Job Strain and Mortality among Men and Women in the United States

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Abstract

The health impact of stressful working conditions is a topic of great research interest, but existing studies have paid relatively little attention to women and even less to people who work outside the formal, paid labor force. We examine the influence of job strain on mortality over a fifteen year period among paid and unpaid men and women workers in the American's Changing Lives Study, a nationally-representative cohort of United States adults that was started in 1986. We find that contrary to the strain hypothesis of the Karasek demand-control model, high strain work does not increase the risk of mortality; in fact, people who report high strain work have improved survival relative to those in low strain work. Among unpaid women, active work is protective and passive work increases the risk of mortality, while among paid women workers, only the active work finding is significant. These results are discussed with regard to the health of the changing American workforce.

Introduction

The health impact of stressful working conditions is a topic of great research interest, but existing studies have paid relatively little attention to women and even less to people who work outside the formal, paid labor force. One of the most influential models of job strain was developed by Karasek (1979), and relates demands and control at work to psychosocial strain and subsequent illness. This job strain model focuses on the interaction of two types of job characteristics: the psychological demands of the work situation, or stressors, and the environmental mediators that help workers to moderate those demands, such as decision latitude, or control over the work process. According to this model, workers who are subject to a combination of high job demands and low decision latitude (high strain jobs) will have the greatest psychological stress and will manifest physiological complaints. Though the results are not unequivocal, job strain has been implicated in increasing the risk of a range of health problems, including cardiovascular disease (CVD) (Johnson et al. 1996; Kristensen 1996; Schnall et al. 1990; Schnall et al. 1998; Theorell et al. 1991; Theorell et al. 1998) and poor mental health outcomes (Johnson et al. 1995; Pelfrene et al. 2002), as well as being linked to health-relevant behaviors (Hellerstedt and Jeffery 1997; Lallukka et al. 2004). However, the existing body of evidence applies largely to paid male workers and does not adequately describe the experiences of a large proportion of the contemporary workforce. Women have increasingly entered the paid labor force and are spending more of their adult lives at work outside the home, increasing their contact with the same stressors men experience on the job. Yet while women increasingly resemble men in their educational preparation for the job market, women's paid work differs from men's. One important difference is

the greater concentration of women in the service sector; jobs across the occupational spectrum, but particularly in the service sector, have shifted workers away from traditional physical and chemical hazards and increased the relative influence of psychosocial job stressors like job strain for health (Cappelli et al. 1997). It is increasingly important to understand how job-related stress is distributed among male and female workers, and whether it has the same effects on their health.

At the same time, focusing only on those who do paid work ignores many women who do unpaid housework but do not work for pay outside the home. We follow Kohn and Schooler (1983) in defining housework as work that has to be done to maintain a household, work that someone else would have to be hired to do if family members did not do it themselves. Like women in paid work, unpaid household workers are subject to potentially health-damaging psychosocial stressors in the home work environment, and women out of the paid workforce have been shown to have poorer health, overall, than their paid counterparts. Nonetheless, being a homemaker is a socially sanctioned role for women in the United States and may have intrinsic rewards that reduce health risks associated with the strain of housework.

The present analysis is unique because we can expand investigation of the hazards of job strain to the full population of men and women at risk: those working for pay as well as those who do unpaid work. We utilize a cohort designed to represent the United States population in 1986 and followed up for the next fifteen years. Men and women in the paid labor force and those doing unpaid work at home were asked an identical set of questions about their working conditions, allowing us to compare psychological demands and decision latitude among paid and unpaid workers and to assess the relationship of job

strain to all-cause mortality over a decade and a half. Mortality is a useful outcome because it captures the total impact of insults to physical health and is an absorbing outcome, making it difficult to distinguish the causal direction in the relationship between working conditions and mortality than is the case for other health conditions. By using mortality, we also avoid using self-reported measures of both working conditions (the exposure of interest) and the health outcome, reducing the possibility that individual differences in reporting are artificially causing a relationship between the two.

Job strain, health and mortality

In the demand-control framework developed originally in health psychology there are four possible work states, created by cross-tabulating a measure of psychological demands and a scale measuring decision latitude, or control, based on median splits. People who have high demands (above the median) and low control (below the median) have *high strain* work, and according to the original hypothesis associated with the model, are at greatest risk for psychological strain and illness (Karasek and Theorell 1990; Karasek 1979). By contrast, people with high demands but high control have an *active work* situation, which is theorized to lead to the "desirable stress" outcome of increased motivation and learning opportunity (Theorell and Karasek 1996). Those with low demands and high control are labeled *low strain* workers, while those who have low demands and low control of their working conditions are identified as doing *passive work*. The strain hypothesis, focusing on the excess risk associated with the combination of low control and high demands, has received much more research attention, but a

second hypothesis focusing on learning new patterns of behavior and skills in active as opposed to passive work is also an important aspect of the original model.

Stressful working conditions are hypothesized to influence health by increasing known risk factors for disease and death. Job strain has been linked to increased blood pressure, a relationship which may work through increases in left ventricular mass (Schnall et al. 1992) or chronic physiological arousal (Harenstam and Theorell 1988). The stress response also involves two neuroendocrine systems: the sympathoadrenal medullary system (which secretes catecholamines, adrenaline, and noradrenaline), and the pituitary-adrenal cortical system (which secretes corticosteroids including coritsol). Some research has shown that different combinations of demand conditions and control over stressors leads to different endocrine responses; for example, under demanding conditions where an organism can exert some level of control over predictable stressors, conditions similar to the active work state in the Karasek model, adrenaline increases but cortisol decreases, leading to effort without distress (for a review, see Schnall, Landsbergis and Baker 1994). A person's feelings of control may reduce the duration of the neuroendocrine response (Frankenhauser 1989). Other possible biological pathways include an influence on the progression of atherosclerosis, or on the precipitation of acute coronary disease, but these pathways have not received much direct empirical support (Schnall, Landsbergis and Baker 1994). Health-related behaviors are additional avenues for the effects of job strain on health. There is evidence for relationships between various components of job strain and a healthy diet (Hellerstedt and Jeffrey 1997; Lallukka et al. 2004), physical activity (Hellerstedt and Jeffrey 1997; Lallukka et al. 2004), body weight (Hellerstedt and Jeffrey 1997; Overgaard, Gyntelberg and Heitmann 2004), drinking

(Lallukka et al. 2004) and smoking (Hellerstedt and Jeffrey 1997; Lallukka et al. 2004), but results are not often large in magnitude and vary by sex.

Two of the persisting questions in job strain research are (1) whether the impact of job control and job demands are truly interactive (the strain hypothesis) or whether one or both have additive, but not interactive, effects (Kasl 1996), and (2) whether the earlier results from job strain studies, based on cross-sectional data, were determined by health-based selection into particular occupational categories, and not by the effects of work on health. With regard to the debate over the strain hypothesis, in a review of high-quality longitudinal studies using the demand-control model or a variant, additive effects for control or demand (usually accompanied by a main effect of the other) were much more commonly found than were interactive effects between the two (de Lange et al. 2003). Of three high quality longitudinal studies specifically assessing the demand-control model and using a variety of outcome indicators (daily life stress, physical and mental health complaints, pregnancy-induced hypertension), none found support for the strain hypothesis (Carayon 1993; Landsbergis and Hatch 1996; Parkes 1991). These findings suggest that the four category indicator of job strain should be tested by assessing the relative importance of additive and interactive effects.

The second enduring question in this literature is whether early findings for the impact of decision latitude, demands, and high strain on health were a product of inadequate control for the selection into work with specific job strain categories by individuals with different health statuses. For example, the types of jobs typically identified as passive may attract individuals with health problems because they do not require strenuous labor. Prospective study designs based on longitudinal data can address

the issue of health selection by accounting for health status and other factors that account for the type of work people are performing at baseline, and then following people to see how their health changes. In general, there is support for causal relationships from work to health over time, but variations in these relationships by sex and for paid versus unpaid workers have been understudied.

Despite the evidence that job strain is related to morbidity and health risk behaviors, there has been relatively less work on the implications of job strain for mortality. This is in part a function of the reliance on cross-sectional data for many of the early job strain studies; but appropriate longitudinal cohort studies are increasingly available for studying longer-term processes such as those leading to mortality. Existing studies of job strain and mortality have shown mixed results, but there is support for a relationship. A representative study of elderly men interviewed three years after their retirement in Malmo, Sweden in 1982-1983 and followed up until 1989 showed that men exposed to job strain had a significantly higher risk of all cause mortality, even with adjustment for social class and cardiovascular risk factors (Falk et al. 1992). A population-based study of Finnish men followed up for an average of eight years showed that compared to those with low demands, high resources (similar to a measure of control), and high income, men with high demands had a significantly greater risk of all-cause mortality, but only if they also had low income (Lynch et al. 1997). In addition, men with low demands, high resources and low income had an increased risk of mortality; all these associations were reduced substantially with controls for baseline health and behavioral, psychosocial and biological characteristics. A separate cohort of Finnish male and female employees free of cardiovascular disease at baseline and with an

average follow up period of 26 years showed 2.2-fold greater risk of cardiovascular mortality with high strain (using an alternative measure); additionally, an increased risk was found for persons reporting low control, though the association was not robust to controls for behavioral risk factors (Kivimaki et al. 2002).[i]

Results of U.S. studies have been mixed and have not supported the strain hypothesis; a study of men who were employed when interviewed between 1971 and 1975 and followed up though 1987 showed a lower risk of mortality for those with the highest levels of control; for blue collar workers only, increased demands (main effect) and being in the active work category (compared to being in low strain or passive work) were associated with a significant reduction in risk of mortality (Steenland, Johnson and Nowlin 1997).[ii] These results were robust to inclusion of controls for sociodemographic, health and behavioral characteristics. One study created a working cohort from a nationally-representative sample of U.S. men and women who worked at least three years between 1968 and 1991, with demand and control measures imputed and cumulated over the working life course and follow up from 1970 through 1992 (Amick et al. 2002). There was no relationship between high strain work and mortality, but individuals experiencing the accumulation of low control work and those doing passive work had significantly higher risk of mortality. Finally, a ten year follow up study of U.S. men and women who were children of the original Framingham Heart Study participants and who were employed outside the home for most of their lives that did not show any association between job strain and increased risk of mortality, with or without controls for a large array of occupational, health and other risk factors (Eaker et al. 2004). The present analysis can add to the evidence on job strain and mortality in the United States because

we study the only nationally-representative cohort in the country that collected self-reported information about working conditions and that includes women as well as men, and unpaid as well as paid workers.

