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Use of Life Course Work-Family Profiles to Predict Mortality Risk Among US Women

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Abstract

Objective—To determine relationships between U.S. women's exposure to midlife work-family demands and subsequent mortality risk.

Methods—Using Health and Retirement Study women born 1935–1956, we calculated employment, marital, and parenthood statuses for each age between 16–50. Using sequence analysis, we identified seven prototypical work-family trajectories. We calculated age-standardized mortality rates and hazard ratios (HRs) for mortality associated with work-family sequence, adjusting for covariates and potentially explanatory later-life factors.

Results—Women staying home with children briefly before reentering the workforce had the lowest mortality rates. Compared to these women and adjusting for age, race/ethnicity, and education, HRs for mortality were 2.14 (1.58,2.90) among single non-working mothers and 1.48 (1.06,1.98) among single working mothers. Married stay-at-home mothers were also at increased risk (1.36; 1.02,1.80). Adjusting for later-life behavioral (smoking, BMI) and economic (household wealth) factors partially attenuated risks.

Conclusions—Women whose lifetime work-family experience is characterized primarily by being a working single mother, non-working single mother, or a never-working married mother may have elevated mortality risk later on, compared with mothers who spent the majority of midlife in the workforce.

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CONTRIBUTOR STATEMENT

ELS co-generated hypotheses, conducted regression analyses, and drafted the manuscript. IMG conducted all sequence analyses. MMG and LFB guided conceptualization and analyses and edited the manuscript.

HUMAN SUBJECTS PROTECTION

The Health and Retirement Study was approved by the University of Michigan human subjects committee. Data used for the present study was determined to be exempt by the Harvard University human subjects committee.

Introduction

Over the past half-century, American women have fundamentally shifted the ways that they combine the roles of employee, spouse, and parent. In 1935, 35% of women aged 25–54 worked for pay; by 1970 participation climbed to 50% and by 1990 to the current level of 75% (1). Marriage patterns also changed: women delayed age at first marriage, chose cohabitation over marriage, and divorced at higher rates than their predecessors (2–4). Finally, fertility remained at approximately 2 children per woman, although age at first birth rose (5). Whereas for a woman born in 1930 a normative work-family trajectory was to marry in her early twenties and exit the labor force at the birth of her first child, patterns for subsequent birth cohorts have diversified (6, 7).

As the US has few public social policies that support working parents (such as paid maternity leave or subsidized childcare), emerging work-family situations may generate competing demands for burdens of time, finances, and other resources (8, 9). Work-family strain, in turn, may predict future disadvantage and disease, including cardiovascular disease, psychiatric disorders, and health-damaging behaviors (10–14), consequently increasing mortality risk. Consequences of work-family conflict may be more pronounced among single mothers without offsetting spousal, social, financial, or emotional support (15), putting them at higher risk of smoking (16), cardiovascular disease (17), and mortality (18). The same objective demand profile may have more profound health effects in lower-SES versus higher-SES women (12).

Research has identified long-term health impacts of work-family strain and attempted to explain the phenomenon. The role accumulation hypothesis posits that marriage, children, and work promote health, individually and together (19). The multiple role hypothesis suggests that while these roles are salubrious individually, certain combinations of roles can impose competing health-damaging demands (20). A major weakness in studies testing both theories is that work-family demands are typically assessed at a single point in midlife (17, 19). However, work-family circumstances often change many times during early and midlife; one-time assessments of demands could obscure underlying patterns. Lifecourse frameworks suggest that both exposure dose and timing can impact later disease risk (21, 22). Thus, analysis of ages during which certain work-family demands might be especially toxic—and analyzing for whom toxicity is most profound—could enhance understanding of relationships between work-family demands and health.

Using the role accumulation and multiple roles frameworks, this study tests whether patterns and timing of work-family life during early and midlife (ages 16–50) predict subsequent mortality risk among American women. We hypothesized that high demands from work and home, with little offsetting support—for example, single working mothers—would be at greater risk for mortality at ages 55–75, compared with women in lower-strain work-family circumstances. We also hypothesized that hazards in higher-risk groups would be partially explained by sociodemographic characteristics, health behaviors, and economic factors at older ages.

