HHS Public Access

Author manuscript

Soc Sci Med. Author manuscript; available in PMC 2016 December 01.

Published in final edited form as:

Soc Sci Med. 2015 December ; 146: 111–119. doi:10.1016/j.socscimed.2015.10.024.

The long-term mortality impact of combined job strain and family circumstances: A life course analysis of working American mothers

Erika L. Sabbath, ScD[a,b,*], **Iván Mejía-Guevara, PhD**[b], **Clemens Noelke, Dr.rer.soc**[b], and **Lisa F. Berkman, PhD**[b,c]

[a]School of Social Work, Boston College, 140 Commonwealth Avenue, Chestnut Hill, MA USA 02467

[b]Center for Population and Development Studies, Harvard University, 9 Bow Street, Cambridge, MA 02138, USA

[c]Departments of Social & Behavioral Sciences; Epidemiology; and Global Health & Population, Harvard T.H. Chan School of Public Health, 677 Huntington Ave, Boston, MA United States

Abstract

Background—Work stress and family composition have been separately linked to later-life mortality among working women, but it is not known how combinations of these exposures impact mortality, particularly when exposure is assessed cumulatively over the life course. We tested whether, among US women, lifelong work stress and lifelong family circumstances would jointly predict mortality risk.

Procedures—We studied formerly working mothers in the US Health and Retirement Study (HRS) born 1924-1957 (n=7,352). We used sequence analysis to determine five prototypical trajectories of marriage and parenthood in our sample. Using detailed information on occupation and industry of each woman's longest-held job, we assigned each respondent a score for job control and job demands. We calculated age-standardized mortality rates by combined job demands, job control, and family status, then modeled hazard ratios for death based on family constellation, job control tertiles, and their combination.

Results—Married women who had children later in life had the lowest mortality risks (93/1,000). The highest-risk family clusters were characterized by spells of single motherhood (132/1,000). Generally, we observed linear relationships between job control and mortality hazard within each family trajectory. But while mortality risk was high for all long-term single mothers, we did not observe a job control-mortality gradient in this group. The highest-mortality subgroup was previously married women who became single mothers later in life and had low job control (HR 1.91, 95% CI 1.38,2.63).

[*]Address correspondence to Dr. Sabbath, Boston College, School of Social Work, 140 Commonwealth Avenue, Chestnut Hill, MA 02467, USA; +1 617-552-2934 (phone); +1 617-552 1080 (fax); erika.sabbath@bc.edu.

Practical implications—Studies of associations between psychosocial work characteristics and health might consider heterogeneity of effects by family circumstances. Worksite interventions simultaneously considering both work and family characteristics may be most effective in reducing health risks.

Keywords

work–family conflict; single motherhood; mortality; social determinants of health; sequence analysis; job stress; job strain; job control

Introduction

Separate bodies of literature have documented the health impact of family circumstances and psychosocial working conditions. On the work side, certain occupational stressors are associated with increased risk of poor health among those currently or previously employed (Berkman et al., 2014). The Karasek demand-control model suggests that high job demands, low job control, and their combination (known as “job strain”) are risk factors for chronic diseases (Babu et al., 2014; Karasek et al., 1998; Kivimäki et al., 2012). In particular, low control over one’s work time has been associated with several chronic health conditions, including cardiovascular disease, depression, and cognitive impairment (Andel et al., 2011; Bosma et al., 1998; Sanne et al., 2005; Stansfeld & Candy, 2006). Low job control is hypothesized to impact health through stress arousal pathways, although mechanisms are not fully understood (Karasek & Theorell, 1992; Schnall et al., 1994).

On the family side, marriage and parenthood are each protective against long-term morbidity and premature mortality (Besculides et al., 2010; McMunn et al., 2006; Verbrugge & Madans, 1985). Consistently married women live longer than those with histories of divorce and widowhood, and mothers live longer than women without children, even after accounting for health selection into motherhood and marriage. Conversely, single motherhood is associated with increased risk of poor health in later life (Berkman et al., 2015; Weitoft et al., 2002).

Beyond job strain and single parenthood as separate risk factors, colliding work and family responsibilities may impact short- and long-term health. This is especially true for working women with children, who often face a “second shift” of work upon returning home (Frankenhaeuser et al., 1989; Hochschild & Machung, 1989). Conflicting demands between work and home have been shown to impact outcomes such as sleep, cardiovascular risk factors, mental health, and health behaviors (Berkman et al., 2010; Frone, 2000; Greenhaus et al., 2006; Melchior et al., 2007; Roos et al., 2006). Work–family conflict may be buffered by social policies and practices as well as informal support. For instance, maternity benefits reduce incidence of depression for women who had their first children in countries with strong maternity benefits (Avendano et al., 2015).

Several gaps remain in the study of work–family exposures and long-term health outcomes. We focus here on two of those gaps. While influential studies have documented long-term health impacts of combined work and family characteristics (Lahelma et al., 2002; Martikainen, 1995; Weatherall et al., 1994), exposure to work and family circumstances is

measured over a limited time period or age range, despite the underlying complexity and time-varying nature of women's work and family life over the life course. Conventional approaches have difficulty making distinctions of either timing or duration of exposure, and resultant exposure misclassification could obscure meaningful public health insights. For example, being a single mother may be a relatively brief transitional state for some women, while for others it is a state encompassing most of their adult years. Furthermore, becoming a single mother early in life may carry different risks from becoming a single mother late in life (Berkman et al., 2015). In the present study, we address prior deficits by applying sequence analysis, an assessment method that permits incorporation of the full range of information encoded in longitudinal exposure data.

The second gap concerns the content of work–family measures, in addition to the method of exposure assessment. Within the work–family conflict literature, work itself is often defined either as binary (whether a woman is working or not working) (Sabbath et al., 2015), or is operationalized as a stressor mainly in terms of its impact on family life (Allen et al., 2000). However, the range of psychosocial exposures that women may experience at work is vast, and many exposures related to workplace organization and relational interactions at work are known to be associated with adverse health outcomes (Landsbergis et al., 2012; Sauter et al., 2002). While there has been much research on the effects of workplace stressors, such as job demand or control, few studies or theoretical frameworks have considered these stressors as potentially interacting with women's family status (Ertel et al., 2008).