Women, work and health

One of the major transitions in the American work force of the last forty years has been the dramatic influx of women into the paid labor force, and the impact of this shift on women's health has been the focus of much investigation. While the job strain model and its variants have dominated epidemiological research on the impact of working conditions on health, much of the sociological research on women, work and health has focused on the impact of being employed in the paid labor force versus doing unpaid work at home, not on the specific characteristics of the work that is done. Combining the concerns of both streams of research leads to several questions not often addressed by existing studies: (1) Is job strain distributed evenly by sex among paid workers? (2) Is job strain distributed similarly for paid and unpaid women workers? and (3) Controlling for differences in distribution, are the effects of job strain on mortality risk the same for paid men, paid women and unpaid women workers? We discuss the existing evidence and theoretical expectations relevant to each of these questions in turn.

Few empirical studies have examined whether job strain is differentially distributed among men and women, but there are several reasons to expect that job strain may vary by sex among paid workers. First, despite major changes in the sex composition of the workforce and in the mix of occupations over the past half century, sex segregation has remained remarkable stable. In the mid-1980s, when the data we use in this analysis were collected, 60% of women would have had to change occupational categories to

achieve the occupational distribution of men (Jacobs 1989). Furthermore, jobs women frequently hold are distinct: female-typical jobs have lower pay (Marini 1989; Treiman and Hartmann 1981), fewer benefits (Perman and Stevens 1989), less on-the-job training (Duncan and Hoffman 1979), fewer promotion opportunities (Glass 1990), and less opportunity to exercise authority (Reskin and Ross 1992). These characteristics influence the conditions women experience and the reports they make about levels of decision latitude and psychological demands at work. Second, women working for pay may report a distinctive pattern of job strain because they are more likely than men to combine paid work with primary responsibility for housework duties. In addition, even among paid workers holding the same kind of job, women's reports of conditions on the job may be influenced by substantive working conditions at home, while men are less likely to be strongly influenced by the demands and control they experience when doing housework. This is at least partially due to traditional gender ideology and norms in the workplace that enhance the subjective rewards of employment for men and of domestic labor for women, while minimizing the drawbacks (Glass and Fujimoto 1994).

Much of the existing research that compares women in paid and unpaid work has focused on how a combination of work and family roles by paid women may benefit health (role enhancement) or harm it (role strain) (Arber, Gilbert and Dale 1985; Arber and Lahelma 1993). The findings have shown that the overall effects of employment in the paid labor force on women's health range from positive to negligible, but the similarities or differences in the substantive conditions experienced by paid and unpaid workers have received less research attention (Lennon 1994). Some existing studies suggest that women doing unpaid housework may have more control or autonomy in

deciding what to do and how to do it than paid workers (Bird and Ross 1993), but that the more routine nature of such work and its diffuse and never satisfied demands have a negative effect on psychological well-being (Glass and Fujimoto 1994; Gove and Tudor 1973; Oakley 1974; Schooler et al. 1984). One of the inherent difficulties in comparing the reported job strain experienced by women in paid and unpaid work is that women with health problems may select out of the paid labor force. Unpaid women's reports of the demands and control they experience may be different from those of paid women because there are substantive differences in the kind of work that is done, or because work is more difficult for people with health problems. We use several strategies to address the influence of health selection in our comparison of job strain for paid and unpaid women in this analysis.

Finally, it is not clear whether there are sex differences in the impact of job strain on mortality. Most existing studies considering both male and female employees conducted analyses on pooled samples, usually with an indicator of sex to adjust for gender-based differences in health outcomes. These studies have implicitly assumed that the effects of job strain on the outcomes in question are equivalent for men and women. Some studies conducted on samples stratified by sex have shown that job strain effects are the same for men and women; for example, low control at work increased the risk of depression similarly for paid male and female civil servants in Britain (Griffin et al. 2002), and measures of job strain had no effect on the risk of all-cause mortality among US men or women (Eaker et al. 2004). However, research traditions around stress and gender have posited that men may experience greater health ramifications of job stress,

while women's health is influenced more strongly by social roles within the family, or the struggle to balance work and family demands (Griffin et al. 2002).

Existing evidence and theoretical traditions lead us to propose a series of related hypotheses about the effects of job strain on mortality among U.S. men and women. First, that women doing unpaid work at home will report greater control and lower demands than women doing paid work. Second, that among those in paid work, men will report greater control and higher demands at work than their female counterparts. Third, that job strain will have similar effects on the survival of women doing unpaid and those doing paid work, once adjustments are made for differences in sociodemographic characteristics and health at baseline. Fourth, that job strain will have a greater impact on the health of men than on the health of women, overall. Finally, that mortality will be higher for those in high strain and in passive work, compared to those in low strain and active work, respectively.

Methods

Data

The data for this analysis come from the American's Changing Lives (ACL) study, a longitudinal cohort comprised of a stratified, multi-stage area probability sample of non-institutionalized adults 25 years and older living in the United States in 1986, with oversampling of adults 60 and older and of African Americans. Weights have been designed to make the ACL respondents representative of the non-institutionalized population in the contiguous United States. In the baseline survey in 1986, face-to-face interviews were conducted with 3,617 men and women (representing 70% of sampled

households and 68% of sampled individuals), and these individuals were followed up with subsequent waves of data collection in 1989, 1994 and 2001/2. Further information about the longitudinal study design for the ACL can be found elsewhere (House et al. 1990; House et al. 1994). In the present analysis we utilize self-reported information about working conditions in 1986 for 2,517 individuals who reported that they were either: (1) working at least 20 hours per week in the paid labor force, or (2) keeping house (unpaid work). We restrict our examination to self-reported working conditions in 1986 because this was the only year in which the questions were asked of respondents who were doing unpaid work. We examine survival patterns for these individuals over the fifteen year period spanning 1987 and 2002, during which there were 522 deaths.

Measures

Mortality. We ascertain deaths over fifteen years of follow up with information obtained from continuous mortality surveillance since the beginning of the study. The dependent variable in our analysis is death occurring from 1987, one year after information about work was collected, through 2002, the last year through which verification of death through the National Death Index had been completed at the time of writing.

Job strain. Working conditions were assessed in 1986 with a series of questions designed to measure decision latitude (three scale items) and psychological job demands (two scale items). The same set of questions was asked of respondents who reported working for pay and those who were keeping house, though the term "housework" was substituted for "work" in the latter set. Questions used to create an indicator of decision

latitude asked about being able to decide how to do work, doing a variety of different things in work, and having a lot of say about what happens in work. Questions that were used to measure psychological demands of work asked whether the respondent had enough time to get work done, and whether he or she was free from conflicting demands that others make. As is typically done, each item was scored on a Likert scale from with values that ranged from strongly agree (1 or 4, depending on the question) to strongly disagree (4 or 1), and the responses to questions comprising a scale were summed. Items were reverse-coded where necessary so that a higher score on the scale indicated greater demands or greater control. Medians for each scale were defined based on the total sample of eligible individuals, and did not differ from sex-specific medians. The four job strain categories created were those identified by the Karasek demand-control model: high strain (high demands and low control), active work (high demands and high control), low strain (low demands and high control), and passive work (low demands and low control).

Controls. The analyses control for sociodemographic characteristics (age, gender, race, marital status, household income, and number of children living in the home), health-related behaviors (smoking status, use of alcohol, physical activity), and health measures (body mass index, self-rated health, an index of depressive symptoms, and the number of life-threatening health conditions) that are correlated with working conditions or mortality. Age is a key determinant of mortality risk, and the characteristics people experience on the job also change with age. Age was measured at baseline, and we calculated the age at each year of follow up based on the respondent's birth date. Sex is implicitly controlled throughout this analysis as we consider men and women separately,

and race is coded 1 for black respondents and 0 for non-Blacks, who are overwhelmingly white as this sample represents the United States population in 1986. We control for current marital status, denoting those who are currently married or living in a marriage-like relationship (coded 1) from those who have never or were formerly married (coded 0), because the impact on health of doing paid work or keeping house may depend on whether there is a spouse also contributing to the household.[iii] We control for family income in 1986 with an 11-category variable capturing the range of incomes.[iv] A count of the number of children in the home is included to capture the extra stress associated with child care.

Health-related behaviors and measures of health at baseline are included to help control for health selection into particular categories of job strain, and to examine their effect on the relationship between job strain and mortality risk. We distinguish current or former smokers (coded 1) from those who report never smoking (coded 0) and include a measure of the frequency of alcohol consumption in the past month (0 = none, 1 = 1 - 89 drinks, 2 = 90+ drinks). Physical activity is measured with an index of activity divided into quintiles (1 = low, 5 = high), and body mass index (BMI) is a continuous measure of weight in kilograms divided by height in meters, squared. Self-rated health is a five category measure with values that range from 1 (excellent) to 5 (poor), and depressive symptoms are measured with the Center for Epidemiologic Studies Depression (CES-D) Scale. The CES-D measure helps to control for any increased propensity to report high psychological demands or low decision latitude by depressed individuals. We also include a measure of the number of life-threatening conditions experienced or treated in

the past 12 months (these included lung disease, heart attack or heart trouble, diabetes, stroke, and cancer) that ranges from 0 to 3 in the analytic sample.