Methods

Sample

We used data from the U.S. Health and Retirement Study (HRS), a longitudinal biennial survey of U.S. adults aged 50+. Design, sampling, and response rates are described elsewhere (23). We restricted analysis to women with complete work-family data (see below) born January 1936-February 1956 (n=7,598). We eliminated 62 women who died between ages 51 (end of exposure accrual) and 55 (beginning of mortality follow-up) to reduce the possibility of illness exerting causal effects on exposure trajectories. Compared with those surviving to age 55, those dying at 51–55 were more likely to be non-Hispanic black (25.8% versus 17.8%), less likely to have graduated from high school (66.2%, versus 77.5%) and more likely to be part of the single non-working mother sequence (see below; 22.58%, versus 6.5%). Our final analytic *n* was 7,536.

Exposure: Life course work and family demands

Histories of marriage, childbearing, and work were collected at HRS interviews. Participants were asked about birth or adoption dates of children; beginning and ending dates of all marriages; and beginning and ending dates of current job (if non-retired), last job (if retired), longest-held job, and up to three other jobs. When complete ascertainment of work-family state for a given year could not be directly inferred, we imputed data using proxy variables, such as total years worked. These partial imputations were performed for 3% women's marriage histories, 24% of work histories, and 0% of child histories. Among those missing work data, an average of nine years was imputed. We validated work history imputations against historical Social Security earnings, available for a subset of participants; imputations produced work histories similar to Social Security records.

We conceptualized work-family demands at each age between ages 16 and 50 as three dimensions combined: children under 18 living at home (yes/no), married (yes/no), and working for pay (yes/no), parallel to other objective measures of work-family demands (24). This produced a total of eight possible work-family states, simplified to six states for analytic purposes. For each woman, we constructed an individual trajectory specifying work-family state at each age between 16 and 50—6^{35} theoretically possible trajectories.

The 7,536 women had 6,489 distinct trajectories of work-family life; 86% of women had completely unique work-family histories. To group these diverse trajectories into scientifically meaningful clusters, we employed sequence analysis (25, 26) to identify prototypical trajectories of life events based on observed temporal patterns within the sample (27). Sequence analysis accounts for both timing of milestones (childbirth, marriage) and duration spent in a given state following transition, an improvement over techniques capturing timing or duration but not both.

We classified each participant by the prototypical sequence most closely resembling her unique trajectory. First, Halpin's modified optimal matching involves theoretical specification of "costs" of transforming one individual's sequence to match another. The goal is to select a match with minimum cost (pairwise distance), given multiple ways of transforming one sequence to resemble another. Optimization is performed using an

algorithm (28) based on number of elementary operations, substitutions, and indel costs needed to make two sequences alike. We calculated substitution costs using mean probability distance, based on the observed mean of a given transition's probability (28). For example, transitions from married non-working mother to married working mother were frequent; transitions from non-working single mother to married working mother were rare. The former would have lower substitution costs than the latter. Indel costs are set to 1, slightly more than half the highest substitution cost (10). The algorithm weights basic operations of optimal matching inversely with episode length, emphasizing both duration of given states and transition costs (29).

Next, we performed hierarchical clustering to obtain distinct clusters of similar life trajectories and determined the optimal number of clusters. A seven-cluster solution mathematically optimized dispersion of within- and between-cluster differences as measured by Calinski/Harabasz's Pseudo-F Test (26) (Supplemental Table 1). This solution, classifying each woman into one of seven clusters, produced maximum within-cluster homogeneity of work-family experiences and maximum between-cluster heterogeneity.

Outcome: All-cause mortality

We ascertained dates of deaths (all-cause) occurring after the 55^{th} birthday and before March 2011 (last available data) using the National Death Index (NDI), with proxy reports for post-2008 deaths (NDI data not yet available).

Covariates

Covariates included birth month/year (divided into three equal-sized groups for descriptive and analytic purposes; Supplemental Table 2), self-reported race/ethnicity (non-Hispanic black, non-Hispanic white, Hispanic, multi-racial/other), education (< high school, ≥high school), smoking status (never, former, current), body mass index (BMI) category (underweight, normal weight, overweight, obese), and household wealth quintile based on sample distribution of wealth. Sociodemographic variables were collected upon HRS enrollment; BMI, smoking, and wealth were calculated from the HRS interview closest to the 55^{th} birthday. We also considered constructs related to family formation: age at first birth, total number of children, marital status at first birth.

