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# WHO'S COUNTING SHEEP? NEGATIVE WORKING CONDITIONS AND SLEEP IN THE UNITED STATES*

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## ABSTRACT

Most adults spend about one-third of most 24 hour days in paid work, and another third of those 24 hours sleeping, yet our understanding of the links between work and sleep is quite limited. This study uses two nationally-representative, prospective samples of US workers, from the American's Changing Lives (ACL) and Midlife in the United States (MIDUS) studies, to examine the way that long work hours, low control, perceived job insecurity and/or daily hassles may "follow workers home" and impinge on their quality of sleep. Our results show that daily hassles at work predict negative changes in sleep quality in samples of workers followed for up to a decade, results that are consistent even in fixed and random effects models. Our models showed less consistent associations between low control and job insecurity and sleep quality among MIDUS respondents only. We found little evidence that work-family conflict acts to mediate the consequences of negative working conditions for sleep quality, but negative work-to-family spillover and the presence of children under three are substantial and significant independent predictors of negative changes in sleep quality. Among ACL respondents only, we found some support for stronger effects of low control on changes in sleep quality among women and less-educated respondents, while job insecurity may be more detrimental for sleep among those of higher occupational status. However, we did not observe any of these moderating effects of social position among the MIDUS respondents. Results are discussed in the context of sociological research on recent changes at work and home in the contemporary United States.

## INTRODUCTION

Most adults spend about one-third of most 24 hour days in paid work, and another third of those 24 hours sleeping, yet our understanding of the links between work and sleep is quite limited. Though sociologists have long been interested in the way that paid work influences individuals and society (Durkheim 1997 [1933]; Hodson 1996; House 1987; Kohn and Schooler 1982; Kohn and Schooler 1983; Lennon 1994; Link, Lennon, and Dohrenwend 1993), with only a few exceptions (e.g., Arber, Hislop, Bote, and Meadows 2007; Hale 2005; Williams 2005) they generally have ignored sleep. Biomedical studies suggest links between working conditions and sleep quality, but most of these existing studies focus on relatively rare negative working conditions and rely on cross-sectional samples that don't represent the majority of workers in the United States. A better understanding of the work-sleep relationship is needed because inadequate sleep has serious consequences ranging from traffic accidents (National Highway Traffic Safety Administration 2006) to health problems (Moore, Adler, Williams, and Jackson 2002) to chronic disease (Tasali, Leproul, Ehrmann, and Van Cauter 2008) to mortality (Ferrie, Shipley, Cappuccio, Brunner, Miller, Kumari, and Marmot Forthcoming). Moreover, given the high prevalence of troubled sleep – a recent report suggests that 50 to 70 million Americans chronically suffer from a disorder of sleep and wakefulness (Colten and Altevogt 2006) – a better understanding of its predictors could improve the well-being of a broad segment of the population. This study uses two nationally-representative, longitudinal samples of US workers to examine the way that common contemporary conditions and experiences at work may "follow workers home" and impinge on their quality of sleep.

Massive macroeconomic and demographic changes in the United States over the past half-century have reshaped the workplace and workforce and have major implications for sleep.

These include industrial transformation from manufacturing toward service industries, rising global competition leading to major organizational restructuring, and the emergence of a 24/7 economy (Howard 1995; Presser 2003). Physical and environmental hazards at work increasingly have given way to psychosocial stressors for a broad range of workers. At the same time, the demography of the labor force in the United States has been transformed by the large-scale entry of women, and a concurrent rise in dual-earner households and single parent families. Sociologists are well-placed to explore the links between contemporary workplaces and patterns of sleep quality; they have studied the strain of long work hours in two-earner households (Jacobs and Gerson 2004; Presser 2003), the consequences of low autonomy and creativity at work (Mirowsky and Ross 2007), rising job insecurity and falling benefits for workers in the wake of downsizing and organizational restructuring (Kalleberg 2000; Kalleberg, Reskin, and Hudson 2000), the consequences of daily hassles (Grzywacz, Almeida, Neupert, and Ettner 2004a), and the difficulties faced by women and families when women both work for pay and act as the primary caregiver for their families (Hochschild and Machung 2003; Moen and Roehling 2005). Our study thus aims to both bring sociological theory to bear on sleep research, and to explore the importance of contemporary working conditions, and inequities therein, for sleep quality.

Existing empirical studies of work and sleep have focused mainly on the consequences of night shift and particularly rotating shift work (for reviews, see Akerstedt 2003; National Center on Sleep Disorder Research 1999). While understanding the consequences of shift work is important, much of the work-sleep literature neglects the variety of other stressors that are prevalent in the contemporary workplace environment and for workers on all shifts, like long work hours, low control at work, perceived job insecurity, or the stress of daily hassles at work.

Only a limited amount of research has examined the relationship between work-home interference and sleep, though this could be an important mechanism linking workplace problems to troubles at bedtime. Perhaps the most serious limitation of most existing studies is that they are based on cross-sectional samples, limiting researchers' ability to understand the causal directionality of the relationship between negative working conditions and sleep quality. Sleepy workers may have a more negative view of their working conditions than the well-rested, for example, rather than troubles at work acting to lower sleep quality. Moreover, when considering self-reported psychosocial stressors like perceived job insecurity and self-reported sleep outcomes, as is typically done in survey-based studies, an underlying negative reporting style could lead to a spurious relationship that can only be investigated if repeated measures are available (Brief, Burke, George, Robinson, and Webster 1988). The present study uses longitudinal data and models to address these limitations, as well as including a measure of respondents' negative reporting style, to provide more robust estimates of the working conditions – sleep relationship.

This study has several strengths; first, we add to substantive knowledge on the importance of inequalities at work for sleep, an important new measure of well-being. Importantly, we are able to address critical shortcomings of prior studies by using nationally-representative prospective data from two different samples with varying periods of follow-up spanning 2.5 to ten years. This study appears to be the first using US data to do so – existing longitudinal studies have been conducted using samples of European or Japanese workers. Additionally, we explore negative work-to-home spillover as a potential mediator of the effects of negative working conditions, as well as possible moderators of their effects, focusing on key stratifying identities of sex, educational attainment and occupational status. Understanding the mechanisms underlying the relationship and/or identifying the groups that bear the greatest burden of poor sleep quality could help to direct preventive and intervention efforts to improve worker well-being.

**Which working conditions matter for sleep quality?**

In the transition to a postindustrial economy and because of the actions of regulatory agencies like the Occupational Safety and Health Administration (OSHA), the most prevalent "hazardous" conditions for workers in the United States have shifted from physical or chemical exposures to psychosocial stressors (Mirowsky and Ross 2007).[1] A handful of studies have shown that work-related stress is frequently cited by workers themselves as a cause of sleeping difficulties (Linton 2004), but since researchers have examined different working conditions in their studies, and generally have not considered a variety of different aspects of work in the same models (Ribet and Derriennic 1999), there is no consensus on which psychosocial stressors at work have the strongest association with sleep quality. A range of working conditions could be considered potential risk factors for disordered sleep. We focus on working conditions that sociologists have theorized are important for understanding the way that paid employment may impact midlife development, or may impinge on life in the hours after work.

One of the most obvious ways that paid employment could preclude adequate and high quality sleep is if it prevents individuals from having enough time to sleep. Working long hours, particularly if they are not voluntary, has been linked to poor sleep quality or fatigue in epidemiological studies (AkerstedtÅkerstedt, Fredlund, Gillberg, and Jansson 2002; Defoe, Power, Holzman, Carpentieri, and Schulkin 2001). However, sociologists have found mixed

[1] Though workers in high-risk industries like construction have much higher rates of exposure, one estimate suggests that only about one in four workers in wealthy countries like the United States are exposed to hazardous physical, chemical and biological conditions, compared with about three in four workers in poorer countries (World Health Organization 1995).

results when they have studied the impact of long working hours on well-being and quality-of-life outcomes (Barnett 1998). Some studies have shown that long hours predict work-family conflict (Grzywacz and Marks 2000), for example, but others have shown that people who work long hours have better physical health (Bird and Fremont 1991) and lower psychological distress (Barnett and Shen 1997) than those who work fewer hours. One possible concern is that a "healthy worker" effect accounts for these positive outcomes – healthier people may be the ones who are able to work long hours (Pavalko, Gong, and Long 2007) – and longitudinal studies are needed to investigate this possibility. Additionally, characteristics of families, such as whether an individual is married or has children, the burden of a spouse's working hours, or other individual or family factors may help to explain why the evidence on long work hours is mixed. We examine long work hours in the context of these factors while also exploring negative psychosocial working conditions.