Analytic Strategy

The comparisons of interest in the present analysis are between paid and unpaid women, paid women and paid men, and pooled samples of women and men that include both people working for pay and those who are unpaid workers; these pooled samples capture the full population at risk of work related strain. In the ACL, persons reporting employment as a main activity were asked questions about their paid work if they were working at least 20 hours per week. Individuals who reported that keeping house was their main or one of their main activities were asked the same series of Karasek questions about their unpaid work. A small subsample (N = 215) of women who reported that employment and keeping house were both major activities were asked both sets of questions, so we conducted analyses in several ways to see how these individuals affected the results.[v] We found similar results using analyses that excluded these women, kept them in the paid sample only, or counted them as unpaid workers only, so in the results presented here we have kept these women in both the paid and unpaid samples when they are presented separately, and for the pooled sample of all women we averaged their scores for paid and unpaid work on the psychological demand and decision latitude items to create an averaged paid/unpaid job strain measure.

As a first step, we present percentages, means and standard deviations of job strain measures and all other characteristics, comparing the characteristics of men and women in paid and unpaid work. Next we estimate sex-specific logistic discrete time

hazard models that examine the relative hazard of mortality for those in active, high strain and passive work (compared to those in low strain work) in each year from 1987 through 2002 as a function of age (time-varying) and all other characteristics at baseline. In the multivariate analysis the lag of one year between the collection of information about work and the beginning of follow-up to help to establish working conditions as preceding the processes leading to death. We estimate an identical series of models for four groups: paid women, unpaid women, pooled women (paid and unpaid) and pooled men (paid and unpaid). As there were so few men in the ACL who responded to the unpaid work questions, the results for the multivariate models were unaffected by their inclusion, and we included them in the men's results to make the sample comparable to the pooled women's sample. In Model 1, we include only controls for age, race, and survey year, to test for the overall effect of job strain, while Model 2 adds a set of sociodemographic, health, and health behavior controls to explore possible pathways for the association between job strain and mortality. Model 3 is almost identical to Model 2 with two exceptions: we remove all individuals who have any life-threatening health conditions in 1986 from the analytic sample, and we remove the indicator variable for life-threatening conditions, as all remaining individuals have none. We also estimated a parallel set of models to look at the additive effects of psychological demand, decision latitude, and their component items, and conducted a formal test for the interaction between demands and decision latitude that is posited by the Karasek model.

Results

Distribution of Job Strain and Mortality

The distribution of job strain categories, the scales of decision latitude and psychological demands, and their component items are shown separately for paid and unpaid men and women and for the pooled samples of all men and all women in Table 1. Figures are presented as weighted percentages or means and their associated standard errors, and significance levels for Pearson Chi-square or t-tests for difference are shown for comparisons between (1) paid and unpaid women, (2) paid women and paid men, and (3) the pooled groups of paid/unpaid women and paid/unpaid men. The same set of figures are presented for men doing unpaid work for comparison, but the small number of individuals in this category precludes their inclusion as a distinct group in multivariate analysis. All three sets of comparisons show statistically significant differences in the distribution of job strain. Among women, those in paid work are more likely than unpaid women workers to report active (29% versus 20%) or high strain work (19% versus 10%), less likely to be in low strain positions (29% versus 53%), and slightly more likely to report passive work (23% versus 17%). Among men, those working for pay are more likely than those in unpaid work to be doing active work (30% versus 11%), are about equally likely to report high strain work (20% versus 19%), are less likely to be classified as low strain (31% versus 46%) or to be doing passive work (20% versus 24%). Overall, men and women in the paid labor force have similar distributions across the categories of job strain, while men and women doing unpaid work have more similarity in their reports of job strain than with their counterparts doing work for pay. When all men and women doing either paid or unpaid work are pooled, the distributions by sex are more distinct than when only paid workers are considered; women are less likely than men to report active (25% versus 29%) or high strain work (14% versus 20%) and more likely to report

low strain work (40% versus 31%), while about 20% of women and men report passive work. Table 1 shows support for our first hypothesis; unpaid women workers report significantly greater decision latitude scores than paid women (10.5 versus 9.7) and lower psychological demand scores (3.7 versus 4.4). There is partial support for the second hypothesis, with paid men reporting significantly higher decision latitude scores than paid women (9.9 versus 9.7), but counter to expectation, their reported levels of psychological demands are equivalent to those of paid women (4.4 for both).

The distributions of all other characteristics are shown separately for men and women doing paid and unpaid work in Tables 2 and 3. The risk of mortality varies across job strain categories: about 2% of women doing paid active work died between 1987 and 2002 compared with about 8% of those doing low strain or passive work for pay. Mortality was higher among women doing unpaid work, ranging from about 9-10% of women who reported active or high strain work to 31% of those who reported passive work. The overall risk of death was higher for men; among working men, the percentage who died between 1987 and 2002 ranges from 5% of men in high strain jobs to about 12% of those in low strain and passive work; similarly, among unpaid men, mortality ranges from 8% of those who report high strain to 52% of those in passive work. The figures in Table 2 also show that women doing unpaid work are distinct from those in paid work; most importantly for the present analysis, unpaid women are generally older, more likely to be married, have lower family incomes, poorer self-rated health, more depressive symptoms, and more life-threatening health conditions. These conditions would suggest poorer survival probabilities for unpaid as compared to paid women workers, and may also show selection of women into unpaid work with age and as health

declines. Health differences between those doing paid and unpaid work appear even greater for men than for women, as shown in Table 3, though the small number of unpaid men makes comparisons difficult.

Job Strain and Mortality

Odds ratios and 95% confidence intervals for the risk of mortality are presented for paid and unpaid women in Table 4 and for the pooled samples that include paid/unpaid women or men in Table 5. The likelihood ratio chi-square statistic, its associated degrees of freedom and the pseudo-R^2 value are presented for comparison of models; statistics for Models 1 and 2 can be directly compared, but Model 3 is estimated on a restricted sample and cannot be compared directly to Models 1 or 2. The results in Table 4 show that compared with those who report low strain jobs, paid women in active work have a lower risk of mortality (adj. OR: 0.34), though the effect is significant only at the $p < .10$ level. The survival advantage of women who report active work is no longer significant in Model 2, when differences in income, smoking status, body mass index, and the number of life-threatening health conditions are controlled. Among unpaid women, job strain appears to have stronger effects on mortality risk. In Model 1, unpaid women who report active work have significantly better survival prospects (adj. OR: 0.57) when compared to unpaid women doing low strain work, while those who report passive work have a significantly increased risk of mortality (adj. OR: 1.62). In Model 2, women doing passive work are no longer at significantly increased risk, though the odds ratio remains elevated; the reduction in the effect of passive work is largely accounted for by health and health behaviors, particularly smoking, physical activity, and the number of

life-threatening conditions. Women doing unpaid active work still have significantly reduced risk of mortality (adj. OR: 0.49) in Model 2, and unpaid women who report high strain work have improved survival prospects (adj. OR: 0.55) compared with unpaid women doing low strain work, though this effect is significant only at the $p< .10$ level. Once we control for the greater concentration of women with health problems in the low strain and passive work categories and of relatively healthier women in the active and high strain categories by omitting women with any life-threatening conditions in Model 3, there is no significant difference in mortality risk among either paid or unpaid women, though the pattern of relationships remains similar. Among paid women, the effect associated with passive work increases in size to resemble that for unpaid women, but does not reach statistical significance.

Other important predictors of mortality include age and the number of life-threatening health conditions, which have strong and significant positive effects on the risk of mortality for paid and unpaid women in all relevant models. There is some suggestion that black women are at increased risk of mortality, net of the factors in these models, and that current and former smokers have an increased risk of mortality, though this effect appears stronger for unpaid women. Physical activity decreases the risk of mortality for unpaid but not paid women, while body mass index is positively related to mortality among paid but not unpaid women. Unpaid women also face a greater mortality risk when they have children in the home and when they report poor self-rated health. There is some evidence that marriage reduces survival among paid women while income increases it, though these effects are significant only at the $p<.10$ level and do not persist in Model 3. Overall, these findings counter the expectation of equal effects of job strain

for paid and unpaid women posited in the third hypothesis; effects seem stronger for unpaid women.

Based on the overall pattern of similarities in the effects of job strain for paid and unpaid women, we estimated the same set of models on the pooled sample of all women, with an indicator variable denoting those women who do paid work. We tested for but did not find an interaction between paid/unpaid work status and the job strain categories (results not shown here), providing further support for the similarity in the effects of job strain for all women. We present the models without interactions in Table 5, where the same set of models is estimated on the pooled sample of paid and unpaid men. The results in Table 5 show that passive work carries a significantly higher risk of mortality than low strain work for women overall (adj. OR: 1.41), though the effect is attenuated and no longer statistically significant in Models 2 and 3. There is some suggestion that passive work may also be hazardous for men, but these results do not reach statistical significance. Among women only, active work is associated with a significantly reduced risk of mortality in all models (adj. OR: 0.45-0.56), though the effect is significant at only the $p < .10$ level in Model 3. By contrast, there is no protective effect of active work among the men in this sample. Finally, there is some evidence that high strain work may increase survival chances for women (adj. OR: 0.47 in Model 3) and men (adj. OR: 0.49-0.51), though these effects are significant only at the $p < .10$ level. Controlling for job strain, men doing work for pay have significantly reduced risk of mortality in Model 1 (adj. OR: 0.38), but the effect is no longer significant in Model 2 and only significant at the $p < .10$ level in Model 3. Among women, those doing work for pay have a reduced risk of mortality, but the effect is only apparent in Model 1 and at the $p < .10$ level. This

suggests that for men and especially women, differences in family characteristics, health, and health behaviors between paid and unpaid workers explain a good deal of the difference in their mortality risk, once job strain and other factors are controlled. Among women, models not presented here suggest that most of the mortality difference between paid and unpaid women in this sample is accounted for by the fact that women doing unpaid work are older on average, a compositional effect already controlled in Model 1.

For both women and men, age has a strong and significant positive effect on the risk of mortality, and black women and men have a higher risk of death that reaches statistical significance among women in Model 3 and among men in Model 1, with weaker effects in other models. There are interesting differences by sex in the effects of some characteristics; increases in family income reduce the risk of mortality for men in Model 2, but have no independent effect on women. Among women, the number of children in the home increases the risk of mortality in Model 2 (at the $p < .10$ level), while for men, having children in the home reduces the likelihood of death in Models 2 and 3, though only at the $p < .10$ level in Model 3. Women who are current or former smokers have an elevated risk of mortality in Models 2 and 3; smoking does not significantly affect men, but they experience a significantly greater risk of death with increases in alcohol use in Model 3, an effect not found for women. Physical activity reduces the risk of mortality among women, though the significance of the effect is reduced to the $p < .10$ level in Model 3, but does not have an effect on men's mortality.