Because work is becoming the norm among mothers—nearly three-quarters of women ages 25-54 currently work outside the home (Mosisa & Hipple, 2006)—it is important to quantify the nature and intensity of stressors, both at home and at work, that employed women may experience over the course of a career. For example, resources and risks provided by family contexts may buffer or exacerbate health effects of job strain, similarly to the modifying role of workplace social support (Johnson et al., 1996; Kossek et al., 2011). Alternatively, working in a lower-strain job may help women in precarious family situations better reconcile competing pressures of work and family life. By clarifying effects of both work and family strain, we hope to shed further light on the mechanisms jointly connecting them with later-life mortality.

Our theoretical and methodological framework is informed by a life course approach to disease development, in which risk factors for chronic disease develop throughout the lifespan, either through critical early experiences or through gradual accumulation of risk (Ben-Shlomo & Kuh, 2002; Kuh et al., 2003). Within this framework, we apply the conservation of resources theory, which suggests that as a person's difficulties in one domain (for example, work) increase, that person has fewer resources to fulfill the obligations of other life domains (for example, family). Prolonged strain on the balance of resources can lead to health problems (Grandey & Cropanzano, 1999; Hobfoll, 1989). Resources used to correct that imbalance—such as spousal support, economic resources available from income, or social protection policies—could reduce negative health impacts of combined exposures by either rebalancing resources allocated to the two roles or reducing the overall load by abandoning one role, usually work (Grandey & Cropanzano, 1999). But someone without those resources (e.g. low-income single mothers in the US) would not be

able to resolve inter-role conflict by leaving the workforce or relying on a partner for support, leading to prolonged constraints in both roles and potentially negative long-term health outcomes.

We apply the conservation of resources theory to investigate whether certain working conditions are particularly harmful to health among women whose lives are characterized by demands from both work and family, but who may not have the material means or supportive resources to alleviate that strain. With this theory as a guide, and using life course exposure assessments for both work and family characteristics, we analyze the relationship between long-term job control, long-term family constellations, and mortality after age 50 among working American mothers. We hypothesized that, within a given work–family circumstance, women with low-control jobs would consistently have higher mortality than those with the same family situation but more favorable psychosocial occupational exposures. Specifically, we hypothesized that health risks of low-control jobs would be greatest among single mothers, who face considerable constraints from both domains and often have fewer resources to reconcile work and family demands.

The preceding hypotheses are best tested using exposures assessed throughout midlife, when work and parental responsibilities are likely to collide. Cumulative exposure assessments permit true life course analyses of the impact of work and family exposure patterns on long-term health. We draw on retrospective data on women's occupation and detailed information on job strain, which we interact with comprehensive family history measures to develop a nuanced picture of each woman's lifetime work and family profile. We then use sequence analysis, an emerging exposure assessment technique in life course epidemiology, to summarize the full breadth of work–family experiences in our sample. Those robust and inherently longitudinal exposure assessment methods enable analysis of interrelationships between lifetime family history, lifetime work characteristics, and mortality risk at older ages.

Methods

We studied both native-born and foreign-born women in the US Health and Retirement Study (HRS) (Juster & Suzman, 1995). Our population of interest was HRS women who ever worked for pay and who had information on the occupation and industry of at least one of the jobs in her work history (n=11,065); we excluded 286 women with no job information available. We restricted the sample to women between 40 and 70 years old at their first HRS interview (n=9,152), and further restricted to those born between 1924 and 1957 (n=8,982). To capture our target demographic of working mothers, we eliminated 875 women who had no children and 1,376 who had never worked for pay or who had worked for pay for five years or fewer between ages 18 and 50. We further excluded 254 women with incomplete trajectories of family history (see below) due to missing marital or child information. Our final sample consisted of 7,352 women, of whom 933 (12.6%) died during follow-up.

Outcome: All-cause mortality

Our outcome was all-cause mortality occurring between the 50th birthday and March 2011 (the most recent available mortality data). Mortality data were drawn from the National

Death Index (NDI) and supplemented by proxy reports for post-2008 deaths, for which NDI data were not yet available.

Exposures

Our exposure assessment had two separate elements: family circumstances and work characteristics.

Family circumstances

Our operational definition of family circumstances was a woman's trajectory of marriage and children in early and mid-adulthood. At HRS entry, women reported the beginning (and, if applicable, ending) dates of all marriages and the birth or adoption dates of all children. Using participants' birth years, we determined, for each age between 18 and 50, whether a woman was married and whether she had children under 18. Thus, at each age, four combinations were possible: married with children under 18, married with no children under 18, single with children under 18, and single without children under 18. For each woman, we then constructed an individual trajectory of family history by enumerating both her marital and her child status at each age. Theoretically, $7.38*10^{19}$ lifetime trajectories were possible (4^{33}). In actuality, among the 7,352 women, we observed 2,923 unique trajectories.

To summarize this diversity, and thus to assess life course family characteristics in the most robust way, we employed sequence analysis, a type of cluster analysis in which a set of prototypical sequences of life events are identified based on patterns observed within a sample (Abbott, 1995; Aisenbrey & Fasang, 2010; Wu, 2000). In recent years, sequencing methods have been successfully used to summarize complex life history data into protoytpical clusters that predict long-term morbidity and mortality risk (Sabbath et al., 2015; Wahrendorf, 2014). Both the timing of milestones (such as the birth of a child) and duration spent in each state are taken into account. The ultimate goal of the method is to cluster individuals into unique clusters according to their trajectories, maximizing homogeneity of experiences within clusters and heterogeneity of experiences between clusters.

The method works by making slight adjustments to individuals' unique trajectories, preserving integrity of individual-level data while revealing larger patterns in the sample. The goal is to constrain the number and type of changes that can be made to any individual's sequence, ensuring that the final prototypical sequence assigned to that person is a reasonable approximation of their lived experience. We used Halpin's modified matching algorithm to specify the costs of transforming one person's sequence to more closely resemble another's (Brzinsky-Fay et al., 2006; Halpin, 2010). This theoretical cost (substitution cost) was based on mean probability distance, a quantification of the frequency of an observed transition within the data. Common year-to-year transitions (such as from married non-mother to married mother) are assigned lower costs, and less common transitions in adjacent years (such as from married non-mother to unmarried mother) are assigned higher costs. Substitution costs are further adjusted inversely with spell length, such that the longer the spell, the smaller the substitution cost. We set indel (insertion and deletion) costs, which penalize the occurrence of the same state in two different sequences at

different time, to 1. The indel cost was set as slightly more than half of the highest substitution cost to prevent the algorithm from distorting the timing and temporal order of events (Brzinsky-Fay et al., 2006).