In addition to the more "objective" measure of long work hours, we also explore the impact of psychosocial stressors that have received attention from sociologists and others: low control at work, perceived job insecurity, and the "daily hassles" of being bothered/upset or experiencing a personal conflict at work. Exposure to psychosocial stressors at work is proximally linked to disordered sleep via increased neurological arousal that involves the release of key neurotransmitters (such as adrenaline and noradrenaline) and neuron-effective hormones (such as cortisol). The presence of cortisol, in particular, can interfere with a worker's ability to "switch off" at the end of the work period and could also lead to depressed mood or enduring agitation or anxiety about the day's events, all of which could prevent adequate sleep (Linton 2004). In particular, whereas higher physical strain at work tends to push a worker toward physical fatigue and restorative sleep, psychological strain of the kind associated with psychosocial stressors at work tends to exert the opposite effect, making it more difficult for individuals to initiate and maintain adequate sleep (Linton 2004; Ota, Masue, Yasuda, Tsutsumi, Mino, and Ohara 2005).

A psychosocial stressor of interest to sociologists and others is a sense of control over one's work. Low control has been shown to be associated with poor health outcomes (Fenwick and Tausig 1994; Reynolds 1997), most centrally by Karasek and colleagues, who developed and applied the demand-control-social support (DCS) model (Karasek and Theorell 1990; Karasek 1979). The DCS model suggests that low control, exemplified by low autonomy and creativity, is particularly harmful when combined with high demands at work. Much of the evidence on health outcomes suggests that low control, rather than high demands, may be the more salient exposure for well-being. Empirical evidence suggests that low control may be linked to low sleep quality (e.g., Kalimo, Tenkanen, Harma, Poppius, and Heinsalmi 2000; Sekine, Chandola, Martikainen, Marmot, and Kagamimori 2006) but the existing studies often have not examined low control and sleep in the context of other negative working conditions, and most are based on cross-sectional samples of workers outside the United States.

Other psychosocial stressors of interest in this study have received less research attention than low control. One such exposure is perceived job insecurity. An individual worried about losing his or her job may experience stress due to anticipation about the problems associated with a job loss, the mental strain associated with being in a powerless position, and ambiguity about what the future might hold and what actions would be most appropriate to reduce the strain (Heaney, Israel, and House 1994; Joelson and Wahlquist 1987). People experiencing perceived job insecurity cannot employ instrumental strategies of coping because of the persistent uncertainty about whether or not the feared employment instability will actually occur, and this could exacerbate negative consequences for sleep. Finally, more frequent and perhaps less severe "hassles" have been the focus of some research linking stressors to well-being (Grzywacz, Almeida, Neupert, and Ettner 2004a). Examples of these "daily hassles" include interpersonal conflicts and other situations in the workplace (Almeida, Wethington, and Kessler 2002) that could accumulate to create a meaningful burden affecting health (McEwen 1998), and potentially could influence sleep quality. Some have argued that the constant assault of these small but frequent daily stressors may even have a greater impact, along with other chronic stressors like low control or perceived job insecurity, than major but infrequent life events (Lazarus and Folkman 1984; Repetti 1982). As measures of daily hassles we examine feeling frequently bothered or upset at work or experiencing a personal conflict in the workplace, neither of which have been studied as a predictor of sleep. However, these "episodic, irregular, microevents that cannot be anticipated daily"(Wheaton 1999, p. 284) have been linked to psychological distress (Grzywacz, Almeida, Neupert, and Ettner 2004b) and may influence sleep quality.

**Work-family conflict as a mechanism**

We consider work-family conflict as a potential mechanism that could explain a relationship between negative working conditions and sleep quality. Sociologists have commented extensively on the changes occurring in the workplace and home spheres that are generating an emerging "time bind" for families (Hochschild 1997; Jacobs and Gerson 2004). Difficulties occur where engagement with the role demands of work makes meeting the role demands of home and family more difficult (Greenhaus and Beutell 1985), a situation that has been labeled work-family conflict. There is reason to believe that work-family conflict could provide a bridge for the stressors and hassles of the workplace to invade the home sphere and influence well-being. Empirical evidence shows that demands at work are associated with increased negative work-to-family spillover (Voydanoff 2005); for example, long work hours may make it difficult to spend time with family members (Grzywacz and Marks 2000). Job insecurity also predicts work-home interference (Batt and Valcour 2003; Voydanoff 2004). Moreover, a small number of studies have shown that negative work-to-family spillover has an independent relationship with exhaustion (Demerouti, Bakker, and Bulters 2004) and sleep deprivation (Geurts, Rutte, and Peeters 1999). Work-to-home interference has been shown to at least partially mediate the relationship between negative working conditions and mental and physical well-being (Geurts, Kompier, Roxburgh, and Houtman 2003), and may also act as a mediator of the working conditions-sleep quality relationship (Geurts, Rutte, and Peeters 1999). We explore a variety of measures of work-family conflict in our analyses, including direct measures of negative work-to-home spillover, indicators of young or older children in the household, an indicator of having a spouse who works long hours, and an indicator of working night hours. Each of these factors could indicate or explain why respondents are having difficulty balancing the demands of work and home.

**Do Working Conditions Matter More for Some Workers than for Others?**

Troubled sleep may be one way that socially-stratified experiences on the job "get under the skin" to impact well-being. Some studies have shown that people who have relatively low educational attainment or incomes and those who hold low status occupations have lower sleep quality than their counterparts with higher socioeconomic position (SEP) (Friedman, Love, Rosenkranz, Urry, Davidson, Singer, and Ryff 2007; Geroldi, Frisoni, Rozzini, De Leo, and Trabucchi 1996; Hunt, McEwen, and McKenna 1985; Hyyppa, Kronholm, and Alanen 1997; Moore, Adler, Williams, and Jackson 2002; Sekine, Chandola, Martikainen, McGeoghegan, Marmot, and Kagamimori 2006). Sociologists have argued that one of the mechanisms linking

SEP to health is greater exposure to stressors among low-status people (Grzywacz, Almeida, Neupert, and Ettner 2004b; Lantz, House, Mero, and Williams 2004), which could include a heavier burden of negative experiences at work. In our analysis we adjust for an array of sociodemographic characteristics to explore the distribution of sleep quality, but we also engage an issue that has received less attention: is the association between negative working conditions and sleep quality stronger for some workers than for others? Differential vulnerability to stressors has been studied by some sociologists (Avison, Ali, and Walters 2007) and we engage with that work here by exploring potential interactions between working conditions and key stratifying identities including sex, educational attainment and occupational status.

**Research Questions**

This study asks several related questions in response to the extant sociological and biomedical literatures on working conditions, poor sleep quality, and their association. First, are common negative work conditions, specifically long work hours, perceived low control, job insecurity, frequently feeling bothered/upset at work, and/or experiencing a personal conflict on the job associated with poor sleep quality, and do the associations persist in longitudinal models? Second, are the associations between negative working conditions and poor sleep quality mediated by work-family conflict? Third, does the experience of these negative working conditions have a stronger association with poor sleep quality for some groups of workers than for others? Specifically, are consequences for sleep worse for women or for less educated or lower status workers than for men or for more educated or higher status workers?

## DATA AND METHODS

### Data

We compare two nationally-representative studies in the analysis: the American's Changing Lives study (ACL) and the Midlife in the United States study (MIDUS). We include respondents from each study who were working at least twenty hours per week at baseline to focus on those among whom exposure to negative working conditions is likely to be substantial, and because some working conditions information is available only for individuals working at least this much. The ACL is a stratified, multi-stage area probability sample of 3,617 non-institutionalized adults 25 years and older living in the United States in 1986, with over sampling of adults 60 and older and of African Americans. Sample weights have been designed to adjust for oversampling of special populations and loss to follow-up due to attrition or death and will be used in all appropriate descriptive statistics and multivariate models. Excluding ACL respondents who did not work at least twenty hours per week in 1986, most of whom were already retired or not working for pay (N = 1,930), those who were not present for the 1989 interview (N = 297), and cases missing on covariates (N = 88), 1,316 individuals are eligible for inclusion in the analytic sample. A subsample of respondents who were working for pay for at least 20 hours per week at both waves one and two (N = 1,090) is used for much of the analysis.

The MIDUS study is a nationally-representative survey of 3,032 Americans aged 25 to 74, initiated in 1995-96 and with a follow-up survey in 2005. Sampling weights have been designed to correct for selection probabilities and non-response, and will be used in all descriptive and multivariate analyses. After elimination of those not working at least twenty hours a week in 1995, most of whom were already retired or not working for pay (N = 1,068), those who did not respond in 2005 (N =782), and cases missing on covariates (N = 143), 1,041 respondents are eligible for inclusion in the analyses. As for the ACL sample, a subsample of respondents who were working for pay for at least 20 hours per week at both waves one and two (N = 708) is used for some of the analysis.