Statistical analyses

Among 7,536 participants surviving to 55, we documented frequency and distribution of the seven work-family sequences by birth cohorts, education, and race/ethnicity.

Next, we calculated age-standardized mortality rates (ASMRs) to compare absolute mortality by sequence. We calculated each participant's age in 1990. Using indirect standardization and standardizing to the US population age distribution in 1990 (30), the most recent US census in which our entire sample was alive, we calculated ASMRs for each sequence and associated 95% confidence intervals. We used Welch *t*-tests for unequal variances (31) to test for significant differences between groups, with α=0.01 to account for multiple comparisons. We used Cox proportional hazards models to test associations between sequences and mortality risk, adjusting sequentially for demographics (age, race/

ethnicity, education), behaviors (smoking, alcohol consumption, BMI), and household wealth.

To test whether sequences accurately accounted for work-family experiences known to be risk factors for poor health (32), we adjusted for age at first birth, total number of children, and marital status at first birth. Minimal attenuation of coefficients would indicate that sequences captured these risk factors.

Sequences were generated using Stata version 12 (College Station, TX), using established algorithms (28). All other analyses were performed using SAS 9.3 (Cary, NC).

Results

Among 7,536 participants, there were 705 (9.4%) deaths. Mortality varied by age, race, education and smoking status (Supplemental Table 2).

Of the seven work-family patterns, most common was the pattern identifying consistently-working married mothers (35% of sample) (Figure 1), followed by married mothers who stayed home with children for many years before working (17%), and by married mothers who stayed home with children for fewer years before working (15%). The other sequences were: married women with children who never worked outside the home (10%); women who worked but did not have children (8%); women with a long spell as a working single mother (8%); and women experiencing a prolonged period of single, non-working motherhood (6%).

Sequence distribution shifted over successive birth cohorts (Figure 2). In the 1935–1939 cohort, 31% of women were consistently working, married mothers, rising to 39% for the 1947–1956 cohort. The prevalence of women without children, and of single motherhood, increased over time; conversely, permanently non-working mothers decreased from 13% in the 1935–1939 cohort to 8% in the 1947–1956 cohort.

Sequence distribution varied by education and race/ethnicity. Among non-high school completers, 13% were non-working single mothers, versus 4% among graduates. Disparities were also observed by race/ethnicity, with 19% of non-Hispanic Black women classified as single working mothers, versus 6% of non-Hispanic White women and 8% of Hispanic women.

In Figure 3, age-standardized mortality rates (ASMRs), standardized to the 1990 US population age distribution, were calculated for each sequence; all rates are per 1,000. The lowest overall ASMR was among married mothers who were out of the workforce for several years with children (ASMR 48.5, 95% CI 36.3,60.7), and was 50.48 (39.2;61.8) for those who were out of the workforce for longer before working. Compared with these latter two groups, mortality was slightly (though non-significantly) higher among married, consistently-working mothers (60.4; 51.3,69.5); among married mothers who never worked (66.8; 51.6,82.0); and among working non-mothers (59.0; 39.4,78.5). None of the preceding mortality rates were significantly different from each other.

Single non-working mothers had the highest ASMR (121.5; 95% CI 94.6,148.4), significantly higher than all other groups ($p<0.01$), followed by single working mothers (83.1; 60.9,105.3), whose mortality rate was significantly higher than the two lowest-mortality groups ($p<0.01$).

We modeled relative associations between work-family sequences and mortality, adjusting sequentially for sets of social and behavioral risk factors (Table 1). The lowest-mortality sequence—working mothers who stayed home briefly—was the reference. The two single-mother sequences had the highest unadjusted mortality hazards, with HR 2.49 (95% CI 1.85.3.36) for non-working single mothers and 1.66 (1.22,2.25) for working single mothers. Married non-working mothers also had elevated risk (1.40; 1.06,1.86).

Upon adjustment for birth cohort, education, and race/ethnicity, associations were attenuated by 14% for non-working single mothers and by 11% for married single mothers, but increased effect estimates by 7% for consistently working, married mothers, from 1.18 (0.93,1.49) to 1.25 (0.99,1.59). HRs for married non-working mothers remained elevated (1.35; 1.02,1.80).