The final step is choosing the number of prototypical clusters that mathematically and sociologically represents the experiences of the overall sample. In our data, a five-cluster solution optimized the two fit metrics, Calinski-Harabasz Pseudo-F and Duda-Hart Pseudo-T. Supplemental Figure A (panels 1-5) shows the distribution of individual family trajectories within each overall cluster.

Lifelong psychosocial work environment

Women in HRS were asked, upon cohort entry, to report their current job, if still working; their last job, if retired; their longest-held job; and up to six other jobs. Using 3-digit 1980 Census classifications from HRS restricted data, we determined occupation and industry codes associated with those jobs. For each person, we then chose the longest held job for which valid data on occupation and industry were available; we elected to use longest-held job because it best represented overall work experience.

Each occupation-by-industry cell in the HRS data was assigned a continuous score for control and demands (Karasek, 1979; Karasek et al., 1998). The original Karasek scores that corresponded with occupation-industry combinations were developed by Karasek and colleagues by matching job strain scores of a cohort of American workers to their 1970 industry and occupation codes (Karasek & Theorell, 1992). Methods of assessing job strain exposure based on these occupation and industry titles have been used by scholars when individual assessments of job strain are not available or are unreliable (Kristensen, 1996). We used cross-walks provided by the Minnesota Population Center to link the 1970 industry/occupation codes used by Karasek to the 1980 industry/occupation codes used in HRS. In the end, each unique combination of industry and occupation in the HRS data was assigned a score for demand and control, and each individual woman was subsequently assigned demand and control scores based on the occupation and industry of her longest-held job.

After assigning demand and control scores to each woman based on occupation and industry, these continuous scores were each trichotomized at the sample's 33rd and 67th percentiles to classify each woman's job control and also job demands as low, medium, or high. Using tertiles, rather than binary measures, allowed a clearer picture of an individual's psychosocial working conditions.

Analyses of our sample provided little evidence that job demands were associated with mortality risk. While all models adjust for demands, we focus on job control as a central determinant of psychosocial occupational conditions. This decision is consistent with literature showing a stronger association between job control and health (Bosma et al., 1997; Johnson et al., 1996).

Combined work and family demands

Our ultimate goal was to capture both work stress and family demands in our exposure assessment. We combined each woman's family score (one of five clusters identified through sequence analysis) with her job control tertile (low, medium, or high). Thus, work-family exposures were grouped into fifteen categories.

Covariates

In regression models, we included covariates for age at HRS baseline, birth cohort (1924-1933, 1934-1943, 1944-1957), year of entry into HRS, race/ethnicity (white, black, Hispanic, mixed/other), and region of birth in the US (New England, Mid Atlantic, EN Central, WN Central, S Atlantic, ES Central, WS Central, Mountain, Pacific, US/NA Division, Not US/including territories). To adjust for respondents' socio-economic backgrounds, we adjusted for parental education in years (0-11, 12, 13-17, missing) and own education (less than high school, high school completion or more). We did not distinguish educational degrees beyond high school, since post-secondary education could be an outcome rather than a cause of fertility outcomes.

Analytic methods

We calculated descriptive statistics by family sequence to better understand differences between women in our exposure categories. For family sequences and job control tertiles, separately and then combined, we calculated age-standardized mortality rates and associated 95% confidence intervals, standardizing to the US population distribution in 1990, the most recent census year in which all members of the sample were alive (United States Census, 1990). We used the Welch test of between-group differences in mortality rates (Ruxton, 2006).

In regression analyses, we used Cox proportional hazards models to test associations between job control, family status, and mortality risk. First, we considered job characteristics (demand tertiles and control tertiles) and family sequences separately. We then tested the combined (15-category) measure of family sequences and job control tertiles. All models adjusted for demographic and socioeconomic covariates. The modal family group was set as the reference. In all models, we tested for and confirmed that we met the proportional hazards assumption.

All sequences were generated and all regression analyses were conducted using Stata 13 SE (Brzinsky-Fay et al., 2006).

Results

Using sequence analysis, we grouped the 7,352 women in our sample into five prototypical clusters (Figure 1). The most common sequence (35% of sample), referred to here as "typical married mothers," represented women who were married in their early 20s, had children soon after, and remained married (or, if divorced or widowed, quickly remarried) through their 40s, after their children turned 18. Two other groups of women had similar overall patterns, but with different timing and duration of transitions. Twenty percent of

women, referred to here as “long-term married mothers,” were married and had children around age 20 and had children under 18 until their mid- to late forties, with little divorce or widowhood. Another 20% of women, referred to here as “later married mothers,” married later (in their mid-twenties on average) and had children later (in their early thirties on average), remaining married when their children were older. The remaining two groups were characterized by either short or long spells of single motherhood. Seventeen percent of women, referred to here as “later single mothers,” were married and had children at a similar time as the typical married mothers, but experienced a period of single motherhood (likely attributable to divorce or widowhood) shortly before their children turned 18. The final cluster of women (8% of the sample), referred to here as “long-term single mothers,” were single mothers nearly the entire time that their children were under 18 and remained unmarried when their children were older.

We examined social and demographic characteristics of the five clusters of women (Table 1). We found that while job control tertiles were evenly distributed among typical married mothers, later married mothers were disproportionately in high-control jobs, and both single mother sequences and long-term married mothers were disproportionately in low-control jobs. Demands, however, did not substantially vary by sequence (data not shown). Years worked and year of birth were similar across sequences, suggesting that any observed differences in mortality would not be attributable to between-sequence variation in time in the labor force or age. We observed between-sequence differences in several social and demographic characteristics. Later married mothers were the most educated (90% high school completion rate), as were their parents (61% high school completion rate). The two single mother sequences had the highest proportion of non-Hispanic black women: 30% of later single mothers and 42% of long-term single mother were non-Hispanic black, versus 10-14% in the other sequences. Furthermore, “long-term married mothers” stand out as the group with most children, 4.2 on average.

To compare absolute mortality rates across both family sequences and job control tertiles, we calculated age-standardized mortality rates and 95% confidence intervals for family trajectories, job control, and their combinations (Figure 1). The lowest-mortality family trajectory was later married mothers (92.6/1,000) and the highest were later single mothers (131.9/1,000) and long-term single mothers (131.7/1,000). The relationship between job control and mortality was linear and inverse, with the highest mortality among those with the lowest control (Supplemental Figure B).