*Sleep Quality*

Measures of sleep quality are self-reported in ACL and MIDUS. In the ACL the item used to measure poor sleep quality is: "During the past week my sleep was restless: most of the time, some of the time, or hardly ever." We dichotomize the responses so that 0 = hardly ever, while 1 = some or most of the time, because this denotes as exposed those respondents who reported troubled sleep for at least some meaningful fraction of the last week, and also because only a small fraction of respondents reported the response "most of the time" (10% in 1986 and 7% in 1989).[2] The MIDUS item indicating poor sleep quality is: "During the past 30 days how often have you experienced trouble getting to sleep or staying asleep: almost every day, several times a week, once a week, several times a month, once a month, or not at all?" We dichotomize the responses so that 0 = not at all or once a month and 1 = several times a month to every day; this generated the most substantively similar measure to the one used for ACL respondents. Below we discuss results obtained when the MIDUS measure of poor sleep quality is used as a continuous measure rather than a dichotomous indicator. Appendix A presents the distribution of each measure using the raw codes and indicates the way each was dichotomized for analysis.

*Working Conditions*

We include a range of items to measure negative working conditions in waves one and two for each sample, with three available for both ACL and MIDUS respondents (average work hours, low control, and perceived job insecurity) and one available only for ACL respondents

[2] Models not shown here indicate that results obtained when only those reporting "most of the time" are classified as exposed are similar to those obtained here, but considerably weaker due to the much smaller number of cases.

(bothered/upset at work) or MIDUS respondents (personal conflict), to maximize the available diversity of measures across samples while retaining general comparability. *Work hours* at the respondent's main job are measured as average hours of work per week. *Low control* is an indicator derived from two sets of items based on Karasek and Theorell's measures of job strain (Karasek and Theorell 1990; Karasek 1979); different items for each are available for ACL and MIDUS respondents (see Appendix B), so the measures cannot be directly compared but are based on a similar range of items adapted from the original scales with some identical items asked in both surveys. For ACL respondents, response categories for items such as "I get to do a variety of different things in my work" are coded so that 1 = strongly agree, 2 = agree somewhat, 3 = disagree somewhat, and 4 = strongly disagree. For MIDUS respondents, items like "How often do you have a choice in deciding how you do your tasks at work?" are coded so that 1 = all of the time, 2 = most of the time, 3 = sometimes, 4 = rarely, and 5 = never. For both samples we create measures of low control by summing all items. To measure *perceived job insecurity*, ACL respondents were asked: "How likely is it that during the next couple of years you will involuntarily lose your main job – not at all likely = 1, not too likely = 2, somewhat likely = 3, or very likely = 4?" MIDUS respondents were asked a similar question, though the emphasis was on keeping their job rather than losing it: "If you wanted to stay in your present job, what are the chances you could keep it for the next two years – excellent = 1, very good = 2, good = 3, fair = 4, or poor = 5?" Measures of daily hassles are distinct for the two samples. For ACL respondents, we include a measure of being *bothered* at work; the item asks "In general, how often do you feel bothered or upset in your work – almost always = 5, often = 4, sometimes = 3, rarely = 2 or never = 1?" For MIDUS respondents, a measure of personal conflict is included in the analysis, based on the question: "In the past 12 months, did you have any serious ongoing problems getting along with someone at work?" (No = 0, Yes = 1). Below we discuss alternative results obtained when dichotomous specifications of all working conditions measures are used.

*Mediators and Moderators*

We explore as potential mediators of the working conditions-sleep association measures of work-family conflict obtained at the second survey wave for each sample. To capture *negative work-to-family spillover*, ACL respondents answered the question "When I am at home, I am bothered by all the things at work that I should be doing. Do you feel this way all the time = 4, often = 3, sometimes = 2, rarely = 1, or never = 0?" MIDUS respondents answered four items, such as: "Your job reduces the effort you can give to activities at home" and "Job worries or problems distract you when you are at home" using the following categories: 5 = all of the time, 4 = most of the time, 3 = sometimes, 2 = rarely, 1 = never. The MIDUS indicator of negative work-life spillover is created by summing the four items. ACL respondents reported on the number and age of children in the household, and we created dichotomous indicators of the presence of *children 3 to 18* years old (No = 0, Yes = 1) and *children under 3* years old (No = 0, Yes = 1). MIDUS respondents reported about the work hours of their spouse, if they had one, and we created a dichotomous indicator so that 1 = spouse works 50 or more hours per week, and 0 = spouse works fewer than 50 hours per week, does not work, or respondent does not have a spouse. MIDUS respondents also reported on the time of day they usually worked, and we created an indicator for *works nights*, coded so that 1 = respondent works during the 9:30pm to 4:30am period at least two nights per week, and 0 = respondent works during the 9:30pm to 4:30am period once a week or less.

Moderators examined in the analysis include sex, educational attainment, and occupational status. Sex is coded so that 0 = female and 1 = male, and educational attainment at baseline is coded as 0 = some college or more and 1 = high school graduate or less. Occupational status is assessed with the Duncan Socioeconomic Index (SEI) score, based on the respondent's three digit census occupation code (using 1970 version for ACL and 1980 version for MIDUS). SEI scores range from about 3 to 96, with higher scores indicating a higher status job. Controlling for SEI helps to isolate the associations between specific negative working conditions and sleep quality, eliminating the possibility that these working conditions simply reflect a job's lower status. We dichotomized SEI at the median for each sample, with 0 = at or above the median SEI score, and 1 = below the median SEI score for each sample.

*Other Predictors*

In multivariate analyses we adjust for baseline sociodemographic, personality and health characteristics predictive of sleep quality, working conditions, or both. Employment status at wave two (0 = not employed, 1 = employed) is included in longitudinal models that estimate the impact of working conditions at baseline only, to differentiate those workers who are clearly no longer exposed to working conditions. Age is measured in years, and a squared term for age is included in multivariate models to adjust for nonlinearities in the association between age and sleep identified in other studies. Respondent's race is coded so that 0 = white, 1 = African American, and 2 = other race, and is treated categorically in multivariate analyses. Marital status is coded so that 0 = married or living with a partner and 1 = unmarried/not living with a partner. We also include a measure of household income, reported in 2007 dollars in Table 2, but transformed for multivariate analysis as a started log [i.e., adding a small positive constant ($500) before taking the log so that individuals with a score of zero on the measure are retained].[3] We include a measure of neuroticism, a relatively stable underlying personality trait that may mark a negative reporting style. In the ACL we use a neuroticism index based on the four questions from the Eysenck Personality Inventory (Eysenck and Eysenck 1975), such as "Are you a worrier?" The standardized scale ranges from -1.2 (least neurotic) to 2.2 (most neurotic). For MIDUS respondents, a neuroticism index was available based on four items; respondents were asked to "Please indicate how well each of the following describes you: 1 = not at all, 2 = a little, 3 = some, 4 = a lot." Items included in the index were: moody, worrying, nervous, and calm. Scores across items were averaged for all individuals reporting on at least two items and range from 1 (least) to 4 (most neurotic). Self-rated health, a general indicator used to distinguish respondents who may have health conditions that influence their ability to sleep, is measured in both samples with a single item: "How would you rate your health at the present time: 1 = poor, 2 = fair, 3 = good, 4 = very good, or 5 = excellent?" We also control for obesity, a risk factor for sleep apnea, which could negatively impact sleep quality. Using self-reported weight and height, obesity is coded so that 0 = body mass index less than 30, while 1 = body mass index 30 or above. Finally, poor sleep quality at baseline is included in most longitudinal models, coded as described above for poor sleep quality at wave two.

**Analytic Strategy**

All analyses are conducted using Stata SE 10 software. Logistic regression models are estimated to explore the association between negative working conditions and sleep quality. A first set of cross-sectional models examines baseline working conditions and baseline sleep quality, with subsequent models considering sleep quality at wave two as predicted by working

[3] Because the same amount of income could mean different things to different families, we also explored controls for reported difficulty paying the bills each month, a more subjective measure of financial hardship, but found no differences in our results.

conditions at (a) wave one, or (b) wave two. Further models examine mediating and moderating factors. We also explore fixed and random effects models for respondents working at the survey waves one and two, making use of some alternative strategies including consideration of wave three data for ACL respondents with a reduced selection of available working conditions, and an alternative, continuous specification of MIDUS poor sleep quality (described below). Attrition of respondents is always a concern when using longitudinal samples. All prospective multivariate models use wave two survey weights, which adjust for survey attrition, while cross-sectional figures use baseline sampling weights.

**RESULTS**

Measures of all study variables – means and standard deviations or percentages for dichotomous variables – are presented in Table 1 (for outcome and key independent variables) and Table 2 (for independent variables). Characteristics are presented for all respondents working at baseline in the left column, and for the sample working at both waves one and two in the right column for each study sample. As shown in Table 1, roughly half of our respondents in each sample report poor sleep quality at Wave 2. By comparison, a study of U.S. workers using data from the 2002-2003 National Employee Survey showed that about 58% reported at least some trouble falling asleep in the past month and about 56% reported at least some trouble staying asleep (Knudson, Ducharme, and Roman 2007), suggesting that our figures are reasonable. Turning to negative working conditions exposures, the average respondent worked about 42 to 44 hours per week in wave one, and 40 to 43 hours per week in wave two (among those working at both waves). Low control scores averaged about 5.0 - 5.1 for ACL respondents (range: 3 – 12) and about 21 for MIDUS respondents (range: 9 – 45), placing the average for ACL and MIDUS respondents close to or just above the bottom quartile of the possible range.