Finally, mortality risk increases as women's self-rated health worsens and as the number of life-threatening illnesses they report increases in Model 2. Surprisingly, we find no effect of these conditions among men; examination of the samples suggests that

paid men, who make up the vast majority of the men in this analysis, report similar levels of life-threatening conditions as paid women, but do not appear to suffer the same mortality disadvantage (see Table 4 results for paid women). We examined the individuals in the ACL sample who did not answer questions about paid or unpaid work to see whether men with serious health problems had exited the labor force by 1986 to a greater extent than women with health difficulties. We found that compared to women who did not report on paid or unpaid work, men who were not working were more likely to be retired or permanently disabled, reported lower self-rated health and reported more life-threatening conditions. More strikingly, compared to men who are working, those who were out of the labor force were much older (63 versus 41 years), had lower family income (score of 5 versus 7.8), were more likely to be current or former smokers (74 versus 65%), had lower levels of physical activity (2.9 versus 3.3), had worse self rated health (3 versus 2), and reported more life threatening conditions (0.47 versus 0.07). Furthermore, while about 11% of men doing some kind of work in 1986 died by 2002, the same figure for men out of the labor force was 60%. While there are differences in health between women in the paid or unpaid labor force and those who do not report any paid or unpaid work, these are not as stark as the differences for men; compared to women who reported about their paid or unpaid working conditions, those who were out of the labor force in 1986 report more life threatening conditions (0.35 versus 0.16) and were more likely to die by 2002 (37 versus 13%). Overall, comparison of the results for the pooled samples of men and women suggests that counter to our fourth hypothesis, job strain appears to have a greater influence on the mortality of women than men. As we have seen from the comparison of paid and unpaid women in Table 4 and the descriptive

comparison of individuals in and out of the labor force above, the bulk of the female mortality disadvantage is driven by the greater likelihood of women with health problems to be doing work of some kind (often unpaid) than their male counterparts, and the apparent greater sensitivity of unpaid women to their working conditions. We found partial support for the fifth hypothesis, as passive work appears to be a risk factor for mortality among women, particularly those doing unpaid work; these results are strengthened when we estimate models that use active work as the reference category, the more natural counterpart to passive work. However, counter to the strain hypothesis, we found no evidence that high strain work increases the risk of mortality. In fact, these results suggest that people reporting high strain work may have improved survival compared to those who report low strain.

To better understand these effects of job strain, we estimated the same set of models, this time replacing the four category measure of job strain with separate linear indicators of psychological demands and decision latitude, and we estimated an additional set of models that looked separately at each individual component item used to construct the indices of demands and control. We also conducted a formal test for the interaction between high demands and low control posited by Karasek's strain hypothesis, by estimating a model that contained linear terms for demands and control (each centered on the grand sample mean) and an interaction term between demands and control. The results of these models are presented in Tables 6 for paid and unpaid women and in Table 7 for the pooled samples for women and men. Table 6 shows that among paid and unpaid women, the additive effect of psychological demands appears to exercise the strongest influence on mortality, and that in our study, increased demands reduce the

risk of death. The linear term for psychological demands is significantly negatively related to mortality in all models for unpaid women, and the component items (not enough time to get work done, not free from conflicting demands) are each negative related to mortality in nearly all the models considered. Among paid women, the effects are weaker, but generally similar to those found for unpaid women. An increase in control protects unpaid women from the risk of mortality in Model 1, but the effect is not significant in Models 2 or 3. The only component of the decision latitude scale that reaches statistical significance for paid women is the measure of having a chance to decide how to do work, in Model 2. For unpaid women, this item is significantly related to mortality in Model 1. The formal models for interaction at the bottom of Table 6 show that for women, demands and control have only additive effects; for unpaid women, the linear term for psychological demands is significant in all models and for paid women, it is significant at the $p < .10$ level in Model 1. Decision latitude is significantly negatively related to mortality among unpaid women in Model 1, but there are no significant interactions between demands and control for unpaid or paid women.

By contrast, the results for the pooled sample of men in Table 7 show a lack of independent additive effects of demands or control, with the exception of a weak negative relationship between psychological demands and mortality in the model testing for interaction. However, the formal test for interaction shows that as demands and control increase together, the risk of mortality rises. This interactive effect is robust to the addition of controls in Model 2, but weakened slightly in Model 3. When paid and unpaid women are pooled, the additive, protective effect of demands is strengthened, and is driven mainly by the item that identifies women who don't have enough time to get all

their work done. There is a weak protective effect of decision latitude and the component item for the scale that measures the respondent's chance to decide how to do work, but only in Model 1. Again, among women there are no interactive effects of psychological demands and decision latitude.

To more clearly convey these findings, in Figure 1 we graph the predicted survival of individuals between 1987 and 2002 by job strain category, based on the results from Model 3. These predicted results exclude individuals with any life-threatening health conditions at baseline, thus representing the effects of job strain while employing the strongest control for health selection used in this analysis. Figure 1 shows that the predicted survival of paid women and paid/unpaid men are similarly high, with no significant differences by job strain category, though the patterns appear to differ slightly; paid women doing passive work appear to be at greatest risk, while among men, those in high strain work appear to have a slightly lower risk of death than other groups. The figure for unpaid women shows the poorer survival prospects of this group overall, and the enhanced survival for those in active and high strain work compared to those in low strain and passive work. Comparing the predicted survival for the pooled sample of women with survival for the pooled male sample shows that women in passive and low strain work have slightly poorer survival prospects compared to men's, while those in active or high strain work appear to have a similar mortality profile to that of men in high strain work.

There are clear indications throughout the analysis that health selection: (1) of unhealthy men out of the paid/unpaid labor force, and (2) of unhealthy women into unpaid work and out of the labor force altogether, plays an important role in the

relationship between job strain and mortality. To further illustrate the potential impact of health selection on our results, in Figure 2 we compare the predicted survival of individuals in active and passive work, with that of individuals who are not doing any paid or unpaid work. To obtain the survival results for people out of the labor force, we estimated Model 2 separately for the men and women who did not report doing work for pay or keeping house as their main activity in 1986, and calculated predicted survival in the same way as for working men and women. Figure 2 shows that women out of the labor force have considerably poorer survival prospects compared to paid women in active or passive work, even after controlling for sociodemographic and health characteristics. By contrast, the predicted survival of unpaid women doing active work is better than that for women out of the labor force, but unpaid women doing passive work have poorer survival prospects than women who are not working at all. This finding is due to the nontrivial proportion of women who were not doing paid or unpaid work, but who were young and healthy individuals looking for a job or fulfilling child care responsibilities and did not consider keeping house to be their primary activity. When we pool paid and unpaid women, those doing any kind of work have a lower risk of mortality than those who are not, but passive work appears to be more risky than active work. The pooled male sample provides a stark contrast to the pooled sample of women; employed men have much better survival probabilities than those out of the labor force, regardless of job strain characteristics, and even adjusting for the effects of serious health problems and all the other factors included in this analysis.

Discussion

The results of this analysis both support and oppose existing evidence for the relationship between job strain and health and mortality. Consistent with other studies, we find that there is stratification by sex and by paid/unpaid work status in the work characteristics that define job strain; unpaid women report higher control and lower demands than their paid counterparts, and paid men have more control at work than paid women. Also, there is some indication that passive work is harmful for women, particularly the unpaid, but this relationship is weakened when we control for health selection; women with health problems were more likely that healthy women to report that their work was characterized by low demands and low decision latitude. Counter to our expectations, though, we found that health selection and differences in sociodemographic characteristics, particularly age, failed to completely explain differences among paid and unpaid women in the strength of the association between job strain and mortality. While the pattern of effects appears to be similar for paid and unpaid women, particularly for active and high strain work, job strain has a stronger impact on mortality among unpaid women. Also, we did not find that men's mortality is more sensitive to job strain; instead, we find stronger effects of job strain for women, most notably for the protective effects of active work among paid and unpaid women. Finally, we found no support for increased risk of mortality among high strain workers; in fact, these individuals had better survival prospects than those in low strain positions.

The finding that passive work is associated with an increased risk of mortality while active work is linked to better survival supports a less-tested hypothesis of the Karasek model that emphasizes the health-enhancing effects of learning new patterns of behavior and skills in active as compared to passive work. These findings are also in

agreement with social-psychological studies that show positive relationships between mental health and occupational self-direction or substantive complexity, the kinds of characteristics exemplified by active work (Kohn and Schooler 1982; Kohn and Schooler 1983; Lennon 1994). The contradiction in the present study is that while analyses of occupational self-direction and health generally posit that the health benefits of substantively complex work are due to the associated sense of control for the worker, the results presented here are driven not by control, but by demands. Our finding for the health enhancing effects of active work for women and of high strain work for women and men is the product of two unexpected relationships in the data: control had only limited protective effects, and demands reduced, rather than increased, the risk of mortality.

There is evidence from a handful of studies for a protective effect of demands (Alterman et al. 1994; Hltatky et al. 1995; Steenland, Johnson and Nowlin 1997), though none of these analyses considered mortality as an outcome. In general, however, such results contrast with the majority of the empirical evidence, which shows a stronger role for job control and negative effects of high demands. There are several plausible reasons why healthier people would report greater demands at work: reported demands may simply be reflecting socioeconomic position if in this population higher status jobs are more demanding (Macleod et al. 2001); this indicator of demands may be capturing something other than what was originally intended – demands for fast-paced performance (Steenland, Johnson and Nowlin 1997); and/or there may be something about demands as demands that promotes health. We find some support for the confounding influence of socioeconomic position; in analyses not shown here, we found that psychological

demands are positively correlated with both income and education in our sample, but that the correlation coefficients are not large, ranging from about .17 to .26. Decision latitude is also positively correlated with income and education, but no more strongly than the measure of demands. To control for the relationship between socioeconomic position, demands and control, the multivariate models presented here control for family income, and we find the effects of job strain do not change when an indicator of respondent's educational attainment is included (results not shown). We also attempted to estimate the models on samples stratified by a categorical indicator of socioeconomic position (high versus low), but the small number of deaths among paid men and women men led to unreliable results.