Across all combinations of family trajectories and job control (Figure 2), the two highest-mortality groups were later single mothers with low control (145.6/1,000) and long-term single mothers with low control (159.0/1,000). The lowest-mortality groups were later married mothers with high control (75.8/1,000) and long-term married mothers with moderate control (86.1/1,000). We observed a linear relationship between job control and mortality within three family sequences: typical married mothers, later single mothers, and later married mothers.

We then used adjusted Cox proportional hazards models to test associations between family sequences, job demands, job control, and mortality. Our first step (Table 2) was to test

whether, individually, family sequences and job strain predicted mortality. Such models both established predictive validity of exposure assessments and revealed their separate associations with mortality. Compared to the modal group of typical married mothers, the two other married mother groups did not have significantly different mortality risks (HR for long-term married mothers 0.98, 95% CI 0.82,1.17; HR for later married mothers 1.00, 95% CI 0.82,1.22). However, the two sequences characterized by single motherhood did have elevated mortality risks. The HR for later single mothers was 1.23 (95% CI 1.03,1.51) and for long-term single mothers was 1.34 (1.05,1.71). Overall, mortality was significantly ($p<0.05$) elevated overall among those who had single motherhood experience, but not significantly elevated among those who did not.

The same model included both job demands and job control. Compared with those who had high job control, decreasing levels of control were associated with greater mortality risks (HR for medium control, 1.19, 95% 1.00,1.42; HR for low control 1.31, 95% CI 1.10,1.56). Indicators for job demand tertiles had small, inconsistent effects and were neither individually nor jointly significant at conventional levels. Thus, we only stratified family sequences by job control in further models, although in those models we did adjust for job demands.

We categorized each woman by both her family history (five categories) and her job control score (three categories) in order to assess the combined impact of these constructs on mortality (Table 3). Our reference group was typical married mothers with high control. Compared with these women, typical married mothers with medium and low-control jobs had increased mortality risk, although the effect was only marginally significant ($p<0.10$). Similar gradients were observed among long-term married mothers and later married mothers. Among later married mothers, only those with low-control jobs were at significantly elevated mortality risk (HR 1.48, 95% CI 1.03,2.12), and we observed a gradient in risk by job strain, with both mid-control and low-control women having significantly elevated mortality risk compared with high-control women in this family cluster. Job characteristics (high, medium, or low control) did not produce a linear mortality gradient among long-term married mothers. Rather, we observed a U-shaped relationship between job control and mortality in this group, although none of the job control subgroups in this cluster had significantly ($p<0.05$) elevated mortality risk, either compared to the overall reference group or compared with each other.

Stratifying by job control fanned out risks among later single mothers, who as a group were at significantly increased mortality risk (Table 2). Later single mothers with high control did not have increased mortality risk (HR 1.20, 95% CI 0.81,1.77). Those with medium control were at increased risk, although the risk was marginally ($p<0.10$) significant (HR 1.37, 95% CI 0.95,1.96), and those with low control were at the greatest risk of any subgroup in the sample (HR 1.91, 95% CI 1.38,2.63) compared with the reference group, and additionally at significantly greater risk ($p=0.019$) than women with the same family structure but high control.

In contrast to the later single mothers, long-term single mothers—the highest-mortality family cluster overall—had elevated mortality risks at all levels of job control, with

differences in risk between job-control groups not reaching statistical significance. Those with high control were at marginally increased risk (HR 1.57, 95% CI 0.96,2.55) compared with the overall reference group; significantly elevated risks were observed among long-term single mothers with medium control (HR 1.72, 95% CI 1.13,2.64) and low control (HR 1.65, 95% CI 1.11,2.47). Thus, mortality risk in this group was high, did not occur on a job-control gradient, and was primarily defined by family circumstance, with little intensifying (or offsetting) effect of working conditions..

Discussion

This study evaluated whether mortality risk after age 50 among working American mothers differed by midlife family dynamics, psychosocial job characteristics, or the interaction between them. Guided by the conservation of resources theory, we initially hypothesized that adverse working conditions would be most strongly associated with mortality for women who spent long periods in precarious family situations, but our results did not fully support this hypothesis. In the family group with the highest overall mortality (long-term single mothers), we observed no mortality gradient by job control; risk was elevated for all these women, regardless of job characteristics. However, among women who became single mothers later in their lives, we observed dramatic differences in mortality risks across levels of job control. For women in more advantageous family circumstances, we observed similar, but smaller gradients between job control and mortality, such that decreasing control was associated with greater mortality risk.

The majority of studies of working mothers and health have not considered working conditions as moderators of disease risk, although several studies have linked employment with single motherhood cross-sectionally to examine long-term joint risks. Most studies of work–family exposures and health either classify women as working or not working, or focus mainly on conflict between work and non-work lives. Our study integrates the job-strain and work–family literatures, allowing us to address gaps in their overlap and explore a hypothesis of compounding disadvantage.

Motherhood, marriage, work, and health: Expanding the evidence

Our study has two major findings. The first finding is that the highest-mortality subgroup was later single mothers with low-control jobs (HR 1.91 (95% CI 1.38, 2.63). Based on theories of accumulation of risk (Ben-Shlomo & Kuh, 2002; Kuh et al., 2003) and conservation of resources (Grandey & Cropanzano, 1999), we initially hypothesized that the highest-risk group would be earlier (e.g. long-term) single mothers with low-control jobs. For that group, the mortality risk was 1.65 (95% CI 1.11, 2.47).

There are several possible reasons why later single mothers with low control experienced such high mortality risk. Later single mothers who were previously able to rely on spousal support to balance risks of low-control jobs may have suddenly experienced the double burden of being a primary caregiver for older children and having low-quality job, without the offsetting support of a spouse. According to the conservation of resources theory, loss (such as divorce or bereavement) represents the unexpected removal of resources previously used to sustain harmony between domains (Hobfoll, 1989), making balancing those domains

more difficult. Many types of losses are likely among later single mothers at the time that single motherhood began, including unexpected financial strain, bereavement (for widowed women), and loss of social support. All the preceding factors have been linked to later-life morbidity and mortality, mediated by low sense of control (Martikainen & Valkonen, 1996; Price et al., 2002). That mediation may help explain the high level of risk seen in later single mothers with low job control.