Adjusting for potential mediators at age 55 (smoking, BMI) attenuated risk among single working mothers by 7% to marginal significance (1.37, 95% CI 0.99,1.90), but increased risk among married non-working mothers, from 1.35 (1.02,1.80) to 1.44 (1.06,1.95).

Finally, we adjusted for household wealth quintiles at 55 to assess whether later-life socioeconomic circumstances attenuated associations. Attenuations were strongest among single mothers: among those who did not work, the HR decreased from 2.10 (1.52,2.89) to 1.72 (1.22,2.44). Among those who worked, the HR decreased from 1.37 (0.99,1.90) to 1.26 (0.90,1.76). The only other sequence still significantly associated with mortality risk was married stay-at-home mothers (1.40; 1.02,1.92).

To test whether sequences captured facets of family formation associated with mortality in prior studies, we examined whether additional adjustment for these facets attenuated HRs (Supplemental Table 3). Non-mothers were excluded. Adjustment for these features of parenthood changed effect estimates very little.

All models were tested for and met the proportional hazards assumption.

Discussion

Among US women born 1935–1956, lifetime trajectories of work-family demands predicted mortality risk at ages 55–75. Using sequence analysis, we identified seven prototypical ways in which women combined work, marriage, and children between ages 16–50. Women spending most of their adult lives as single mothers (working and non-working) were at greatest risk of dying during follow-up, followed by non-working married mothers. Married women out of the workforce when their children were young were at lowest risk. Effects were partially explained by behavioral factors and household wealth in later adulthood.

Prior studies suggest that single mothers are at heightened risk for morbidity and mortality, particularly for those experiencing other forms of social disadvantage such as poverty (17, 18, 33–35). However, most prior studies have not taken work history into account, nor have they used lifetime measures of work-family demands. This lifecourse perspective on exposure is critical: almost all women transitioned from one work-family state to another during midlife. A cross-sectional exposure assessment would have obscured substantial differences in mortality risk revealed through sequence analysis. Our study adds evidence that health impacts of prolonged single motherhood may continue past active childrearing, and that working women are at lower risk than those with similar family situations but do not work.

Literature to date on work-family demands and health offers two primary hypotheses, emphasizing either accumulation of opportunity or demands of multiple roles (19, 20). The multiple role hypothesis postulates that simultaneous functions of spouse, parent, and employee impose competing demands especially for women, and resultant role conflict or role overload is detrimental to health (9). Conversely, role accumulation suggests that simultaneous experience of marriage, parenthood, and work provides enhanced opportunities for social engagement, financial independence, and fulfillment, leading to improved health.

To date, the majority of evidence supports role accumulation (36, 37). We found that mortality rates were generally lowest for those simultaneously combining the three roles of mother, spouse, and worker (supporting role accumulation). However, removing one or more of those roles may induce strains between the remaining roles, contributing to poor health, in a variation of the multiple role hypothesis. Although not all differences are statistically significant, the lowest age-standardized mortality rates were among women combining the three roles of marriage, work, and child-rearing (married mothers going back to work earlier at 48.5 per 1,000; married mothers going back to work later at 50.5; consistently working, married mothers at 60.4). Moderate mortality rates were observed among those filling two of three roles (working non-mother, at 58.96; non-working married mother at 66.82; working single mother at 83.1). Mortality was highest among those filling one role (non-working single mothers at 121.5). These general patterns persisted in regression analyses after adjustment for confounders such as age, education, and race/ethnicity.

Associations between accumulation of roles and health may be partially attributable to selection. Healthier people tend to work (38), be married (39, 40), and have children (41); selection may be compounded when domains are considered simultaneously. Though research suggests that causation may play a stronger role than selection in explaining associations between work-family status and health (42), we cannot rule out selection. However, adjustment for early-life structural factors that may influence selection into single motherhood—such as non-white race and low educational attainment—failed to fully explain effects. Thus, work-family strain may carry risks correlated with but ultimately independent of earlier-life determinants of health.