ACL respondents scored about 1.7 on perceived job insecurity (range: 1 – 4) and MIDUS respondents scored about 1.5 - 1.6 (range: 1 – 5), suggesting that ACL respondents were slightly more worried about job loss. Turning to daily hassles, ACL respondents reported scores of 2.6-2.7 (range: 1 – 5), suggesting that they averaged a score between sometimes and often bothered or upset at work. About 15% of MIDUS respondents reported a personal conflict at work in Wave 1, and about one in ten of those still working at follow up reported a personal conflict at Wave 2. There are minimal differences in baseline exposure to negative working conditions or troubled sleep when comparing the main analytic sample and the sample working at both waves one and two, and Table 2 shows that other characteristics are also similar for the two groups within the ACL and MIDUS samples.

**Are Negative Working Conditions Associated with Poor Sleep Quality?**

Tables 3 and 4 present the first set of multivariate logistic regression results for the ACL and MIDUS samples, respectively. Figures presented are odds ratios and 95% confidence intervals obtained from logistic regression models, and sample sizes and tests of model fit are presented at the bottom for each model. Table 3 shows results for cross-sectional models (1986 and 1989) in the left panel and for longitudinal models in the right panel. Model 1 is the simplest baseline model of association between negative working conditions and poor sleep quality, adjusting only for age, age-squared, and sex. Model 2 adds controls for all other independent predictors available at baseline, including sociodemographic characteristics (race, marital status, educational attainment, household income) and baseline neuroticism score, self-rated health and obesity. Taken together, the cross sectional Models 1 and 2 suggest perceived job insecurity and feeling bothered/upset at work are most strongly linked to poor sleep quality for ACL respondents in wave one, with low control a significant predictor only before more extensive controls are added in Model 2. The cross-sectional Model 3, which considers predictors and poor sleep quality measured in 1989, shows that only feeling bothered/upset at work remains a significant predictor in wave two.

Turning to longitudinal models of change in poor sleep quality, Model 4 examines the impact of 1986 working conditions on 1989 poor sleep quality, controlling for all predictors in Model 2 and adding employment status in 1989 and, most importantly, poor sleep quality in 1986. Model 5 substitutes working conditions in 1989 for those in 1986, to examine the impact of temporally more proximal conditions at work for sleep in 1989. Taken together, the results of Models 4 and 5 suggest that perceived job insecurity is not associated with changes in poor sleep quality, though it was a predictor in cross sectional models at baseline. Additionally, it is the more temporally proximate measure of feeling bothered/upset at work in Wave 2 that is a significant predictor of change in poor quality sleep. Feeling bothered/upset at baseline, on its own, is not a significant predictor of change in poor sleep quality over the subsequent 2.5 year period (Model 4).

Table 4 presents results from MIDUS respondents; Models 1 through 5 are constructed to match those for ACL respondents in Table 3, though MIDUS respondents report on personal conflict at work instead of feeling bothered/upset as a measure of daily hassles. The cross-sectional Models 1 and 2 show that contemporaneous reports of perceived job insecurity are the strongest predictors of poor sleep quality at baseline in 1995. By contrast, the cross sectional Model 3 for 2005 shows that the likelihood of reporting poor sleep quality rises as low control score increases, and is higher for those reporting personal conflict at work, though both of these associations are only marginally significant ($p<.10$). Turning to results of longitudinal Models 4 and 5, we find that low control in 1995 or 2005 is significantly and positively associated with change toward poor sleep quality. Personal conflict at work in 2005 is marginally significantly associated with change toward poor sleep quality between 1995 and 2005.

**Does Work-Family Conflict Explain the Relationship?**

Can the relationships between negative working conditions and poor sleep quality uncovered here be explained by increased work-family conflict among those who appear to "carry home" the low control or daily hassles they experience at work? Table 5 presents results from models that test whether measures of work-family conflict act as mediators of these associations. Models presented in Table 5 are identical to Model 5 from Tables 3 and 4, but they include additional indicators of wave 2 work-family conflict. We only present coefficients for working conditions and work-family conflict indicators here. Results for ACL respondents in Model 1 suggest that negative job-to-home spillover is a significant predictor of change in sleep quality net of the other measures, but it does not explain why feeling bothered/upset at work is associated with negative changes in sleep quality. Comparing the odds ratios for bothered/upset at work from Model 5 in Table 3 and Model 1 in Table 5, we see a reduction of only about 4% (1.29 – 1.24/1.29 = 0.039). Controlling for children ages 3 to 18 in the household in Model 2 does not explain the bothered/upset association either, though having older children is associated with a significantly *reduced* risk of negative change in sleep quality. Model 3 shows that respondents with children under 3 years of age in the household by wave two have a substantially higher risk of reporting negative changes in poor sleep, though feeling bothered/upset at work remains a significant predictor. One explanation for the very different effects associated with younger and older children may be that since the gap between waves one and two in the ACL study was about 2.5 years, the presence of children younger than three years of age in wave two probably indicates newly arrived, very young children. By contrast, when considering children older than three, respondents may have adapted to having children by the time they reach older ages, and their arrival likely happened before the study baseline, so any effect on sleep quality was probably already evidenced by wave one.

Turning to MIDUS respondents, Model 4 shows that higher reported negative job to home spillover scores in wave 2 are associated with a significantly greater risk of negative change in sleep quality between waves. The positive association between low control and change in sleep quality is basically unchanged with this addition (compared to Model 5 in Table 4), though the association with daily hassles (here, personal conflict) is reduced by about 15% and is no longer marginally significant. Controls for a spouse who works overtime (Model 5) or for respondent's own frequent night shifts (Model 6) do not change the results we observed in Table 4.

**Do Negative Working Conditions Affect Everyone's Sleep?**

Our final research question asks if the association between negative working conditions and poor sleep quality may be moderated by social characteristics: are consequences worse for some workers than for others? We re-estimated Model 5 from Tables 3 and 4 for ACL and MIDUS respondents, respectively, adding interaction terms with key characteristics at baseline. In Table 6 we show results for: (a) the main effect of each negative working condition, (b) the interaction term with the predictor of focus for that model, and (c) the main effect of the focal predictor (male, high school or less, low SEI). Models 1 and 4 in Table 6 consider the interaction with male sex, Models 2 and 5 examine the interaction with educational attainment (high school or less versus some college or more), and Models 3 and 6 show the interactions with SEI score (below the median for the sample versus above the median).

Model 1 for ACL respondents shows that there is a marginally significant sex difference in the impact of low control, with males showing less likelihood of a transition to poor sleep when exposed than their female counterparts. In addition, ACL respondents with a high school education or less are more likely to suffer from negative changes in sleep quality than those with more education as their reported score for low control increases (Model 2). Countering these findings of greater consequences for traditionally disadvantaged workers, Model 3 shows that the consequences of perceived job insecurity for negative changes in sleep quality are greater for respondents above the median on occupational status, though the association is only marginally significant. Models 4 through 6 show that none of the tested interaction terms are statistically significant among MIDUS respondents, though there are issues of low power in all models presented in Table 6, given sample sizes and the number of control variables included. One interaction is substantively, if not statistically, significant. Model 6 shows that the consequences of daily hassles at work appear to be greater for respondents above the median on occupational status. Simpler models with fewer predictors support this finding.

**Sensitivity Analyses**

We conducted additional analyses to examine the robustness of these results. We explored whether and to what degree unobserved differences across respondents might account for our results by estimating a series of fixed and random effects models using the sample of respondents working at both waves one and two. Table 7 for ACL respondents and Table 8 for MIDUS respondents present the odds ratios or coefficients from these models. For ACL respondents we first estimated fixed and random effects logistic models for the 1986 to 1989 period (left panel), then estimated another set of fixed and random effects models that include data from the 1989 to 1994 period, using the wave three data from 1994 (right panel). Measures of low control and job insecurity were not collected in 1994, so we focus on work hours and feeling bothered/upset at work in the models in the right panel. At the bottom of the table we include information about the number of cases used to estimate the models, and present Hausman test results to guide comparisons across fixed and random effects results. A Hausman test statistic of $p<.05$ suggests using fixed effects results, while a p-value greater than 0.05 suggests using random effects results. The results presented in Table 7 provide support for our earlier findings for ACL respondents. The Hausman test comparing the first two models (left panel) supports using estimates from the random effects model, which show a significant effect of being bothered/upset at work, while both fixed and random effects models using the additional survey wave (right panel) show a significant association between being more frequently bothered/upset at work and negative changes in sleep quality.