Our other main finding was that, while a job control-mortality gradient was observed within most family clusters even when the individual hazard ratios did not reach statistical significance, this phenomenon was not present among long-term single mothers, who had elevated mortality risk at high (HR 1.57, 95% CI 0.96,2.55), moderate (HR 1.72, 95% CI 1.13,2.64), and low (HR 1.65, 95% CI 1.11,2.47) levels of job control. Initially, we had hypothesized that we would observe the consistent within-cluster mortality gradients by job control seen in most other family clusters, based on prior research showing variation in associations between psychosocial working conditions and disease outcomes by socioeconomic status, social support, and other factors (Marmot & Bosma, 1997; Sabbath et al., 2012). But our findings support a somewhat different conclusion: that the stress of being a long-term single working mother for the majority of one's adult life has profound health consequences, and the potency of that risk may override a moderating influence of additional stressors such as poor working conditions.

Given that mortality is such a definitive health endpoint, it is not surprising that only a few subgroups of women (Table 3) were at significantly ($p<0.05$) or marginally ($p<0.10$) increased risk of death based on their work and family circumstances, compared with the reference category: we observed increased risk among those with low job control, those with very difficult family situations, or both.

Limitations and strengths

This study has several limitations, most of which pertain to challenges of life course exposure assessment. Due to gaps in HRS employment data on occupation and industry—especially for earlier-life jobs—we could not account for time variation in occupational stress exposure, and instead we assigned one job control score to represent working life. This method introduces possible exposure misclassification; more detailed occupational data would permit more powerful tests.

Sequence analysis also has weaknesses as an exposure assessment method. Clusters identified are based on distribution of characteristics in the sample (so are not directly generalizable to the larger population) and are empirically rather than theoretically based. However, sequence analysis permits a more nuanced picture than would be possible with one-time assessments of work–family responsibilities. If we had taken a critical-period approach and assessed marital status at first birth, for example, we would have misclassified nearly all women who became single mothers either earlier or later, since many long-term single mothers were married for a very short time (Figure 1). As the highest-mortality cluster was later single mothers with low-control jobs, a cross-sectional exposure assessment at first birth would have obscured risks in that particular group.

A final weakness is potential confounding of observed associations by socioeconomic factors. It is well-established that low job control is more prevalent in lower-income and lower-status jobs (Karasek & Theorell, 1992). Because we used occupation and industry indicators to determine job strain scores, our measures may partially reflect additional physical and psychosocial characteristics of workers' jobs, aside from job strain, that may impact health (Krieger et al., 2008). Although we adjusted for both own and parental education, this may not fully account for occupation- and income-based socioeconomic risk factors for mortality. However, prior studies of the relationship between job strain and cardiovascular disease have found that socioeconomic factors aside from job control partially, but not completely, explain relationships between working conditions and health (Bruner et al., 2004; Kuper & Marmot, 2003; Lynch et al., 1997).

Our study offers advantages over previous work. We used data from a large, well-established cohort study, in a subset composed entirely of working mothers. Restricting the study to working mothers reduced the possibility of health selection bias into work, motherhood, or both. Finally, diversity of family experiences within our sample, coupled with long-term follow-up after the period of exposure, allowed explorations of associations between subtly different family situations, work characteristics, and health.

Areas for future research and practice

Findings suggest that all-cause mortality is elevated among women with a history of single motherhood and those with histories of low job control, and that the nature of the combined impact of work and family on mortality may vary by family characteristics. However, the study does not further explore the underlying mechanism. For example, analyses of cause-specific mortality could clarify the diseases to which women in certain work–family circumstances succumbed. Furthermore, future work could examine association between work family constellations and later life morbidity, such as mental health, cognitive functioning or cardiovascular disease. Morbidity may be more sensitive to subtle exposure differences than mortality, allowing us to see potential differentiation between the three married-mother groups.

Analytically, this study raises several questions for future analysis. First, it is possible that socioeconomic factors beyond education—namely income—could help further pinpoint the groups at greatest risk. Future analyses could explicitly test the moderating or mediating role of income in explaining observed associations. In addition, as discussed above, a time-varying measure of job control would increase robustness. Altogether, this research would enable better targeting and screening for certain health conditions among women at particular risk.

Conclusions and implications for public health practice

Our study finds that among working American women, both short-term and long-term single motherhood are associated with increased mortality risk; for women in certain family circumstances, risk varies by psychosocial characteristics of her work. From a workplace intervention perspective, among women in very difficult family circumstances, intervening on psychosocial work characteristics alone may be insufficient to reduce health risks.

Research-wise, studies testing associations between psychosocial work characteristics and health might consider heterogeneity of effects by family circumstances.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding for this project was provided by NIA 5R01AG040248 and by the John D. and Catherine T. MacArthur Foundation. The funders had no role in the study design, analysis, or conclusions.

References

Abbott A. Sequence analysis: new methods for old ideas. Annual Review of Sociology. 1995:93–113.

Aisenbrey S, Fasang AE. New life for old ideas: The“ second wave” of sequence analysis bringing the“ course” back into the life course. Sociological Methods & Research. 2010; 38:420–462.

Allen TD, Herst DEL, Bruck CS, Sutton M. Consequences associated with work-to-family conflict: A review and agenda for future research. Journal of Occupational Health Psychology. 2000; 5:278–308. [PubMed: 10784291]

Andel R, Crowe M, Kåreholt I, Wastesson J, Parker MG. Indicators of job strain at midlife and cognitive functioning in advanced old age. The Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 2011; 66:287–291.

Avendano M, Berkman LF, Brugiavini A, Pasini G. The long-run effect of maternity leave benefits on mental health: Evidence from European countries. Social Science & Medicine. 2015; 132:45–53. [PubMed: 25792339]

Babu GR, Jotheeswaran A, Mahapatra T, Mahapatra S, Kumar A, Detels R, et al. Is hypertension associated with job strain? A meta-analysis of observational studies. Occupational and Environmental Medicine. 2014; 71:220–227. [PubMed: 24142979]

Ben-Shlomo Y, Kuh D. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. Int. J. Epidemiol. 2002; 31:285–293. [PubMed: 11980781]

Berkman L, Buxton O, Ertel K, Okechukwu C. Managers’ practices related to work-family balance predict employee cardiovascular risk and sleep duration in extended care settings. J Occup Health Psychol. 2010; 15:316–329. [PubMed: 20604637]

Berkman, L.; Kawachi, I.; Glymour, M. Social epidemiology. Oxford University Press; 2014.

Berkman L, Zheng Y, Glymour MM, Avendano M, Borsch-Supan A, Sabbath E. Mothering alone: cross-national comparisons of later-life disability and health among women who were single mothers. Journal of Epidemiology & Community Health. 2015

Besculides M, Koball HL, Moiduddin E, Henderson J, Goesling B. What do we know about the link between marriage and health? Journal of Family Issues. 2010; 31:1019–1040.