Adjusting for chronic disease risks and SES at older ages (smoking, BMI, wealth) attenuated HRs in the two single mother sequences, but increased HRs among married non-working mothers. This "masking" in the latter group may occur because of lower prevalence of risks, but greater underlying mortality risk than their working counterparts because of physical and mental health benefits of working. Results may also be mediated by health care access, in addition to selection: unmarried, non-working women may not have access to employer-sponsored health insurance and suffer long-term health consequences as a result. Unfortunately, we do not have historic data on health coverage to test this hypothesis.

Behavioral factors may be mediators, rather than confounders, since we hypothesize that they are on the pathway between work-family patterns and mortality risk. Smoking and obesity potentially represent stress coping (14, 43, 44); attenuation upon adjustment for smoking and BMI among single mothers suggests that these factors partially explain greater mortality risk for those with conflicting work and family responsibilities. This supports findings that smoking may help explain the longevity gap between American and European women (45).

Greater relative wealth may offset strains associated with working motherhood by permitting access to goods and resources (33). Adjustment for household wealth at age 55 attenuated HRs to non-significance, except in married stay-at-home mothers. The latter finding may be attributable to that group having greater wealth on average. As participants generally enrolled in HRS after age 50, unfortunately we do not have comparable wealth metrics during the exposure period.

Our exposure assessment method has several shortcomings (27). In particular, because we summarized work-family experiences, the 7,536 participants—representing 6,489 unique work and family sequences—were collapsed into seven groups, resulting in loss of nuance and obscuring between-individual differences in work-family experience among those in a given sequence. However, such summarization is necessary to uncover broader population patterns.

There are also limitations to work-family measures used to construct the sequences. First, we were unable to distinguish between nuances of our three elements of work-family life such as part-time versus full-time work; adoption versus biological childbearing versus step-parenting; or dependent children living at home past age 18. For work, we collapsed part-time and full-time work, although part-time work is associated with fewer health risks (46, 47). This choice was mainly practical, and is a limitation of sequence analysis: even if rare states or combinations are including in initial exposure assessments, rare combinations often disappear in final cluster solutions because of the need to create a small number of clusters from a wide range of lived experiences. Second, we used objective measures of work-family state, rather than perceived work-family conflict. Our metric permitted a lifecourse approach to work-family histories, a novel contribution of this study. However, the lack of appraisal assumes that all individuals with the same work-family context have similar work-family demands, perhaps a strong assumption in that health effects vary by whether spillover is positive or negative (48, 49). Future studies could explore heterogeneity in work-family demands by incorporating perceived home demands into measures of work stress (50) or

vice versa (12, 13), and could also take into account additional variables during the exposure period such as perceived spousal support or additional socioeconomic measures.

Despite limitations, sequence analysis is an important advance in providing measures that correspond with theoretically relevant aspects of work-family experiences. Typically, workplace or cross-domain exposures—particularly psychosocial exposures—are measured in midlife, and participants' health is subsequently tracked longitudinally. However, few studies have taken a lifecourse perspective on exposure. Given varying mortality rates among the three sequences containing women who worked when their children were older, assessment of work-family demands at age 40 would have assigned the same work-family state (married, working, and with children under 18) to women in all three sequences, even though their total work-family experiences—and mortality risks—differ. This is also true among those who stayed home with young children. To date, sequence analysis has been primarily used for description rather than exposure assessment. Our findings speak to the method's predictive utility for health outcomes.

Findings have implications for both research and policy. Results highlight the necessity of lifecourse perspectives in exposure assessment, as nearly all women made at least one major role transition between ages 16 to 50; a single assessment would have obscured those differences. We present and explore sequence analysis as a method for public health studies.

From a policy perspective, we identify potential future health consequences of growing numbers of US women parenting alone while working, absent social policies that could provide offsetting support. Whereas strong social safety net policies in Europe may fill this role, lack of such policies in the United States—and ongoing cuts to basic social programs—may further strain resources among women balancing work-family demands.