We made use of a slightly different strategy with MIDUS respondents, because only two waves of data are available. The left panel of Table 8 shows odds ratios from fixed and random effects logistic regression models, while the right panel shows fixed and random effects linear regressions of changes in sleep quality using the six category measure of poor sleep as a continuous outcome. Taking advantage of the more detailed measure of poor sleep quality may allow us to see the impact of changes in negative work conditions on smaller incremental changes in sleep quality. The results presented in Table 8 show some differences from our earlier findings for MIDUS respondents. Fixed and random effects models suggest that changes in perceived job insecurity are most clearly associated with changes in poor sleep quality, though job insecurity was a significant predictor only in the cross-sectional baseline models presented in Table 4, and not in the longitudinal models in that table. The right panel of Table 8 shows that a newly arising personal conflict at work is positively associated with change toward poorer sleep quality when using the more detailed outcome indicator, though this association is not evident in the left panel. In none of these models does low control retain the predictive power it had in our earlier models. These findings suggest some caution in interpreting results obtained from our earlier models for MIDUS respondents, but generally support our earlier findings for the importance of daily hassles at work, especially among ACL respondents.

With longitudinal data on working conditions, we also are able to examine the differences between respondents with intermittent versus persistent exposure to the working conditions of interest. In models not shown here, we summed the number of times respondents reported a particular exposure (0, 1, or 2) over the two survey waves, after dichotomizing exposures. We found that among ACL respondents, feeling bothered/upset at one survey wave is associated with a significantly greater risk of change in sleep quality, while the odds ratio for persistently exposed individuals is large but not statistically significant. This result is not surprising, given that only 3% of ACL respondents reported being bothered at both waves. For MIDUS respondents, we found that reporting low control at one or both survey waves is associated with a significantly greater risk of change in sleep quality, with the odds ratio for persistent exposure larger than for intermittent exposure. Exploration of the potential for collinearity among indicators of working conditions was also conducted, as well as analyses of multiplicative effects of pairs of exposures, but these analyses did not change the conclusions reached above.[4]

To examine whether our choice to preserve the continuous specifications of working conditions indicators affected our results, we re-estimated models using dichotomized versions

[4] A related question is the total burden of exposure borne by respondents; when we create a count of how many negative working conditions respondents report in wave 2 (after dichotomizing each), about 40% of ACL respondents report none, 43% report one, 15% report two, 3% report three, and fewer than 1% report long work hours, low control, job insecurity and feeling bothered. The figures for MIDUS respondents are 50% with none, 37% with one, 11% with two, 3% with three, and fewer than 1% with all four negative working conditions.

of work hours (details available from authors on request). Results for ACL respondents were essentially identical to those reported here, except that respondents working 50 or more hours per week had a marginally lower risk of negative changes in sleep quality in the fixed and random effects models using wave three data (Table 7, right panel). Results for MIDUS respondents using categorical predictors showed that working 50 or more hours per week was associated with greater risk of reporting poor sleep quality in the cross-sectional model for 1995, and also marginally related to negative change in sleep quality in the random effects model for the dichotomous sleep quality measure (Table 8, left panel). Low control also appeared as a significant predictor in both random effects models when coded as a dichotomous indicator, but Hausman tests clearly showed that fixed effects models were preferred, and in these models low control was not a significant predictor. Overall, it appears that our results are robust to choices about operationalizing measures of working conditions.

A final possibility is that the negative working conditions considered here are making it difficult for individuals to get enough sleep – thereby leading them to report poor quality sleep. When we added a categorical measure of sleep duration at wave two (6 hours or less per night, 7 to 8 hours (optimal), and 9 or more hours), we found that short sleep was associated with changes toward poorer sleep quality in both samples, and long sleep was associated with negative changes for ACL respondents only. Even with the control for sleep duration, our conclusions about the associations between negative working conditions and sleep quality remained unchanged.

**CONCLUSIONS**

We set out to better understand the connections between conditions at work and sleep quality in the United States. Work and sleep take up about two-thirds of every weekday, yet sociologists have not rigorously explored the connection between the two. Moreover, though sleep quality is a compelling outcome in its own right and an important predictor of health, we have only limited empirical understanding of predictors in the workplace. Most of the evidence that working conditions affect sleep quality is based on cross-sectional data or samples of workers who have unusually difficult work conditions (such as rotating shift work). We used two nationally-representative, prospective samples of US workers to examine the way that common contemporary conditions and experiences at work may "follow workers home" and impinge on their quality of sleep. Three questions were explored: first, are long work hours, perceived low control, job insecurity, and/or daily hassles at work associated with poor sleep quality, and do the associations persist in longitudinal models? Second, are the associations between negative working conditions and poor sleep quality mediated by work-family conflict? Third, are consequences for sleep worse for women or for less educated or lower status workers than for men or for more educated or higher status workers?

With regard to the first question, our results show that psychosocial stressors at work – particularly daily hassles – predict changes toward poorer sleep quality in samples of workers followed for up to a decade. Particularly for ACL respondents, the association between feeling bothered/upset at work and poor quality sleep was robust across cross-sectional and longitudinal models, and was evident even in stringent fixed and random effects models. The association between having a personal conflict at work and sleep quality changes among MIDUS respondents was weaker, but given the longer period of follow up (up to 10 years versus 2.5 years for ACL respondents) and the relatively small fraction who reported a personal conflict in wave two (about 10%), these findings are quite informative. Our models showed mixed results for other psychosocial stressors among MIDUS respondents; low control was predictive of change in sleep quality in longitudinal models, but not under the fixed and random effects specifications, while job insecurity emerged as a predictor in these fixed and random effects models, but was not significant in the earlier longitudinal models. Neither low control nor perceived job insecurity was associated with change in sleep quality among ACL respondents overall.

We found little evidence that work-family conflict acts to mediate the consequences of negative working conditions for sleep quality. However, negative work-to-family spillover and the presence of children under three are substantial and significant independent predictors of negative changes in sleep quality and deserve further exploration in future studies. Among ACL respondents only, we found some support for stronger effects of low control on changes in sleep quality among women and less-educated respondents, while job insecurity may be more detrimental for sleep among those of higher occupational status. However, we did not observe any of these moderating effects of social position among the MIDUS respondents.

Most notable for its absence in our results, working long hours was not associated with poor sleep quality in our longitudinal models. Despite sociological and popular attention to the "Overworked American" and our increasingly 24/7 economy, work hours alone do not appear to be a risk factor for complaints about sleep. We also found no evidence for a negative impact of night shift hours among MIDUS respondents who worked nights at least twice a week, and models not shown here revealed no detrimental effects of weekend or evening shifts among MIDUS respondents. However, the "time bind" faced by workers and families struggling to combine paid work and family care is reflected in our findings. Negative work-to-family spillover and the arrival of new children into the household did show the expected detrimental association with sleep quality.

Several limitations should be considered when assessing these results. First, it would be preferable to have a wider range of more objective measures of working conditions, such as the actual job insecurity respondents face, the level of control over work an outsider rater would assign to their specific job, and the like. Larger samples of workers and additional waves of survey data would be helpful for isolating associations within subgroups and more carefully investigating the temporal ordering of changes in exposures and outcomes. It would also be useful to know more about the reasons that worker's ratings of their working conditions change between survey waves. Despite these limitations, our results provide new evidence for a link between conditions at work and troubled sleep. Our conclusions are strengthened by our access to longitudinal data on workers from across the occupational spectrum, and our results were consistent even when we applied stringent fixed effects specifications. Controls for neuroticism and baseline health in our longitudinal models, and for all stable, unobserved characteristics in the fixed effects models, mean that our findings are not likely unduly affected by negative reporting styles or physical or mental health selection. Future research is needed to substantiate these results and further explore the factors that could buffer workers from these negative conditions or interventions that could break the link between conditions on in the workplace and maintenance of healthy sleep patterns.

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Appendix A. Original Scoring of Sleep Quality Items by Survey Wave, ACL and MIDUS studies.

| | ACL | | MIDUS | |
|---|---|---|---|---|
| | 1986 | 1989 | 1995 | 2005 |
| Hardly ever | 49.7 | 51.6 | -- | -- |
| Sometimes | 40.3 | 41.2 | -- | -- |
| Most times | 9.9 | 7.2 | -- | -- |
| | | | | |
| Not at all | -- | -- | 48.5 | 28.8 |
| Once/mo. | -- | -- | 15.7 | 18.2 |
| Several times/mo. | -- | -- | 14.0 | 15.8 |
| Once/wk | -- | -- | 4.9 | 7.5 |
| Several times/wk. | -- | -- | 11.5 | 18.4 |
| Almost every day | -- | -- | 5.4 | 11.3 |

Note: Figures are weighted. Shaded areas show respondents classified as having poor sleep quality on each measure.