Suspecting that our measure of demands is actually indicating jobs that have high levels of decision latitude, we imputed a measure of substantive complexity from the Dictionary of Occupational Titles (DOT) for all the paid workers in the ACL sample, based on their three-digit census occupation code in 1986. We found that self-reported demands and imputed substantive complexity are positively correlated (coefficients range from .23 to .27 for men and women), and that people who report active work have the highest imputed scores for substantive complexity, while those in passive work have the lowest complexity. Furthermore, when substituting these imputed measures of substantive complexity for each individual's self-reported psychological demand score in the same multivariate models discussed above, we found that the two indicators had almost identical effects on the risk of mortality. In other words, the measure of psychological demands used in the present analysis appears to be behaving very similarly to an imputed measure of substantive complexity, which has been used in other studies as

a measure of control at work. Finally, demanding work performed under time pressure may actually have some health promoting effects, especially for women. [Need a small blurb about good stress here]. All in all, while we add to exiting evidence that demands and control are distributed unequally by socioeconomic position [citations], our attempts to control for some aspects of socioeconomic standing reveal persisting independent effects of substantive working conditions.

While viewing demands as more protective than damaging helps to explain the results we find for women, there are relatively small direct effects of demands on the risk of mortality among men in this study; furthermore, we find that while active work is not protective for men, high strain appears to enhance survival. There are several factors that may explain the differences between men and women in the effects of job strain, including differential health-based selection out of the labor force; distinctive experiences of the men reporting active work in 1986; the reliance on a single measure of job strain; and/or too few deaths among working men over follow-up. We discuss each of these explanatory factors in turn. First, this analysis has shown that health selection is a key component of the relationship between stressful working conditions and mortality. We find that women with serious health problems are more likely than their male counterparts to report that they are working, but they are likely to be performing unpaid work. This is not surprising, given that unpaid household work is a socially-sanctioned female role with no normative "retirement age," and the relative unhealthiness of this group helps to explain the more robust relationship between job strain and mortality that we find for unpaid women relative to their paid counterparts over the fifteen year follow-up. By contrast, keeping house is not a male-typical role and does not appear to be a

common alternative for those men who leave work for health reasons. Men with serious health problems are absent from this analysis, and if the Karasek strain hypothesis is correct, men working under high strain conditions would be most likely to have serious health problems and to have stopped working before 1986, leaving a healthier-than-average group of men working under high strain conditions, relative to people in active, low strain, or passive work. Exit from the labor force continued to be higher among high strain workers over follow-up; we found that 88% of men reporting active work in 1986 were still working eight years later, compared with only 80% of men in high strain work, 80% in low strain work, and 81% in passive work. If the least healthy individuals were leaving at greater rates in other groups, mortality would appear relatively high among men who report active work conditions.

Another possibility is that men who reported active work in 1986 were distinctive, and had work experiences that impacted negatively on their health. We examined the job titles of individuals in each job strain category and found that, contrary to the case for paid women, there appeared to be a distinction in the kinds of jobs performed by men who reported active work, as compared to men in other job strain categories. Although the modal category in each job strain category except passive work was "managers and administrators, not elsewhere classified," a very common job title for men, a full third of men in active work were in management positions in 1986, compared with 13% of those in high strain work, 22% in low strain work, and 10% in passive work. More strikingly, a full 60% of men in active work were in professional or managerial positions, compared to 34% of those in high strain work, 39% in low strain work, and 15% in passive work. The fortunes of white collar workers took a turn for the worse in the late 1980s and 1990s,

with greater threats of job loss than were typical for this group. Such experiences may have left a mark on the health of men in active work at the time. The situation for women is quite different; due to labor market stratification on the basis of sex and the more limited range of occupations that women typically enter, there is less distinction across categories in the types of jobs women hold. This means that there may be more generalizable features of "good work" among women than among men.

The present analysis has several shortcomings; first, measuring job strain at one point in time is not ideal; to include unpaid workers in this analysis, we were limited to looking at working conditions in 1986 only, the year that people keeping house were asked about their work. However, working conditions are not stable over time, and cumulative measures of working experiences might change our results; specifically, the possibility that men transfer out of high strain work into other kinds of work as they age or develop health problems means that one-time measures are limited. On the other hand, self-reports of demand and control may change over time even among people who continue to hold the same job, so multiple self-report measures are not a panacea. Rather, careful attention over time to both self-reported working conditions and objective indicators of possible changes in work, such as job titles or markers of job leaving, would greatly enhance the reliability and interpretability of future studies of job strain. Also, it is not clear what the optimal follow-up time is for a study of job strain and mortality; in this analysis we used a fifteen year window, but death rates among paid workers are low, and we did not have a large number of deaths to study. Simpler logistic regression models of the odds of death any time during follow up produced results identical to those discussed here, so we are reassured that our results are robust. Future work, however, should

examine the optimal time frame over which to observe sufficient mortality to obtain robust results, but during which past working experiences continue to exert an effect in the development of health problems.

Taken together, our findings suggest that while substantive working conditions appear to have an important impact on mortality, the classic operationalization of Karasek's job strain model may not well capture the experiences of U.S. workers. We find that the effects of working are similar for women in conventional paid work as well as for women doing unpaid work in the household, and that demands and challenge at work, while reflecting more advantaged structural positions in the occupational hierarchy, may also have independent positive effects for the health of men and women.

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Table 1. Distribution of job strain and components

	Paid women	Unpaid women	X^2 or t-test paid women vs. unpaid women	Paid men	X^2 or t-test paid women vs paid men	Unpaid men	Pooled Samples: Paid and unpaid women	Pooled Samples: Paid and unpaid men	Pooled Samples: X^2 or t-test all women vs. all men
Job Strain			p = <.001		p = .048				p = <.001
% Active work	28.7	19.5		29.7		11.3	24.6	28.9	
% High Strain	19.4	10.1		20.1		18.9	14.4	19.6	
% Low strain	28.6	53.3		30.7		45.5	40.2	31.4	
% Passive work	23.3	17.1		19.5		24.3	20.8	20.1	
Psychological demands (Range: 2 (low) – 8 (high))	4.43 (1.46)	3.68 (1.54)	p = <.001	4.44 (1.50)	p =.656	3.66 (1.79)	4.02 (1.49)	4.39 (1.50)	p = <.001
Component Items: Psychological Demands[a]									
I don't have enough time to get my household work done	1.89 (0.87)	1.73 (0.92)	p = <.001	1.96 (0.89)	p = .119	1.92 (1.10)	1.77 (0.85)	1.95 (0.89)	p = <.001
I am not free from conflicting demands that others make	2.55 (0.95)	1.95 (0.98)	p = <.001	2.48 (0.95)	p = .487	1.74 (1.02)	2.25 (0.99)	2.45 (0.95)	p = <.001
Decision Latitude (Range: 3 (low) – 12 (high)	9.73 (2.00)	10.5 (1.61)	p = <.001	9.93 (1.99)	p = .002	9.75 (2.05)	10.1 (1.80)	9.96 (1.93)	p = .005
Component Items: Decision Latitude[a]									
I have a chance to decide how I do my household work	3.10 (1.00)	3.37 (0.97)	p = <.001	3.14 (0.99)	p = .082	3.10 (1.02)	3.24 (0.97)	3.15 (0.96)	p = .022
I get to do a variety of things in my household work	3.50 (0.74)	3.45 (0.79)	p = .928	3.57 (0.76)	p = .009	3.23 (0.80)	3.47 (0.74)	3.56 (0.74)	p = .004
I have a lot of say about what happens in my household work	3.13 (0.94)	3.72 (0.61)	p = <.001	3.22 (0.88)	p = .010	3.43 (0.92)	3.41 (0.84)	3.24 (0.85)	p = <.001
N	797	1,045		818		72	1,662	855	

Note: Pearson Chi-square tests performed to test for difference in the distribution of job strain categories, t-tests used to test for difference in means of all other items. Percentages, means and standard deviations are based on weighted data, while Ns are unweighted.

a. Component items are coded using a four item Likert scale: 1 = strongly disagree, 2 = disagree somewhat, 3 = agree somewhat, 4 = strongly agree.

Table 2. Descriptive Statistics among Women in Paid and Unpaid Work by Category of Job Strain, 1986.