Bosma H, Marmot MG, Hemingway H, Nicholson AC, Brunner E, Stansfeld SA. Low job control and risk of coronary heart disease in Whitehall II (prospective cohort) study. BMJ. 1997; 314:558. [PubMed: 9055714]

Bosma H, Stansfeld SA, Marmot MG. Job control, personal characteristics, and heart disease. Journal of Occupational Health Psychology. 1998; 3:402–409. [PubMed: 9805284]

Bruner EJ, Kivimaki M, Siegrist J, Theorell T, Luukkonen R, Riihimaki H, et al. Is the effect of work stress on cardiovascular mortality confounded by socioeconomic factors in the Valmet study? J Epidemiol Community Health. 2004; 58:1019–1020. [PubMed: 15547064]

Brzinsky-Fay C, Kohler U, Luniak M. Sequence analysis with Stata. Stata Journal. 2006; 6:435.

Ertel KA, Koenen KC, Berkman LF. Incorporating home demands into models of job strain: Findings from the Work, Family & Health Network. Journal of occupational and environmental medicine/

American College of Occupational and Environmental Medicine. 2008; 50:1244. [PubMed: 19001950]

Frankenhaeuser M, Lundberg U, Fredrikson M, Melin B, Tuomisto M, Myrsten AL, et al. Stress on and off the job as related to sex and occupational status in white-collar workers. Journal of Organizational Behavior. 1989; 10:321–346.

Frone MR. Work-family conflict and employee psychiatric disorders: The national comorbidity survey. Journal of Applied Psychology. 2000; 85:888–895. [PubMed: 11155895]

Grandey AA, Cropanzano R. The Conservation of Resources Model Applied to Work-Family Conflict and Strain. Journal of Vocational Behavior. 1999; 54:350–370.

Greenhaus J, Allen TD, Spector PE. Health consequences of work-family conflict: The dark side of the work-family interface. Research in occupational stress and well-being. 2006; 5:61–98.

Halpin B. Optimal matching analysis and life-course data: the importance of duration. Sociological Methods & Research. 2010; 38:365–388.

Hobfoll SE. Conservation of resources: A new attempt at conceptualizing stress. American Psychologist. 1989; 44:513–524. [PubMed: 2648906]

Hochschild, A.; Machung, A. The second shift: Working parents and the revolution at home. Viking; New York: 1989.

Johnson JV, Stewart W, Hall EM, Fredlund P, Theorell T. Long-Term Psychosocial Work Environment and Cardiovascular Mortality among Swedish Men. American Journal of Public Health. 1996; 86:324. [PubMed: 8604756]

Juster FT, Suzman R. An overview of the Health and Retirement Study. Journal of Human Resources. 1995:S7–S56.

Karasek R. Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. Administrative Science Quarterly. 1979; 24:285.

Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. The Job Content Questionnaire (JCQ): an instrument for internationally comparative assessments of psychosocial job characteristics. J Occup Health Psychol. 1998; 3:322–355. [PubMed: 9805280]

Karasek, R.; Theorell, T. Healthy work: stress, productivity, and the reconstruction of working life. Basic books; 1992.

Kivimäki M, Nyberg ST, Batty GD, Fransson EI, Heikkilä K, Alfredsson L, et al. Job strain as a risk factor for coronary heart disease: a collaborative meta-analysis of individual participant data. The Lancet. 2012; 380:1491–1497.

Kossek E, Pichler S, Bodner T, Hammer LB. Workplace social support and work-family conflict: A meta-analysis clarifying the influence of general and work-family specific supervisor and organizational support. Personnel Psychology. 2011; 64:289–313. [PubMed: 21691415]

Krieger N, Chen JT, Waterman PD, Hartman C, Stoddard AM, Quinn MM, et al. The inverse hazard law: blood pressure, sexual harassment, racial discrimination, workplace abuse and occupational exposures in US low-income black, white and Latino workers. Social Science & Medicine. 2008; 67:1970–1981. [PubMed: 18950922]

Kristensen TS. Job stress and cardiovascular disease: A theoretic critical review. Journal of Occupational Health Psychology. 1996; 1:246–260. [PubMed: 9547050]

Kuh D, Ben-Shlomo Y, Lynch J, Hallqvist J, Power C. Life course epidemiology. J Epidemiol Community Health. 2003; 57:778–783. [PubMed: 14573579]

Kuper H, Marmot M. Job strain, job demands, decision latitude, and risk of coronary heart disease within the Whitehall II study. J Epidemiol Community Health. 2003; 57:147–153. [PubMed: 12540692]

Lahelma E, Arber S, Kivelä K, Roos E. Multiple roles and health among British and Finnish women: the influence of socioeconomic circumstances. Social Science & Medicine. 2002; 54:727–740. [PubMed: 11999489]

Landsbergis PA, Grzywacz JG, LaMontagne AD. Work organization, job insecurity, and occupational health disparities. American Journal of Industrial Medicine. 2012 n/a-n/a.

Lynch J, Krause N, Kaplan GA, Tuomilehto J, Salonen JT. Workplace conditions, socioeconomic status, and the risk of mortality and acute myocardial infarction: the Kuopio Ischemic Heart Disease Risk Factor Study. American Journal of Public Health. 1997; 87:617. [PubMed: 9146441]

Marmot MG, Bosma H. Contribution of job control and other risk factors to social variations in coronary heart disease. Lancet. 1997; 350:235. [PubMed: 9242799]

Martikainen P. Women's employment, marriage, motherhood and mortality: a test of the multiple role and role accumulation hypotheses. Social Science & Medicine. 1995; 40:199–212. [PubMed: 7899932]

Martikainen P, Valkonen T. Mortality after the death of a spouse: rates and causes of death in a large Finnish cohort. American Journal of Public Health. 1996; 86:1087–1093. [PubMed: 8712266]

McMunn A, Bartley M, Hardy R, Kuh D. Life course social roles and women's health in mid-life: causation or selection? Journal of Epidemiology and Community Health (1979-). 2006; 60:484–489. [PubMed: 16698977]

Melchior M, Berkman L, Niedhammer I, Zins M, Goldberg M. The mental health effects of multiple work and family demands. Social Psychiatry and Psychiatric Epidemiology. 2007; 42:573–582. [PubMed: 17530152]

Mosisa A, Hipple S. Trends in labor force participation in the United States. Monthly Lab. Rev. 2006; 129:35.