Appendix B. Items Used in Construction of Measures of Low Job Control, ACL and MIDUS studies.

**ACL Stem Question and Items**

"After each statement, please put an "X" in the answer category that best describes how strongly you agree or disagree with the statement AS IT APPLIES TO YOUR WORK." (1 = Strongly agree, 2 = Agree somewhat, 3 = Disagree somewhat, 4 = Strongly disagree)

- I have very little chance to decide how I do my work (Reverse coded)
- I get to do a variety of different things in my work
- I have a lot to say about what happens in my work

**MIDUS Stem Question and Items**

"Please indicate how often each of the following is true of your job," or "In the past year, how often has each of the following occurred at your job?" (1 = All of the time, 2 = Most of the time, 3 = Sometimes, 4 = Rarely, 5 = Never)

- On your job, how often do you have to initiate things --such as coming up with your own ideas, or figuring out on your own what needs to be done?
- How often do you have a choice in deciding how you do your tasks at work?
- How often do you have a choice in deciding what tasks you do at work?
- How often does your job provide you with a variety of things that interest you?
- How often do you have a say in decisions about your work?
- How often do you have a say in planning your work environment -- that is, how your workplace is arranged or how things are organized?
- You control the amount of time you spend on tasks
- How often do you learn new things at work?
- How often does your work demand a high level of skill or expertise?

Table 1. Descriptive Characteristics by Sample and Wave, ACL and MIDUS Respondents.

| | ACL | | MIDUS | |
|---|---|---|---|---|
| | Working in Wave 1 | Working Waves 1 & 2 | Working in Wave 1 | Working Waves 1 & 2 |
| % Low sleep quality Wave 2 | 48.8% | 48.7% | 52.7% | 49.9% |
| ***Working Conditions*** | | | | |
| Hours Week Wave 1 | 44.0 | 44.3 | 42.3 | 42.8 |
| | (11.7) | (11.7) | (10.9) | (10.8) |
| Hours Week Wave 2 | -- | 43.4 | -- | 40.1 |
| | | (12.5) | | (13.6) |
| Low Control Wave 1[a] | 5.10 | 5.06 | 21.32 | 21.20 |
| | (1.99) | (1.99) | (6.09) | (5.91) |
| Low Control Wave 2[a] | -- | 4.98 | -- | 20.99 |
| | | (1.95) | | (5.92) |
| Job Insecurity Wave 1[a] | 1.73 | 1.73 | 1.59 | 1.56 |
| | (0.860) | (0.850) | (0.938) | (0.903) |
| Job Insecurity Wave 2[a] | -- | 1.69 | -- | 1.54 |
| | | (0.807) | | (0.921) |
| Bothered Wave 1 | 2.61 | 2.61 | na | na |
| | (0.833) | (0.820) | | |
| Bothered Wave 2 | -- | 2.65 | na | na |
| | | (0.825) | | |
| Personal Conflict Wave 1 | na | na | 0.148 | 0.152 |
| | | | (0.356) | (0.359) |
| Personal Conflict Wave 2 | na | na | -- | 0.104 |
| | | | | (0.305) |
| N | 1316 | 1094 | 1041 | 801 |

*Note* : Figures are weighted, column totals unweighted.

a. Measures coded differently for ACL and MIDUS, cannot be directly compared.

Table 2. Predictors, Mediators and Moderators by Sample and Wave, ACL and MIDUS Respondents.

| | ACL | | MIDUS | |
|---|---|---|---|---|
| | Working in 1986 | Working 1986 & 1989 | Working in 1995 | Working 1995 & 2005 |
| % Employed at wave two | 92.0% | 100.0% | 78.8% | 100.0% |
| Age (years) | 40.5 | 39.8 | 43.1 | 40.8 |
| | (11.3) | (10.6) | (10.8) | (9.5) |
| % Male | 55.9% | 57.0% | 45.9% | 47.1% |
| Race | | | | |
| % White | 85.2% | 85.2% | 88.7% | 88.9% |
| % African American | 9.8% | 9.6% | 8.1% | 7.9% |
| % Other | 5.0% | 5.3% | 3.1% | 3.3% |
| % Unmarried | 27.7% | 26.9% | 22.6% | 23.1% |
| % High School or less Education | 45.8% | 44.1% | 41.4% | 39.4% |
| Household Income in 2007 $ | 69,082 | 70,271 | 66,592 | 67,971 |
| | (43,681) | (43,861) | (48,812) | (50,359) |
| Neuroticism Score[a] | -0.085 | -0.096 | 2.270 | 2.296 |
| | (0.949) | (0.934) | (0.664) | (0.659) |
| Self-Rated Health | 4.00 | 4.03 | 3.62 | 3.67 |
| | (0.875) | (0.859) | (0.880) | (0.851) |
| % Obese (BMI 30 or higher) | 13.4% | 13.4% | 22.4% | 20.0% |
| % Low Sleep Quality | 50.3% | 50.2% | 35.8% | 34.4% |
| ***Potential Mediators & Moderators*** | | | | |
| Work-family Conflict Wave 2[a] | -- | 2.149 | -- | 10.37 |
| | | (0.994) | | (2.59) |
| % Have Children 3-18 years Wave 2 | 37.4% | 38.4% | -- | -- |
| % Have Children Under 3 years Wave 2 | 10.5% | 10.6% | -- | -- |
| % Spouse works Overtime Wave 2 | -- | -- | 8.9% | 9.5% |
| % Work Nights Wave 2 | -- | -- | -- | 7.9% |
| % Duncan SEI score < median Wave 1 | 49.4% | 48.2% | 56.5% | 55.3% |
| N | 1316 | 1094 | 1041 | 801 |

*Note* : Figures are weighted, column totals unweighted.

a. Measures are coded differently for ACL and MIDUS respondents and should not be directly compared.

Table 3. Odds Ratios from Logistic Regression Models of Poor Sleep Quality, ACL respondents.

| | Cross-Sectional: 1986 or 1989 Poor Sleep Quality | | | Longitudinal: 1989 Poor Sleep Quality | |
|---|---|---|---|---|---|
| | Model 1: 1986 | Model 2: 1986 | Model 3: 1989 | Model 4: 1986 WC | Model 5: 1989 WC |
| Hours/Week | 1.01 (0.995- 1.016) | 1.00 (0.993- 1.015) | 1.00 (0.989- 1.014) | 0.99 (0.983- 1.004) | 1.00 (0.986- 1.011) |
| Low Control | 1.06 (0.999- 1.123) † | 1.03 (0.968- 1.095) | 1.01 (0.946- 1.084) | 0.99 (0.927- 1.048) | 1.01 (0.946- 1.088) |
| Job Insecurity | 1.28 (1.121- 1.462) *** | 1.21 (1.055- 1.394) ** | 1.02 (0.871- 1.192) | 1.09 (0.954- 1.253) | 1.05 (0.895- 1.235) |
| Bothered | 1.53 (1.326- 1.757) *** | 1.38 (1.185- 1.602) *** | 1.35 (1.145- 1.584) *** | 1.12 (0.965- 1.298) | 1.29 (1.090- 1.519) ** |
| Age (years) | 0.98 (0.917- 1.054) | 0.98 (0.911- 1.060) | 0.87 (0.788- 0.954) ** | 0.92 (0.855- 0.997) * | 0.87 (0.793- 0.954) ** |
| Age (years) squared | 1.00 (0.999- 1.001) | 1.00 (0.999- 1.001) | 1.00 (1.000- 1.003) ** | 1.00 (1.000- 1.002) * | 1.00 (1.001- 1.003) ** |
| Male | 0.92 (0.729- 1.159) | 1.03 (0.809- 1.317) | 1.06 (0.805- 1.383) | 0.94 (0.738- 1.205) | 1.05 (0.797- 1.385) |
| African American | -- | 0.95 (0.640- 1.416) | 1.19 (0.778- 1.826) | 1.23 (0.829- 1.815) | 1.25 (0.810- 1.943) |
| Other Race | -- | 1.89 (1.096- 3.252) * | 1.42 (0.851- 2.358) | 1.36 (0.822- 2.250) | 1.26 (0.743- 2.137) |
| Unmarried 1986 | -- | 1.17 (0.880- 1.559) | 0.98 (0.716- 1.354) | 0.92 (0.694- 1.229) | 1.01 (0.736- 1.382) |
| High School or less | -- | 1.41 (1.093- 1.810) ** | 0.85 (0.649- 1.117) | 0.72 (0.555- 0.923) * | 0.80 (0.602- 1.061) |
| Household Income 1986 | -- | 1.02 (0.829- 1.247) | 0.97 (0.771- 1.220) | 0.98 (0.803- 1.205) | 1.06 (0.846- 1.337) |
| Neuroticism Score | -- | 1.46 (1.271- 1.667) *** | 1.42 (1.232- 1.641) *** | 1.32 (1.153- 1.511) *** | 1.31 (1.125- 1.515) *** |
| Self-Rated Health 1986 | -- | 0.73 (0.636- 0.847) *** | 0.75 (0.638- 0.871) *** | 0.91 (0.789- 1.046) | 0.85 (0.724- 0.995) * |
| Obese 1986 | -- | 1.48 (1.043- 2.086) * | 1.11 (0.787- 1.572) | 0.93 (0.658- 1.307) | 0.88 (0.606- 1.291) |
| Troubled Sleep 1986 | -- | -- | -- | 2.78 (2.187- 3.538) *** | 2.81 (2.161- 3.657) *** |
| Working in1989 | -- | -- | -- | 1.07 (0.685- 1.676) | -- |
| N | 1312 | 1312 | 1089 | 1312 | 1089 |
| LR Chi-square | 66.55*** | 156.3*** | 86.77*** | 150.21*** | 140.55*** |

*Note* : ***p<.001, **p<.01, *p<.05, †p<.10.

