveys. See text for more complete descriptions of variables. For the analyses in this table, missing data were replace with multiply imputed data. Models also include covariates for health risk factors and childhood health, as described in Table 2.

* = $p < 0.05$

** = $p < 0.01$

Table 5

OLS Regressions of Changes in Psychological Distress/Depression on Health Risk Factors, Childhood Health, SES, and Job Characteristics, by Gender

	WOMEN (n=2,179)								MEN (n=1,821)							
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)
Depression Scale: 1993	0.45	(0.02)**	0.44	(0.02)**	0.44	(0.02)**	0.44	(0.02)**	0.45	(0.02)**	0.45	(0.02)**	0.45	(0.02)**	0.45	(0.02)**
Completed 0 to 3 Years of College		—	−1.43	(0.77)		—	−1.39	(0.78)		—	−1.24	(0.74)		—	−1.19	(0.74)
Completed 4 or more Years of College		—	−1.25	(0.74)		—	−1.56	(0.78)*		—	−0.10	(0.68)		—	−0.03	(0.71)
Base Hourly Wage Rate (Logged)		—	0.23	(0.13)		—	0.19	(0.13)		—	0.00	(0.14)		—	−0.01	(0.14)
Occupational Standing (Occupational Education)		—	−0.01	(0.01)		—	0.00	(0.01)		—	−0.03	(0.01)**		—	−0.02	(0.01)
Physical Job Characteristics Index: 1993		—		—	0.45	(0.14)**	0.52	(0.15)**		—		—	0.23	(0.12)	0.16	(0.13)
Change in Physical Job Characteristics, 1993–2004		—		—	0.41	(0.16)**	0.42	(0.16)**		—		—	−0.04	(0.13)	−0.06	(0.13)
Ergonomics Job Characteristics Index: 1993		—		—	−0.03	(0.17)	−0.13	(0.19)		—		—	0.05	(0.15)	−0.03	(0.16)
Change in Ergonomics Job Characteristics, 1993–2004		—		—	0.36	(0.16)*	0.30	(0.16)		—		—	−0.01	(0.15)	−0.04	(0.16)
Job Control Index: 1993		—		—	−0.17	(0.12)	−0.16	(0.12)		—		—	−0.19	(0.10)*	−0.18	(0.10)
Change in Job Control, 1993–2004		—		—	−0.05	(0.12)	−0.05	(0.12)		—		—	−0.10	(0.11)	−0.11	(0.11)
Job Pressures Index: 1993		—		—	0.12	(0.18)	0.09	(0.19)		—		—	0.01	(0.17)	0.05	(0.17)
Change in Job Pressures, 1993–2004		—			0.01	(0.16)	−0.02	(0.16)		—		—	0.21	(0.14)	0.22	(0.15)
Inverse Mills Ratio	−2.55	(1.28)*	−2.30	(1.29)	−2.57	(1.29)*	−2.39	(1.29)	−2.18	(1.20)	−1.74	(1.22)	−1.63	(1.21)	−1.57	(1.22)
Constant	9.07	(3.00)**	9.50	(3.04)**	8.30	(3.31)*	8.65	(3.34)**	6.46	(3.09)*	7.89	(3.12)*	5.50	(3.35)	6.84	(3.47)*
R2 (predictors)	0.294	(13)	0.297	(17)	0.302	(21)	0.305	(25)	0.279	(13)	0.286	(17)	0.287	(21)	0.289	(25)
F Test Comparing Model 2 to Model 1		—		2.305		—		—		—		3.912**		—		—
F Test Comparing Model 3 to Model 1		—		—		3.285**		—		—		—		2.525**		—
F Test Comparing Model 4 to Model 2		—		—		—		3.137**		—		—		—		1.200

	WOMEN (n=2,179)								MEN (n=1,821)							
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)	b	(s.e.)
F Test Comparing Model 4 to Model 3		—		—		—		2.014		—		—		—		1.263

Note: Sample restricted to cases in which the WLS graduate responded to the 1993 telephone and mail surveys and either (1) died after 1993 or (2) responded to both the 2004 mail and telephone surveys. See text for more complete descriptions of variables. For the analyses in this table, missing data were replaced with multiply imputed data. Models also include covariates for health risk factors and childhood health, as described in Table 2.

* = $p < 0.05$

** = $p < 0.01$