	Women in Paid Work				Women in Unpaid Work			
	AW	HS	LS	PW	AW	HS	LS	PW
% Dead by 2002	1.8	3.4	8.0	8.1	8.7	9.6	22.7	30.8
Number of Deaths	6	10	25	28	32	14	195	81
Age in 1986	38.4	38.4	42.2	43.6	45.1	42.1	52.5	52.2
	(10.3)	(11.2)	(11.7)	(11.3)	(15.7)	(15.8)	(17.5)	(16.9)
% Black	7.1	15.8	13.1	15.3	7.4	11.4	9.2	12.8
% Currently Married	62.8	63.0	67.8	68.0	78.8	74.9	68.7	65.5
Family Income	8.17	7.44	7.42	6.93	6.68	6.01	5.28	4.40
	(2.43)	(2.70)	(2.92)	(2.83)	(3.09)	(2.94)	(3.05)	(2.90)
Number of children in the home (Range: 0 – 7)	0.99	1.03	1.23	1.31	1.43	1.54	0.94	1.14
	(1.08)	(1.12)	(1.18)	(1.19)	(1.25)	(1.45)	(1.20)	(1.39)
% Current or Former Smoker	54.4	47.2	52.7	47.9	44.8	38.4	51.2	47.7
Alcoholic Drinks in Past Month (0 = none, 1 = 1-89, 2 = 90+)	0.70	0.55	0.57	0.48	0.56	0.51	0.40	0.33
	(0.46)	(0.51)	(0.50)	(0.50)	(0.50)	(0.51)	(0.51)	(0.48)
Physical Activity Category (1 = low quintile, 5 = high quintile)	3.19	2.81	3.11	3.01	3.00	2.71	2.92	2.50
	(1.30)	(1.40)	(1.40)	(1.43)	(1.38)	(1.26)	(1.43)	(1.43)
Body Mass Index (~13-55)	23.9	25.1	24.9	24.9	24.7	24.9	25.2	26.5
	(4.59)	(4.78)	(4.98)	(4.43)	(4.80)	(4.61)	(5.28)	(5.62)
Self-Rated Health (1=excellent, 5=poor)	1.89	2.12	2.03	2.17	2.31	2.68	2.40	2.85
	(0.85)	(0.86)	(0.88)	(0.96)	(1.03)	(0.99)	(1.08)	(1.09)
CES-D Score (~-1.1 – 4.5)	-0.04	0.39	-0.18	0.10	-0.06	0.71	-0.12	0.46
	(1.08)	(1.10)	(1.00)	(0.99)	(0.89)	(1.13)	(0.99)	(0.99)
Number of Life-threatening conditions (0-3)	0.07	0.06	0.12	0.08	0.17	0.12	0.21	0.32
	(0.26)	(0.27)	(0.22)	(0.32)	(0.52)	(0.35)	(0.49)	(0.64)
N	185	168	234	210	170	86	584	203

Note: Job strain categories are labeled as follows: AW = Active work, HS = High strain, LS = Low strain, and PW = Passive work. Percentages, means and standard deviations are based on weighted data, while Ns are unweighted.

Table 3. Descriptive Statistics among Men in Paid and Unpaid Work by Category of Job Strain, 1986.

	Men in Paid Work				Men in Unpaid Work			
	AW	HS	LS	PW	AW	HS	LS	PW
% Dead by 2002	10.2	4.9	11.6	12.0	35.4	8.2	42.8	51.9
Number of Deaths	25	13	51	30	2	1	20	12
Age in 1986	40.4	38.3	41.9	39.0	40.5	39.7	46.3	55.9
	(10.7)	(11.2)	(11.9)	(11.1)	(14.2)	(12.5)	(17.7)	(18.3)
% Black	7.7	8.9	9.6	15.3	10.1	13.8	12.0	15.7
% Currently Married	82.5	71.2	79.1	72.7	46.0	57.6	27.3	40.7
Family Income	8.96	7.42	8.00	6.81	6.35	7.23	4.82	3.52
	(2.52)	(2.83)	(2.59)	(2.96)	(2.46)	(3.44)	(2.77)	(2.94)
Number of children in the home (Range: 0 – 7)	1.25	1.09	1.08	1.40	0.94	1.36	0.82	0.56
	(1.19)	(1.17)	(1.18)	(1.40)	(1.01)	(1.15)	(1.90)	(0.98)
% Current or Former Smoker	60.7	65.1	65.0	68.3	94.6	87.2	68.4	73.5
Alcoholic Drinks in Past Month (0 = none, 1 = 1-89, 2 = 90+)	0.89	0.85	0.90	0.74	0.91	0.89	0.97	0.39
	(0.51)	(0.58)	(0.57)	(0.58)	(0.31)	(0.54)	(0.63)	(0.50)
Physical Activity Category (1 = low quintile, 5 = high quintile)	3.30	3.44	3.32	3.19	2.70	3.10	2.94	3.17
	(1.28)	(1.29)	(1.38)	(1.43)	(1.43)	(1.22)	(1.13)	(1.54)
Body Mass Index (~13-55)	26.4	25.8	26.1	26.1	25.1	25.9	24.3	25.2
	(4.17)	(4.07)	(3.80)	(4.26)	(3.67)	(4.86)	(3.73)	(3.67)
Self-Rated Health (1=excellent, 5=poor)	2.04	2.00	1.82	2.06	1.43	2.64	2.20	2.63
	(0.87)	(0.89)	(0.82)	(0.97)	(0.83)	(1.03)	(1.17)	(1.10)
CES-D Score (~-1.1 – 4.5)	-0.21	0.11	-0.44	-0.02	1.12	0.22	0.14	0.15
	(0.77)	(0.97)	(0.71)	(0.97)	(1.20)	(1.21)	(1.03)	(0.85)
Number of Life-threatening conditions (0-3)	0.07	0.10	0.05	0.05	0.04	0.0	0.36	0.38
	(0.25)	(0.32)	(0.22)	(0.24)	(0.20)	(0.0)	(0.51)	(0.71)
N	216	157	269	176	6	10	36	20

Note: Job strain categories are labeled as follows: AW = Active work, HS = High strain, LS = Low strain, and PW = Passive work. Percentages, means and standard deviations are based on weighted data, while Ns are unweighted.

Table 4. Results of Discrete Time Hazard Rate Models of Mortality for Women in Paid and Unpaid Work.

	Women in Paid Work			Women in Unpaid Work		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Person-years	12,279	12,279	11,160	14,500	14,500	11,677
Job Strain (reference = Low Strain)						
Active work	0.34† (0.11-1.02)	0.44 (0.14-1.36)	0.56 (0.15-2.09)	0.57* (0.34-0.95)	0.49* (0.29-0.83)	0.64 (0.34-1.20)
High strain	0.61 (0.23-1.63)	0.82 (0.30-2.28)	0.29 (0.04-1.91)	0.75 (0.38-1.47)	0.55† (0.27-1.11)	0.54 (0.21-1.38)
Passive work	0.97 (0.48-1.93)	1.09 (0.52-2.27)	1.57 (0.63-3.94)	1.62** (1.16-2.27)	1.28 (0.91-1.83)	1.18 (0.72-1.93)
Age in years	1.10*** (1.07-1.13)	1.09*** (1.06-1.13)	1.11*** (1.06-1.16)	1.09*** (1.08-1.10)	1.09*** (1.08-1.11)	1.10*** (1.08-1.12)
Black	1.43 (0.62-3.32)	1.16 (0.44-3.07)	2.88† (0.96-8.59)	1.47† (0.94-2.31)	1.11 (0.68-1.81)	1.66 (0.88-3.13)
Study year (starting in 1987)	0.94† (0.88-1.01)	0.96 (0.90-1.04)	0.98 (0.89-1.08)	0.99 (0.96-1.02)	1.00 (0.97-1.04)	1.00 (0.96-1.05)
Currently married	—	2.34† (1.00-5.51)	1.98 (0.66-5.92)	—	0.85 (0.55-1.31)	0.96 (0.55-1.69)
Family Income	—	0.89† (0.78-1.02)	0.94 (0.79-1.12)	—	1.00 (0.92-1.09)	0.99 (0.89-1.09)
Number of children living in the home	—	0.97 (0.69-1.37)	0.73 (0.43-1.22)	—	1.25* (1.05-1.48)	1.18 (0.94-1.48)
Current or former smoker	—	1.76† (0.90-3.43)	1.73 (0.75-4.02)	—	1.70** (1.25-2.32)	1.73** (1.15-2.62)
Alcohol use	—	1.10 (0.58-2.06)	1.17 (0.51-2.71)	—	0.72† (0.51-1.02)	0.89 (0.58-1.35)
Physical Activity	—	1.07 (0.85-1.35)	1.14 (0.85-1.54)	—	0.83** (0.74-0.94)	0.83* (0.71-0.97)

Table continued below.

Table 4, Continued. Results of Discrete Time Hazard Rate Models of Mortality for Women in Paid and Unpaid Work.

	Women in Paid Work			Women in Unpaid Work		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Body Mass Index	—	1.08* (1.00-1.15)	0.98 (0.89-1.09)	—	0.98 (0.95-1.01)	0.98 (0.94-1.02)
Self Rated Health	—	1.10 (0.74-1.64)	1.23 (0.75-2.01)	—	1.25** (1.06-1.46)	1.21† (0.98-1.48)
CESD score	—	0.77 (0.53-1.13)	0.84 (0.52-1.37)	—	1.03 (0.87-1.23)	1.06 (0.84-1.33)
# Life Threatening Conditions	—	2.49** (1.46-4.27)	—	—	1.61*** (1.29-2.01)	—
LR Chi^2 (d.f.)	72.4 (6)	99.7 (16)	61.1 (15)	332.6 (6)	413.3 (16)	246.3 (15)
Pseudo R^2	0.129	0.178	0.171	0.158	0.197	0.192

Note: † p<0.10, * p<.05, ** p<.01, *** p<.001

Table 5. Results of Discrete Time Hazard Rate Models of Mortality for Men and Women in Paid Work and Unpaid Work.

	Women in Paid and Unpaid Work			Men in Paid and Unpaid Work		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Person-years	24,018	24,018	20,256	12,619	12,619	11,633
Job Strain (reference = Low Strain)						
Active work	0.49** (0.29-0.81)	0.45** (0.27-0.74)	0.56† (0.30-1.04)	1.09 (0.63-1.86)	1.21 (0.70-2.11)	1.17 (0.63-2.17)
High strain	0.79 (0.45-1.38)	0.68 (0.38-1.21)	0.47† (0.20-1.10)	0.51† (0.23-1.13)	0.49† (0.22-1.12)	0.52 (0.21-1.29)
Passive work	1.41* (1.02-1.95)	1.16 (0.83-1.61)	1.24 (0.80-1.92)	1.35 (0.79-2.29)	1.37 (0.79-2.39)	1.39 (0.75-2.60)
Doing work for pay	0.70† (0.48-1.03)	0.91 (0.60-1.38)	0.69 (0.40-1.20)	0.38* (0.18-0.81)	0.53 (0.24-1.18)	0.39† (0.14-1.06)
Age in years	1.09*** (1.08-1.10)	1.09*** (1.07-1.11)	1.09*** (1.07-1.12)	1.09*** (1.07-1.11)	1.08*** (1.06-1.10)	1.07*** (1.05-1.10)
Black	1.50† (0.99-2.28)	1.24 (0.79-1.95)	1.83* (1.04-3.20)	1.85* (1.07-3.21)	1.66† (0.94-2.92)	1.84† (0.98-3.45)
Study year (starting in 1987)	0.98 (0.95-1.01)	0.99 (0.96-1.03)	1.00 (0.96-1.05)	0.99 (0.94-1.03)	1.00 (0.95-1.05)	0.99 (0.94-1.05)
Currently married	—	0.99 (0.66-1.51)	1.08 (0.63-1.83)	—	1.01 (0.56-1.85)	1.06 (0.52-2.13)
Family Income	—	0.97 (0.90-1.05)	0.97 (0.89-1.07)	—	0.92† (0.85-1.01)	0.93 (0.84-1.02)
Number of children living in the home	—	1.16† (0.99-1.36)	1.09 (0.88-1.36)	—	0.77* (0.60-1.00)	0.76† (0.58-1.01)
Current or former smoker	—	1.74*** (1.30-2.33)	1.78** (1.21-2.61)	—	1.44 (0.85-2.46)	1.37 (0.76-2.45)
Alcohol use	—	0.78 (0.57-1.07)	0.85 (0.58-1.26)	—	1.40† (0.97-2.03)	1.63* (1.09-2.44)

Table continued below.