Table 4. Odds Ratios from Logistic Regression Models of Poor Sleep Quality, MIDUS respondents.

| | Cross-Sectional: 1995 or 2005 Poor Sleep Quality | | | Longitudinal: 2005 Poor Sleep Quality | |
|---|---|---|---|---|---|
| | Model 1: 1995 | Model 2: 1995 | Model 3: 2005 | Model 4: 1995 WC | Model 5: 2005 WC |
| Hours/Week | 1.01 (0.992- 1.018) | 1.00 (0.988- 1.015) | 1.00 (0.987- 1.020) | 1.01 (0.992- 1.019) | 1.00 (0.987- 1.021) |
| Low Control | 1.01 (0.991- 1.036) | 1.00 (0.979- 1.026) | 1.03 (1.000- 1.063) † | 1.03 (1.004- 1.054) * | 1.04 (1.005- 1.071) * |
| Job Insecurity | 1.28 (1.119- 1.472) *** | 1.22 (1.055- 1.406) ** | 1.05 (0.868- 1.273) | 0.90 (0.777- 1.053) | 1.04 (0.857- 1.272) |
| Personal Conflict | 1.08 (0.748- 1.550) | 0.97 (0.659- 1.437) | 1.71 (0.979- 2.979) † | 0.89 (0.600- 1.305) | 1.77 (0.990- 3.169) † |
| Age (years) | 0.95 (0.873- 1.040) | 0.95 (0.860- 1.039) | 1.12 (0.973- 1.283) | 1.17 (1.054- 1.288) ** | 1.28 (1.100- 1.481) ** |
| Age (years) squared | 1.00 (1.000- 1.001) | 1.00 (1.000- 1.002) | 1.00 (0.997- 1.000) | 1.00 (0.997- 0.999) ** | 1.00 (0.996- 0.999) ** |
| Male | 0.66 (0.498- 0.864) ** | 0.78 (0.584- 1.045) † | 0.67 (0.476- 0.956) * | 0.74 (0.553- 0.997) * | 0.71 (0.496- 1.028) * |
| African American | -- | 1.02 (0.615- 1.683) | 0.53 (0.253- 1.117) † | 0.51 (0.271- 0.957) * | 0.43 (0.194- 0.951) * |
| Other Race | -- | 0.63 (0.273- 1.446) | 1.97 (0.688- 5.618) | 2.11 (1.013- 4.382) * | 2.48 (0.924- 6.663) † |
| Unmarried 1995 | -- | 1.08 (0.763- 1.531) | 0.93 (0.599- 1.435) | 0.85 (0.607- 1.201) | 0.80 (0.519- 1.217) |
| High School or less | -- | 0.77 (0.577- 1.022) † | 0.94 (0.657- 1.341) | 0.99 (0.736- 1.325) | 0.94 (0.644- 1.360) |
| Household Income 1995 | -- | 0.99 (0.827- 1.175) | 1.24 (0.914- 1.684) | 0.85 (0.708- 1.027) † | 0.89 (0.698- 1.131) |
| Neuroticism Score | -- | 2.38 (1.901- 2.971) *** | 1.58 (1.217- 2.038) ** | 1.27 (1.012- 1.584) * | 1.26 (0.960- 1.655) † |
| Self-Rated Health 1995 | -- | 0.78 (0.665- 0.921) ** | 0.78 (0.637- 0.953) * | 1.02 (0.861- 1.206) | 1.06 (0.856- 1.318) |
| Obese 1995 | -- | 0.95 (0.678- 1.326) | 0.70 (0.483- 1.007) † | 0.97 (0.690- 1.356) | 0.73 (0.475- 1.126) |
| Troubled Sleep 1995 | -- | -- | -- | 6.13 (4.480- 8.385) *** | 6.61 (4.459- 9.808) *** |
| Working in 2005 | -- | -- | -- | 0.53 (0.360- 0.790) ** | -- |
| N | 1041 | 1041 | 648 | 1037 | 680 |
| LR Chi-square | 27.25*** | 110.77*** | 55.14*** | 217.79*** | 149.92*** |

*Note* : ***p<.001, **p<.01, *p<.05, †p<.10.

Table 5. Odds Ratios from Logistic Regression Models of Poor Sleep Quality with Controls for Various Measures of Negative Work-Family Spillover, ACL and MIDUS respondents.

| | ACL | | | | | | | | | MIDUS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model 1 | | | Model 2 | | | Model 3 | | | Model 4 | | | Model 5 | | | Model 6 | | |
| Hours/Week | 1.00 | (0.98- 1.01) | | 1.00 | (0.99- 1.01) | | 1.00 | (0.99- 1.01) | | 1.00 | (0.98- 1.02) | | 1.01 | (0.99- 1.02) | | 1.00 | (0.99- 1.02) | |
| Low Control | 1.03 | (0.96- 1.11) | | 1.02 | (0.95- 1.10) | | 1.01 | (0.94- 1.09) | | 1.03 | (1.00- 1.07) | * | 1.04 | (1.01- 1.07) | * | 1.04 | (1.00- 1.07) | * |
| Job Insecurity | 1.05 | (0.89- 1.23) | | 1.05 | (0.90- 1.24) | | 1.06 | (0.90- 1.24) | | 0.99 | (0.81- 1.22) | | 1.05 | (0.86- 1.28) | | 1.05 | (0.86- 1.27) | |
| Daily Hassles | 1.24 | (1.04- 1.46) | * | 1.26 | (1.06- 1.49) | ** | 1.27 | (1.08- 1.50) | ** | 1.51 | (0.83- 2.74) | | 1.72 | (0.95- 3.10) | † | 1.76 | (0.98- 3.15) | † |
| Neg. Job to Home | 1.18 | (1.02- 1.36) | * | -- | | | -- | | | 1.11 | (1.03- 1.20) | ** | -- | | | -- | | |
| Kids 3-18 years | -- | | | 0.53 | (0.39- 0.72) | *** | -- | | | -- | | | -- | | | -- | | |
| Kids Under 3 years | -- | | | -- | | | 2.17 | (1.37- 3.43) | ** | -- | | | -- | | | -- | | |
| Spouse Works Overtime | -- | | | -- | | | -- | | | -- | | | 1.05 | (0.57- 1.91) | | -- | | |
| Works Nights | -- | | | -- | | | -- | | | -- | | | -- | | | 1.22 | (0.69- 2.13) | |
| N | 1089 | | | 1089 | | | 1089 | | | 680 | | | 658 | | | 680 | | |
| LR Chi-square | 145.74*** | | | 158.24*** | | | 151.71*** | | | 157.25*** | | | 144.39*** | | | 150.39*** | | |

*Note* : ***p<.001, **p<.01, *p<.05, †p<.10. Models also control for all predictors shown in Model 5 of Table 3 (ACL respondents) or Table 4 (MIDUS respondents).