Overall, results suggest that mortality consequences of work-family strain may persist for years beyond active childrearing, and that lifelong work-family patterns can profoundly affect health.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Visual representation of sequence	Description	N	%
	Non-working single mother	486	6.45%
	Working single mother	632	8.39%
	Working non-mother	568	7.54%
	Married mother who went back to work earlier	1158	15.37%
	Non-working married mother	787	10.44%
	Married mother who went back to work later	1308	17.36%
	Consistently working, married mother	2597	34.46%

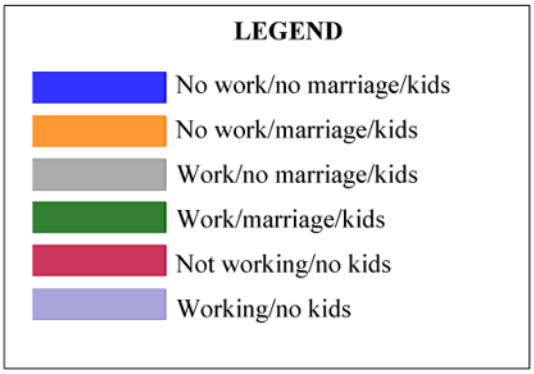
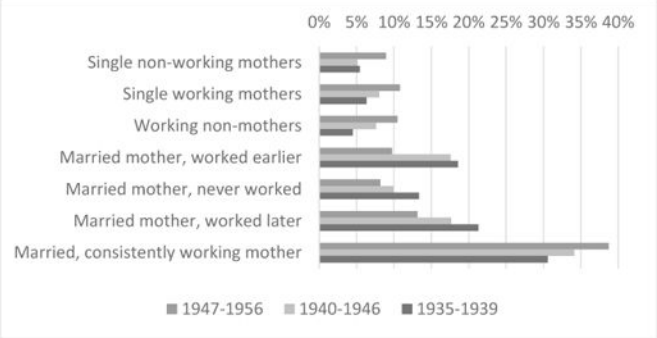
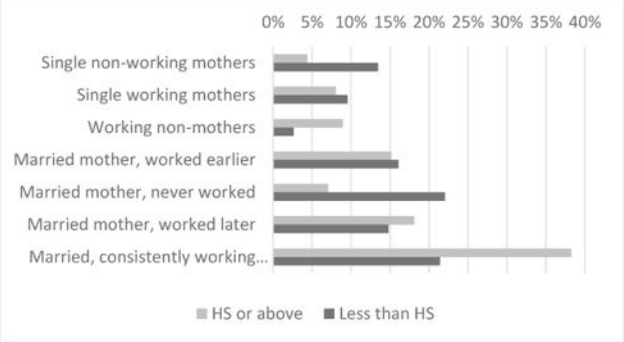


Figure 1.
Distribution of sample by work-family sequence. Visual sequences represent the age span from 16 to 50, with time moving from left to right. The colors associated with each work-family state during this period correspond to the legend below

Panel 1: Distribution of sequences by birth cohort



Panel 2: Distribution of sequences by education



Panel 3: Distribution of sequences by race/ethnicity

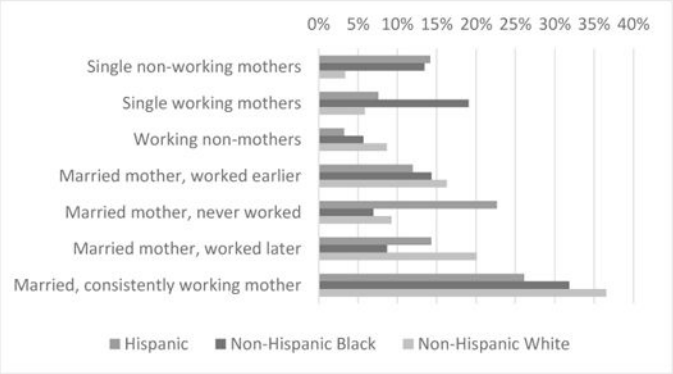


Figure 2.

Distribution (%) of seven identified work-family sequences by sociodemographic characteristics. Percentages are calculated within the sociodemographic groups being compared, rather than within clusters