Table 5, Continued. Results of Discrete Time Hazard Rate Models of Mortality for Women and Men in Paid Work and Unpaid Work.

	Women in Paid and Unpaid Work			Men in Paid and Unpaid Work		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Physical Activity	—	0.88* (0.79-0.98)	0.88† (0.77-1.02)	—	1.01 (0.96-1.06)	0.96 (0.80-1.15)
Body Mass Index	—	0.99 (0.96-1.01)	0.97 (0.93-1.01)	—	0.99 (0.93-1.04)	1.03 (0.97-1.09)
Self Rated Health	—	1.21* (1.03-1.41)	1.17 (0.96-1.43)	—	1.04 (0.83-1.31)	1.06 (0.82-1.37)
CESD score	—	0.95 (0.81-1.13)	1.00 (0.81-1.25)	—	1.02 (0.78-1.33)	0.91 (0.66-1.26)
# Life Threatening Conditions	—	1.68*** (1.36-2.08)	—	—	1.09 (0.65-1.82)	—
LR Chi^2 (d.f.)	440.1 (7)	512.5 (17)	317.8 (16)	145.0 (7)	163.8 (17)	125.3 (16)
Pseudo R^2	0.179	0.208	0.206	0.134	0.151	0.142

Note: † p <0.10, * p<.05, ** p<.01, *** p<.001

Table 6. Results of Discrete Time Hazard Rate Models of Mortality by Working Conditions for Women in Paid and Unpaid Work.

	Women in Paid Work			Women in Unpaid Work		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Person-years	12,279	12,279	11,160	14,500	14,500	11,677
Psychological Demands	0.80† (0.63-1.02)	0.93 (0.72-1.19)	0.80 (0.58-1.10)	0.81** (0.72-0.91)	0.79*** (0.70-0.89)	0.83* (0.71-0.97)
Component Items: Psychological Demands						
I don't have enough time to get my work done	0.55* (0.34-0.89)	0.67 (0.41-1.11)	0.48* (0.24-0.96)	0.73** (0.59-0.90)	0.72** (0.58-0.90)	0.70* (0.52-0.95)
I am not free from conflicting demands that others make	0.91 (0.65-1.26)	1.06 (0.76-1.48)	0.95 (0.62-1.47)	0.82* (0.69-0.96)	0.78** (0.66-0.92)	0.88 (0.72-1.09)
Decision Latitude	0.93 (0.80-1.08)	0.90 (0.76-1.06)	0.93 (0.76-1.14)	0.91† (0.83-1.00)	0.98 (0.89-1.08)	1.01 (0.89-1.15)
Component Items: Decision Latitude						
I have a chance to decide how I do my work	0.80 (0.61-1.05)	0.73* (0.55-0.97)	0.75 (0.52-1.08)	0.87* (0.76-1.00)	0.93 (0.81-1.08)	0.93 (0.76-1.13)
I get to do a variety of things in my work	0.96 (0.67-1.39)	0.99 (0.68-1.44)	0.90 (0.57-1.43)	0.94 (0.78-1.13)	1.07 (0.89-1.30)	1.19 (0.91-1.55)
I have a lot of say about what happens in my work	1.01 (0.72-1.42)	1.00 (0.71-1.41)	1.19 (0.75-1.88)	0.91 (0.72-1.16)	0.94 (0.73-1.21)	0.98 (0.69-1.40)
Model Testing for Interaction[a]						
Psychological demands	0.79† (0.62-1.01)	0.91 (0.71-1.18)	0.81 (0.58-1.13)	0.79*** (0.70-0.89)	0.78*** (0.69-0.88)	0.83* (0.70-0.98)
Decision Latitude	0.92 (0.78-1.09)	0.89 (0.75-1.06)	1.00 (0.78-1.28)	0.88* (0.79-0.97)	0.94 (0.85-1.05)	0.97 (0.84-1.12)
Interaction between PD and DL	0.99 (0.89-1.11)	0.99 (0.88-1.10)	1.09 (0.94-1.25)	0.99 (0.92-1.06)	0.99 (0.92-1.06)	0.99 (0.89-1.09)

Note: † p <0.10, * p<.05, ** p<.01, *** p<.001

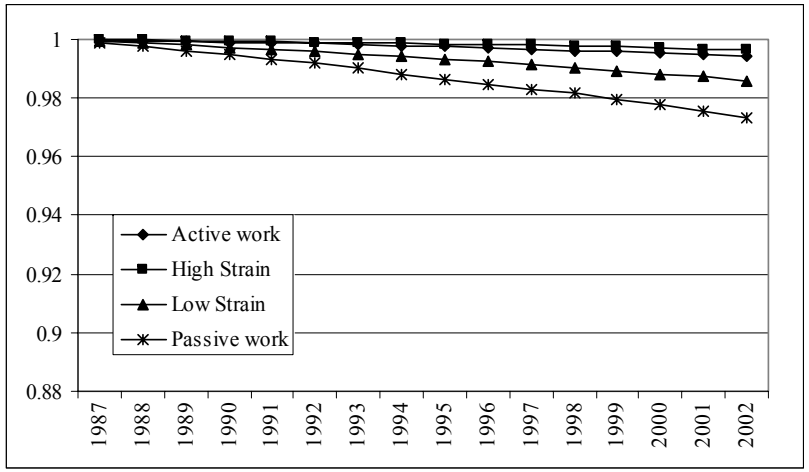
a. We formally test for interaction between psychological demands and decision latitude by estimating a model that includes three terms: a centered linear term for psychological demands, a centered linear term for decision latitude, and an interaction of the two centered linear terms.

Table 7. Results of Discrete Time Hazard Rate Models of Mortality by Working Conditions for Women and Men in Paid and Unpaid Work.

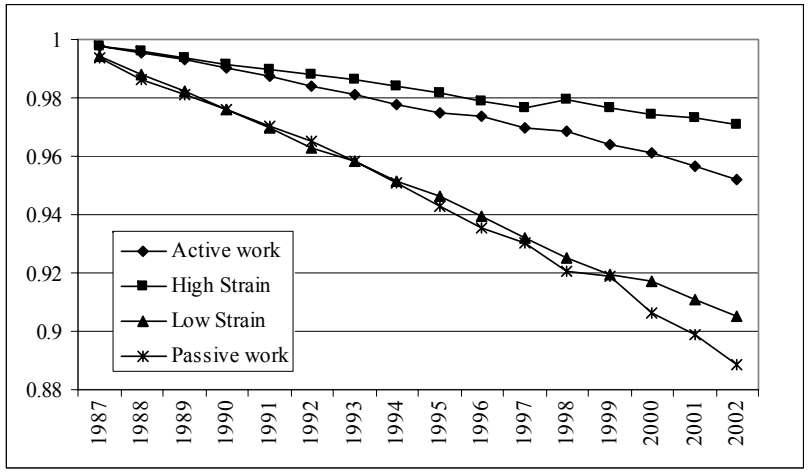
	Women in Paid and Unpaid Work			Men in Paid and Unpaid Work		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Person-years	24,018	24,018	20,256	12,619	12,619	11,633
Psychological demands	0.81*** (0.72-0.91)	0.81*** (0.72-0.91)	0.82* (0.70-0.96)	0.91 (0.79-1.05)	0.92 (0.80-1.07)	0.93 (0.79-1.08)
Component Items: Psychological Demands						
I don't have enough time to get my work done	0.66*** (0.53-0.83)	0.68** (0.54-0.85)	0.61** (0.45-0.84)	0.94 (0.73-1.20)	0.96 (0.75-1.22)	0.94 (0.72-1.24)
I am not free from conflicting demands that others make	0.84* (0.72-0.98)	0.83* (0.72-0.97)	0.91 (0.75-1.10)	0.85 (0.68-1.05)	0.85 (0.69-1.07)	0.87 (0.68-1.11)
Decision Latitude	0.92† (0.85-1.01)	0.97 (0.89-1.06)	0.98 (0.87-1.09)	1.01 (0.91-1.14)	1.04 (0.92-1.17)	1.03 (0.89-1.18)
Component Items: Decision Latitude						
I have a chance to decide how I do my work	0.88† (0.77-1.00)	0.91 (0.80-1.04)	0.88 (0.74-1.05)	1.04 (0.85-1.29)	1.09 (0.87-1.35)	1.08 (0.83-1.39)
I get to do a variety of things in my work	0.93 (0.78-1.12)	1.05 (0.88-1.26)	1.08 (0.85-1.39)	1.00 (0.74-1.35)	1.03 (0.76-1.39)	1.04 (0.73-1.47)
I have a lot of say about what happens in my work	0.95 (0.78-1.17)	0.96 (0.78-1.19)	1.04 (0.78-1.38)	1.00 (0.77-1.30)	1.06 (0.81-1.40)	0.99 (0.73-1.35)
Model Testing for Interaction[a]						
Psychological demands	0.78*** (0.69-0.87)	0.80*** (0.71-0.90)	0.79** (0.67-0.92)	0.87† (0.75-1.01)	0.89 (0.77-1.04)	0.90 (0.76-1.06)
Decision Latitude	0.91† (0.83-1.01)	0.93 (0.84-1.03)	1.00 (0.87-1.15)	1.02 (0.91-1.15)	1.06 (0.94-1.20)	1.03 (0.90-1.19)
Interaction between PD and DL	1.00 (0.94-1.06)	0.98 (0.92-1.04)	1.04 (0.95-1.13)	1.09* (1.00-1.18)	1.10* (1.01-1.19)	1.09† (0.99-1.20)