Table 6. Odds Ratios from Logistic Regression Models of Poor Sleep Quality with Interactions (Sex, Education and Socioeconomic Index Score), ACL and MIDUS

| | ACL Troubled Sleep 1989 | | | | | | | | | MIDUS Troubled Sleep 2005 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M1: Male | | | M2: HS or less | | | Model 3: Low SEI | | | M4: Male | | | M5: HS or less | | | Model 6: Low SEI | | |
| Hours/Week | 1.00 | (0.98- 1.02) | | 1.00 | (0.98- 1.01) | | 1.00 | (0.98- 1.02) | | 1.01 | (0.98- 1.04) | | 1.01 | (0.99- 1.03) | | 1.01 | (0.99- 1.04) | |
| Interaction | 0.99 | (0.97- 1.02) | | 1.00 | (0.98- 1.03) | | 1.00 | (0.98- 1.02) | | 1.00 | (0.96- 1.03) | | 0.98 | (0.95- 1.02) | | 0.98 | (0.95- 1.01) | |
| Low Control | 1.09 | (0.98- 1.21) | | 0.94 | (0.84- 1.04) | | 0.97 | (0.86- 1.08) | | 1.04 | (1.00- 1.09) | † | 1.04 | (1.00- 1.08) | † | 1.04 | (0.98- 1.09) | |
| Interaction | 0.89 | (0.77- 1.02) | † | 1.16 | (1.01- 1.33) | * | 1.09 | (0.94- 1.26) | | 0.99 | (0.93- 1.05) | | 0.99 | (0.93- 1.06) | | 1.02 | (0.95- 1.09) | |
| Job Insecurity | 1.09 | (0.85- 1.41) | | 1.04 | (0.82- 1.31) | | 1.21 | (0.96- 1.53) | | 1.01 | (0.77- 1.33) | | 1.02 | (0.78- 1.33) | | 1.07 | (0.77- 1.48) | |
| Interaction | 0.95 | (0.68- 1.32) | | 1.02 | (0.74- 1.41) | | 0.76 | (0.55- 1.05) | † | 1.08 | (0.73- 1.61) | | 1.04 | (0.70- 1.56) | | 0.91 | (0.60- 1.38) | |
| Daily Hassles | 1.25 | (0.95- 1.64) | | 1.40 | (1.12- 1.76) | ** | 1.39 | (1.08- 1.78) | ** | 1.26 | (0.55- 2.88) | | 1.76 | (0.85- 3.66) | | 2.65 | (1.03- 6.82) | * |
| Interaction | 1.05 | (0.75- 1.49) | | 0.84 | (0.61- 1.17) | | 0.88 | (0.63- 1.22) | | 1.94 | (0.60- 6.23) | | 1.01 | (0.29- 3.48) | | 0.48 | (0.14- 1.66) | |
| Main Effect Interaction | 2.31 | (0.46- 11.5) | | 0.57 | (0.12- 2.75) | | 1.37 | (0.28- 6.65) | | 0.87 | (0.10- 7.52) | | 1.99 | (0.23- 17.0) | | 1.13 | (0.13- 9.69) | |
| N | 1089 | | | 1089 | | | 1089 | | | 680 | | | 680 | | | 670 | | |
| LR Chi-square | 143.81*** | | | 145.59*** | | | 144.93*** | | | 151.53*** | | | 150.96*** | | | 156.94*** | | |

*Note* : ***p<.001, **p<.01, *p<.05, †p<.10. Models also control for all predictors shown in Model 5 of Table 3 (ACL respondents) or Table 4 (MIDUS respondents).

Table 7. Odds Ratios from Fixed and Random Effect Logistic Regression Models of Poor Sleep Quality, ACL respondents.

| | FE 1986-1989 | | | RE 1986-1989 | | | FE 1986-1989 & 1989-1994 | | | RE 1986-1989 & 1989-1994 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hours/Week | 1.00 | (0.978- 1.019) | | 1.00 | (0.990- 1.014) | | 1.00 | (0.983- 1.010) | | 1.00 | (0.989- 1.008) | |
| Low Control | 1.03 | (0.919- 1.145) | | 1.03 | (0.965- 1.096) | | na | | | na | | |
| Job Insecurity | 1.14 | (0.924- 1.401) | | 1.12 | (0.974- 1.295) | | na | | | na | | |
| Bothered | 1.18 | (0.952- 1.458) | | 1.48 | (1.274- 1.717) | *** | 1.20 | (1.025- 1.400) | * | 1.46 | (1.285- 1.655) | *** |
| Age (years) | 0.89 | (0.691- 1.159) | | 0.88 | (0.810- 0.950) | ** | 0.89 | (0.788- 0.999) | * | 0.88 | (0.824- 0.943) | *** |
| Age (years) squarec | 1.00 | (0.998- 1.004) | | 1.00 | (1.000- 1.002) | ** | 1.00 | (0.999- 1.002) | | 1.00 | (1.001- 1.002) | ** |
| Male | -- | | | 0.90 | (0.685- 1.191) | | -- | | | 0.91 | (0.711- 1.164) | |
| African American | -- | | | 0.97 | (0.715- 1.324) | | -- | | | 1.12 | (0.847- 1.468) | |
| Other Race | -- | | | 1.81 | (0.917- 3.572) | † | -- | | | 1.98 | (1.074- 3.665) | * |
| Unmarried | 0.92 | (0.423- 2.001) | | 1.02 | (0.765- 1.369) | | 1.06 | (0.666- 1.676) | | 0.95 | (0.737- 1.222) | |
| High School or less | -- | | | 1.21 | (0.908- 1.606) | | -- | | | 1.30 | (1.010- 1.679) | * |
| Household Income | 1.28 | (0.801- 2.050) | | 1.02 | (0.830- 1.262) | | 1.11 | (0.816- 1.514) | | 0.99 | (0.823- 1.184) | |
| Neuroticism Score | -- | | | 1.65 | (1.418- 1.921) | *** | -- | | | 1.59 | (1.393- 1.816) | *** |
| Self-Rated Health | 0.84 | (0.659- 1.072) | | 0.70 | (0.603- 0.804) | *** | 0.74 | (0.621- 0.874) | *** | 0.71 | (0.625- 0.796) | *** |
| Obese | 1.31 | (0.642- 2.655) | | 1.21 | (0.860- 1.699) | | 1.15 | (0.692- 1.917) | | 1.21 | (0.911- 1.609) | |
| N (observations) | 746 | | | 2179 | | | 1498 | | | 3012 | | |
| N (individuals) | 373 | | | 1094 | | | 529 | | | 1094 | | |
| LR Chi-square | 9.2 | | | 135.36*** | | | 28.48*** | | | 167.38*** | | |
| Hausman test (Chi$^{2}$) | 16.31 (p=0.091) | | | | | | 26.80 (p=0.001) | | | | | |

*Note* : ***p<.001, **p<.01, *p<.05, †p<.10.

Table 8. Odds Ratios from Fixed and Random Effect Logistic and Linear Regression Models of Poor Sleep Quality, ACL respondents.

| | Logistic Regression, Dichotomous Sleep Quality | | Linear Regression, Continuous Sleep Quality | |
|---|---|---|---|---|
| | FE 1995-2005 | RE 1995-2005 | FE 1995-2005 | RE 1995-2005 |
| Hours/Week | 1.02 (0.991- 1.041) | 1.00 (0.986- 1.016) | 0.004 (0.005) | -0.002 (0.004) |
| Low Control | 1.01 (0.946- 1.068) | 1.02 (0.989- 1.054) | -0.001 (0.012) | 0.009 (0.008) |
| Job Insecurity | 1.49 (1.080- 2.042) * | 1.27 (1.054- 1.537) * | 0.159 (0.059) ** | 0.122 (0.045) ** |
| Personal Conflict | 1.08 (0.511- 2.284) | 1.25 (0.765- 2.046) | 0.289 (0.150) † | 0.244 (0.119) * |
| Age (years) | 1.10 (0.919- 1.328) | 1.03 (0.914- 1.151) | 0.072 (0.038) † | 0.043 (0.028) |
| Age (years) squared | 1.00 (0.999- 1.002) | 1.00 (0.999- 1.001) | 0.000 (0.000) | 0.000 (0.000) |
| Male | -- | 0.58 (0.386- 0.885) | -- | -0.297 (0.103) ** |
| African American | -- | 0.59 (0.231- 1.524) | -- | -0.419 (0.234) † |
| Other Race | -- | 0.67 (0.240- 1.894) | -- | -0.080 (0.253) |
| Unmarried | 1.17 (0.485- 2.834) | 1.41 (0.915- 2.183) | 0.187 (0.163) | 0.173 (0.106) |
| High School or less | -- | 0.85 (0.542- 1.334) | -- | 0.033 (0.112) |
| Household Income | 1.09 (0.691- 1.728) | 1.54 (1.203- 1.970) ** | -0.003 (0.090) | 0.208 (0.057) *** |
| Neuroticism Score | -- | 2.78 (1.989- 3.893) *** | -- | 0.590 (0.077) *** |
| Self-Rated Health | 0.85 (0.572- 1.251) | 0.84 (0.682- 1.039) | -0.006 (0.074) | -0.087 (0.051) † |
| Obese | 1.53 (0.570- 4.125) | 0.82 (0.532- 1.255) | 0.026 (0.187) | 0.072 (0.105) |
| Constant | -- | -- | -1.427 (1.119) | -2.561 (0.841) ** |
| N (observations) | 444 | 1508 | 1508 | 1508 |
| N (individuals) | 222 | 801 | 801 | 801 |
| LR Chi-square | 75.58*** | 71.17*** | 12.79*** | 159.82*** |
| Hausman test (Chi$^{2}$) | 30.14 (p<.001) | | 62.39 (p<.001) | |

*Note* : ***p<.001, **p<.01, *p<.05, †p<.10.