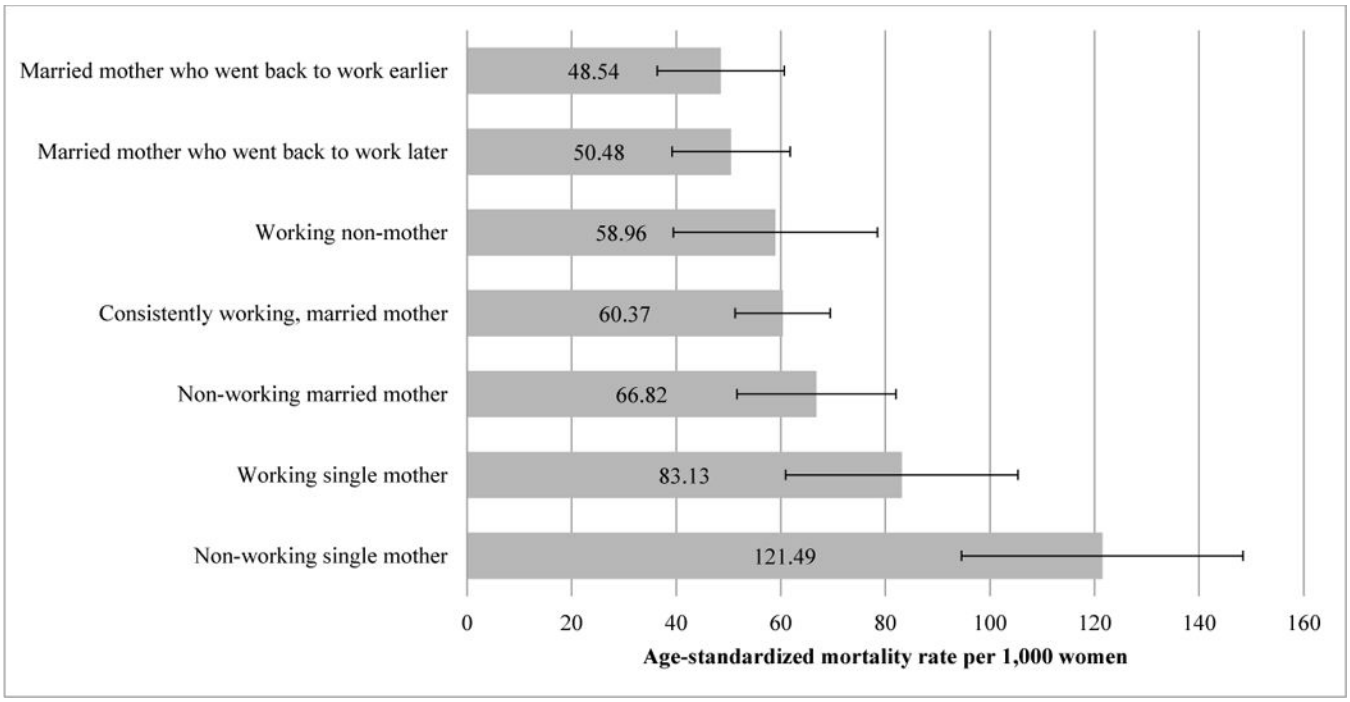


Figure 3.

Age-standardized mortality rates and 95% confidence intervals per 1,000 women for each of the seven identified work-family forms, ages 55–75

Table 1

Hazard ratios (95% confidence interval) for each of the seven identified work-family forms, adjusting for sociodemographic, behavioral, and economic characteristics

	Model 1: Bivariate	Model 2: Adjusting for age, education, race/ethnicity	Model 3: Adjusting for M2 plus smoking and BMI at age 55	Model 4: Model 3, adjusting for household wealth quintile at 55
Married mother, worked earlier	1.0	1.0	1.0	1.0
Single non-working mother	2.49 (1.85, 3.36)	2.14 (1.58, 2.90)	2.09 (1.51, 2.89)	1.72 (1.21, 2.44)
Single working mother	1.66 (1.22, 2.25)	1.45 (1.06, 1.98)	1.37 (0.99, 1.90)	1.26 (0.90, 1.76)
Working non-mother	1.23 (0.86, 1.77)	1.38 (0.96, 1.99)	1.38 (0.94, 2.02)	1.28 (0.86, 1.93)
Married non-working mother	1.40 (1.06, 1.86)	1.35 (1.02, 1.80)	1.44 (1.06, 1.95)	1.38 (1.01, 1.90)
Married mother, worked later	0.93 (0.71, 1.23)	1.00 (0.76, 1.32)	1.03 (0.76, 1.37)	1.02 (0.76, 1.39)
Married mother, always worked	1.18 (0.93, 1.49)	1.25 (0.99, 1.59)	1.24 (0.97, 1.60)	1.21 (0.94, 1.57)