Price, RH.; Choi, JN.; Vinokur, AD. Links in the chain of adversity following job loss: How financial strain and loss of personal control lead to depression, impaired functioning, and poor health. Educational Publishing Foundation; US: 2002. p. 302-312.

Roos E, Lahelma E, Rahkonen O. Work-family conflicts and drinking behaviours among employed women and men. Drug and Alcohol Dependence. 2006; 83:49–56. [PubMed: 16300907]

Ruxton GD. The unequal variance t-test is an underused alternative to Student's t-test and the Mann-Whitney U test. Behavioral Ecology. 2006; 17:688–690.

Sabbath E, Mejia Guevara I, Glymour MM, Berkman LF. Use of life course work-family profiles to predict mortality risk among American women. American Journal of Public Health. 2015; 105:e96–e102. [PubMed: 25713976]

Sabbath E, Melchior M, Goldberg M, Zins M, Berkman LF. Work and family demands: predictors of all-cause sickness absence in the GAZEL cohort. Eur J Public Health. 2012; 22:101–106. [PubMed: 21558153]

Sanne B, Mykletun A, Dahl AA, Moen BE, Tell GS. Testing the Job Demand-Control-Support model with anxiety and depression as outcomes: The Hordaland Health Study. Occupational Medicine. 2005; 55:463–473. [PubMed: 15845554]

Sauter SL, Brightwell W, Colligan M, Hurrell J, Katz T, LeGrande D, et al. The changing organization of work and the safety and health of working people. Cincinnati: National Institute for Occupational Safety and Health. 2002

Schnall PL, Landsbergis PA, Baker D. Job Strain and Cardiovascular Disease. Annual Review of Public Health. 1994; 15:381–411.

Stansfeld S, Candy B. Psychosocial work environment and mental health—a meta-analytic review. Scandinavian Journal of Work, Environment & Health. 2006; 32:443–462.

United States Census. 1990.

Verbrugge LM, Madans JH. Social Roles and Health Trends of American Women. The Milbank Memorial Fund Quarterly. Health and Society. 1985; 63:691–735. [PubMed: 3853761]

Wahrendorf M. Previous employment histories and quality of life in older ages: sequence analyses using SHARELIFE. Ageing and society. 2014:1–32.

Weatherall R, Joshi H, Macran S. Double burden or double blessing? Employment, motherhood and mortality in the longitudinal study of England and Wales. Social Science & Medicine. 1994; 38:285–297. [PubMed: 8140455]

Weitoft GR, Haglund B, Hjern A, Rosén M. Mortality, severe morbidity and injury among long-term lone mothers in Sweden. International Journal of Epidemiology. 2002; 31:573–580. [PubMed: 12055157]

Wu LL. Some comments on" Sequence analysis and optimal matching methods in sociology: Review and prospect". Sociological methods and research. 2000; 29:41–64.

Research Highlights

- Women's mortality risk varied by family type, job stress, and their combination
- Family risk factors outweighed work risk factors among long-term single mothers
- Studies of work stress and health should consider variation by family circumstance

Visual representation of sequence, ages 18 (left) to 50 (right)	Description	N	%	Age-standardized mortality rate
	"Typical married mother"	2589	35%	115.2/1,000
	"Later single mother"	1217	16%	131.9/1,000
	"Long-term single mother"	610	8%	131.7/1,000
	"Long-term married mother"	1487	20%	98.6/1,000
	"Later married mother"	1449	19%	92.6/1,000

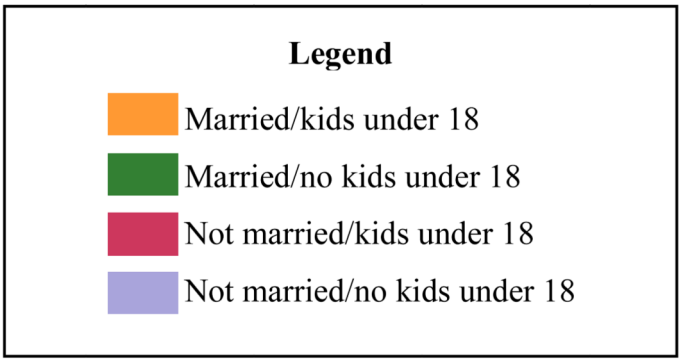

Figure 1.
Distribution of sample by family sequence and age-standardized mortality rates per 1,000 people for each sequence. Visually, sequences represent the age span from 18 to 50, with time moving from left to right. The colors that represent each family state during this period correspond to the legend below.