Note: † p <0.10, * p<.05, ** p<.01, *** p<.001

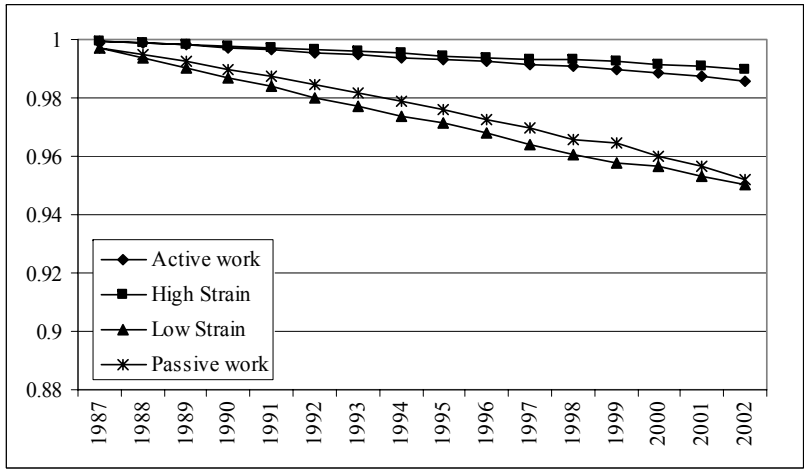
a. We formally test for interaction between psychological demands and decision latitude by estimating a model that includes three terms: a centered linear term for psychological demands, a centered linear term for decision latitude, and an interaction of the two centered linear terms.



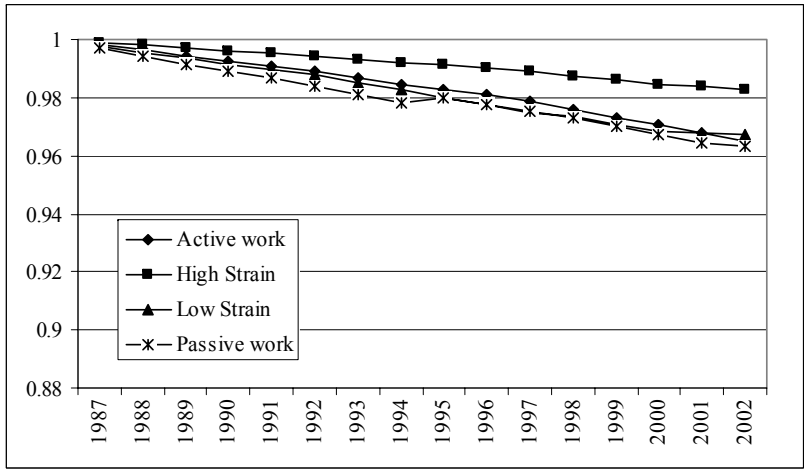
Paid women



Unpaid women

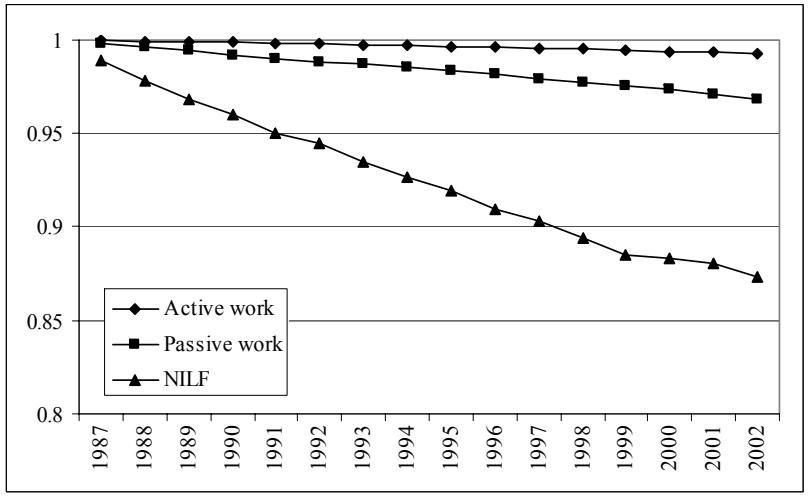


Paid and Unpaid women

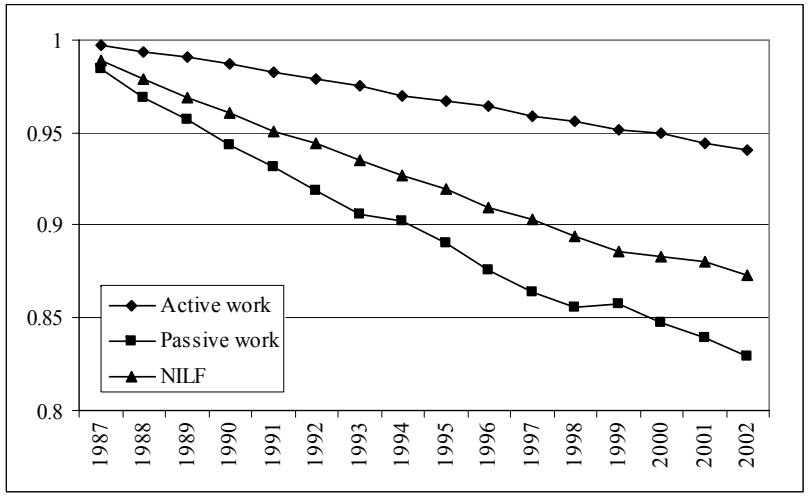


Paid and Unpaid Men

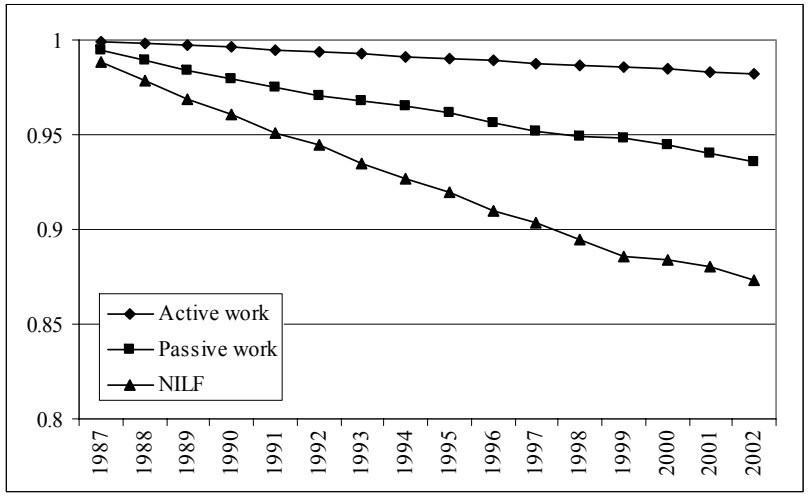
Figure 1. Predicted Survival 1987 – 2002 by Sex, Work Status, and Job Strain Category, based on Model 3 (All covariates, All individuals had no life threatening conditions at baseline).



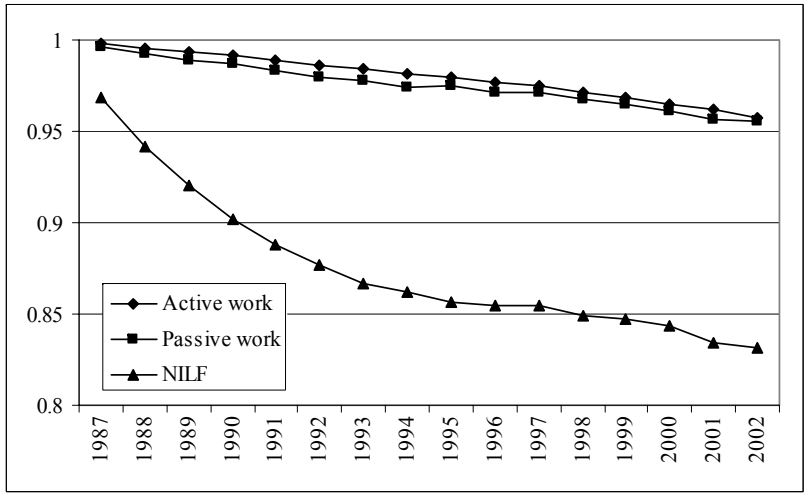
Paid women



Unpaid women



Paid and Unpaid women



Paid and unpaid men

Figure 2. Predicted Survival 1987 – 2002 by Sex, Work Status, and Job Strain Category (High Strain and Passive only), based on Model 2 (All covariates, controlling for health at baseline).

Endnotes

[i] The job strain indicator used in this study had three categories: high job strain (high or intermediate demands combined with low control), low job strain (low demands combined with high or intermediate control), and intermediate job strain (all other combinations of demands and control).

[ii] Respondents did not provide self-reports of their working conditions for this study; the investigators imputed information on demands and control based on scores taken from other surveys of workers in different occupations. This means that all individuals in a given occupation receive the same job strain classification, but that the exposure measure thus avoids the subjectivity associated with self-reported working conditions.

[iii] We also tested a more complex indicator that combined information about marital status with information about the work status of the spouse, but this did not change the substantive results of the analysis so we use the simpler measure here.

[iv] We also considered controlling for respondent's education to further adjust for differences in socioeconomic status associated with both job strain and mortality, but education was highly correlated with many of the variables already in the analysis and did not substantially change the effect of job strain on mortality. We also experimented with stratifying the analysis by major categories of educational qualifications, but there were too few deaths to obtain consistent and reliable results.

[v] Unfortunately, given the small number of women in this subsample, there were insufficient deaths to conduct multivariate analyses comparing the relative importance of job strain in paid and unpaid work.