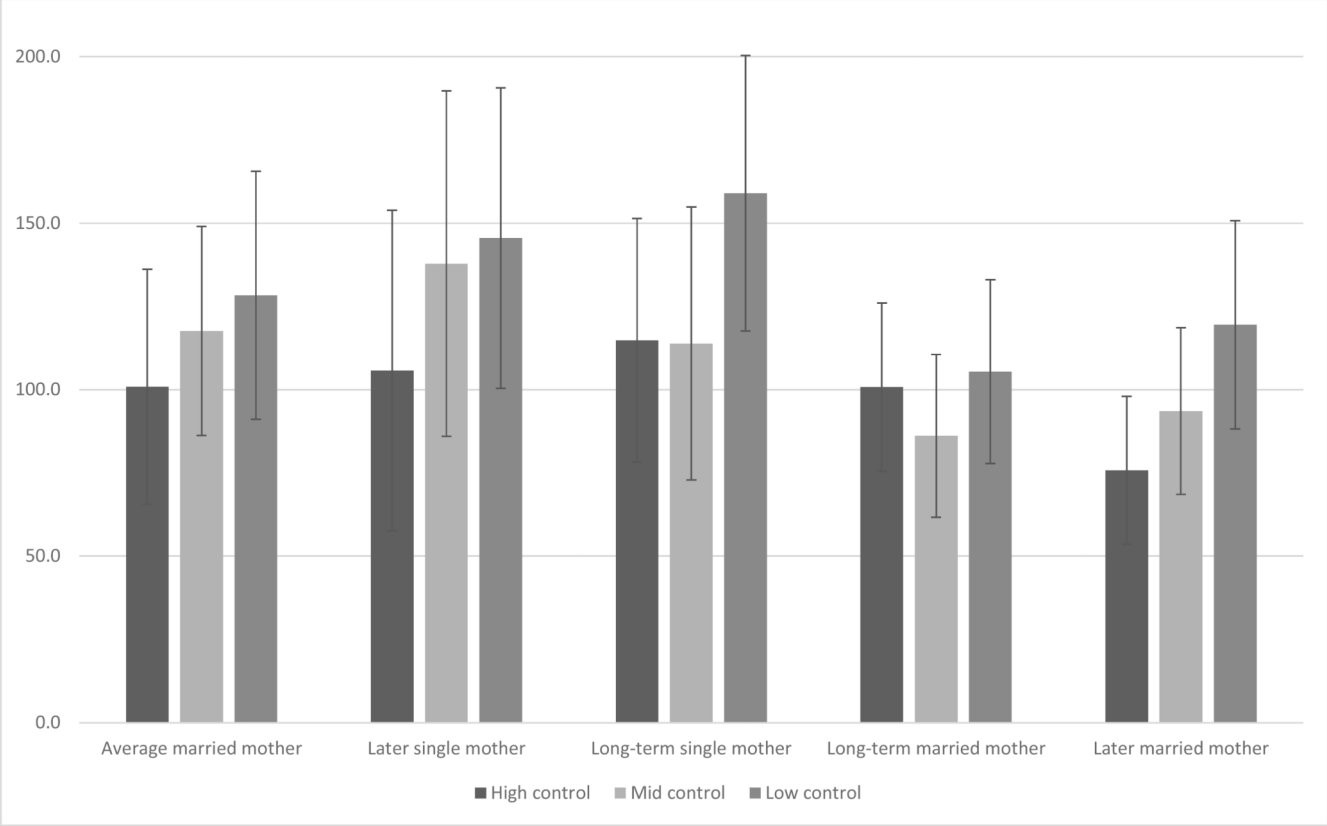

Figure 2.
Age-standardized mortality rates, by combined family sequence and job control

Table 1

Characteristics of sample, by family sequences shown in Figure 1 (n=7,352)

	Typical married mother	Later single mother	Long-term single mother	Long-term married mother	Later married mother
N (%)	2589 (35%)	1217 (17%)	610 (8%)	1487 (20%)	1449 (20%)
Job control	High control: 33%	High control: 29%	High control: 28%	High control: 28%	High control: 44%
	Mid control: 33%	Mid control: 35%	Mid control: 33%	Mid control: 33%	Mid control: 33%
	Low control: 34%	Low control: 36%	Low control: 39%	Low control: 39%	Low control: 23%
Mean (SD) years worked	22.2 (8.7)	23.0 (8.8)	23.8 (8.8)	20.3 (9.5)	22.1 (8.7)
Mean (SD) n children	2.5 (1.2)	3.3 (1.9)	2.7 (1.7)	4.2 (2.1)	2.6 (1.5)
Mean (SD) years married	29.5 (3.5)	20.3 (5.8)	6.9 (6.0)	31.3 (1.9)	25.9 (4.1)
Education	Less than HS: 20%	Less than HS: 29%	Less than HS: 30%	Less than HS: 31%	Less than HS: 10%
	HS or more: 80%	HS or more: 71%	HS or more: 70%	HS or more: 69%	HS or more: 90%
Race/ethnicity	NH white: 83%	NH white: 60%	NH white: 44%	NH white: 76%	NH white: 77%
	NH black: 10%	NH black: 30%	NH black: 42%	NH black: 14%	NH black: 11%
	Hispanic: 5%	Hispanic: 8%	Hispanic: 11%	Hispanic: 9%	Hispanic: 9%
	Other/mixed: 2%	Other/mixed: 2%	Other/mixed: 3%	Other/mixed: 1%	Other/mixed: 3%
Mean (SD) year of birth	1941 (7.1)	1941 (7.1)	1942 (7.6)	1939 (7.1)	1941 (8.3)
Parental education	Less than HS: 47%	Less than HS: 50%	Less than HS: 53%	Less than HS: 44%	Less than HS: 39%
	HS or more: 53%	HS or more: 50%	HS or more: 47%	HS or more: 56%	HS or more: 61%

Table 2

Hazard ratios (HR) and 95% confidence intervals for mortality as predicted by family sequence, job control tertiles, and job demands tertiles. Adjusted for age at HRS baseline, birth cohort, year of entry into HRS, race/ethnicity, region of birth in the US, parental education, and own education.

Variable	Category	HR	95% CI
Family status	Typical married mother (ref)	1.0	
	Later single mother	1.25	(1.03, 1.51)
	Long-term single mother	1.34	(1.05, 1.71)
	Long-term married mother	0.98	(0.82, 1.17)
	Later married mother	1.00	(0.82, 1.22)
Job control tertile	High (ref)	1.0	
	Medium	1.19	(1.00, 1.42)
	Low	1.31	(1.10, 1.56)
Job demands tertile	High (ref)	1.0	
	Medium	1.05	(0.90, 1.24)
	Low	1.07	(0.90, 1.26)

Table 3

Hazard ratios (HR) and 95% confidence intervals for mortality as predicted by joint family sequence and job control tertiles. “P for within-cluster difference from high control” refers to pairwise Wald tests of between-category differences; in this case, within each family cluster, we tested whether those with mid-control and low-control jobs had significantly different mortality rates than those with the same family trajectory but high control. Adjusted for job demands, age at HRS baseline, birth cohort, year of entry into HRS, race/ethnicity, region of birth in the US, parental education, and own education.

Family trajectory	Job control tertile	HR	95% CI	P for *within-cluster* difference from high control
Average married mother (ref)	High Control Job (Ref.)	1.0		
	Mid Control Job	1.30	(0.96, 1.76)	0.091
	Low Control Job	1.33	(0.99, 1.79)	0.062
Later single mother	High Control Job	1.20	(0.81, 1.77)	
	Mid Control Job	1.37	(0.95, 1.96)	0.530
	Low Control Job	1.91	(1.38, 2.63)	0.019
Long-term single mother	High Control Job	1.57	(0.96, 2.55)	
	Mid Control Job	1.72	(1.13, 2.64)	0.738
	Low Control Job	1.65	(1.11, 2.47)	0.854
Long-term married mother	High Control Job	1.24	(0.88, 1.75)	
	Mid Control Job	1.14	(0.81, 1.60)	0.662
	Low Control Job	1.23	(0.90, 1.69)	0.991
Later married mother	High Control Job	0.89	(0.62, 1.28)	
	Mid Control Job	1.31	(0.93, 1.86)	0.048
	Low Control Job	1.48	(1.03, 2.12)	0.013