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Work-Family Conflict, Psychological Distress and Sleep Deficiency Among Patient Care Workers

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Abstract

Objectives—There is a well-established link between psychological distress, work-related stress and sleep. The aim of this study was to test the hypothesis that work-family conflict was associated with sleep deficiency both cross-sectionally and longitudinally while controlling for potential covariates.

Methods—In this two-phase study, a workplace health survey was collected from a cohort of patient care workers (n=1,572) at two large hospitals. Follow-up was collected nearly two years later in a subsample (n=102). Self-reported measures included work-family conflict, socio-demographics, workplace factors, psychological distress, and outcomes of sleep duration, sleep insufficiency, and sleep maintenance. Bivariate associations (P<0.2) from the baseline sample were used to build multivariable logistic regression models.

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Conflict of interest: None

Results—The participants were 90 % women with a mean age of 41 (± 11.7) years. At baseline, after adjusting for covariates, higher levels of work-family conflict were significantly associated with sleep deficiency, short sleep duration and perceived sleep insufficiency, but not with sleep maintenance problems. Higher levels of work-family conflict also predicted sleep insufficiency at follow-up nearly two years later. None of the other variables were associated with sleep outcomes longitudinally.

Conclusion—This is the first study to determine the predictive and cross-sectional associations of work-family conflict on sleep deficiency, also controlling for other measures of job stress and psychological distress. The results indicate that future interventions on sleep deficiency in patient care workers should include a specific focus on work-family conflict.

Keywords

Sleep; Work-Family Conflict; Psychological Distress; Nurses

Introduction

Sleep deficiency has been shown to affect both psychological wellbeing¹ and work performance². The term sleep deficiency includes three components: short sleep duration, sleep maintenance problems, and/or sleep insufficiency. These components have independently been associated with pain and functional limitations³, and have a negative influence on quality of life⁴. The components also represent a substantial economic burden to society⁵. Patient care workers are a high-risk population for sleep deficiency. A recent study showed the prevalence of self-reported insomnia symptoms and sleep deficiency being 40 % and 57 %, respectively³.

Patient care workers are vulnerable presumably because their work schedules often involve shift and night work⁶. Long shifts (>8 hours) and a short recovery time between shifts (<10 hours), have been associated with sleep disturbance and poor sleep quality⁷. Patient care workers also struggle with several risk factors for sleep deficiency, as they are prone to work-family conflict^{8,9}, psychosocial stress and numerous workplace hazards¹⁰.

The negative effects from components like sleep maintenance problems are well documented. Insomnia symptoms are commonly defined as a difficulty initiating or maintaining sleep, and/or experiencing a non-restorative sleep with decreased daytime functioning, lasting at least four weeks¹¹. A primary insomnia diagnosis is only given by a trained physician during a clinical interview excluding other explanations like: substance abuse/medication, respiratory disorder, comorbid conditions, time zones and/or other events happening during sleep (nightmares, night terrors, sleep walking or parasomnias). The estimated cost and impact of insomnia symptoms is staggering. A recent study among US workers reported a prevalence as high as 23.2 %, and calculated that the annual cost of insomnia symptoms rose above \$60 billion when they estimated the effect of lowered work performance and increased absenteeism¹².

In addition to insomnia, experimental studies on sleep have shown several adverse effects from the components sleep insufficiency and short sleep duration⁴. A shortened duration of

habitual sleep, e.g., < 6 hours / night has been associated with increased risk of all-cause mortality, diabetes, obesity, hypertension, cardiovascular risk and lower psychological wellbeing⁴¹³¹⁴. Perceived sleep insufficiency has been associated with lower supervisor support and lower job satisfaction³, lower physical activity and exercise¹⁵ and increased risk for mental disorders¹⁶.

Several studies associate job stress with both sleep deficiency³¹⁷, and the development of psychological disorders¹⁶¹⁸. The concept of job stress has been defined in part by two major models, the demand-control model¹⁹ and later the demand-control-support model²⁰. Although both these models have explanatory value, they have been challenged both regarding their somewhat narrow conceptualization of job stress and how they choose to measure these job stress concepts²¹.

A factor proven salient in several studies of job stress is work-family conflict²²²³. The trade-off between the domestic work-load and job related work-load, as well as the planning, guilt and maneuvering to fit schedules and interests, are identified as major causes of stress²³. A meta-analysis on the work-family interface distinguishes between demands from the private sphere conflicting with work, and demands from work conflicting with home life²⁴. Several factors have been shown to influence the experience of work-family conflict. Social support at work has been identified as salient in both negative health outcomes and perceived levels of conflict²⁵. Marital status, child caring and traditional sex roles have also been shown to impact work-family conflict, as females have a higher workload at home and less time to recover from work²⁴²⁶. On an organizational level, both work flexibility and the option to receive paid sick leave has been shown to affect the level of conflict reported²⁷²⁸.

Nurses have been shown to have considerable more problems with work interfering with home life, than the other way around⁹. This coincides with a study showing how females to a larger extent than men, tend to carry work stress into home life²⁹. Nurses are a mostly female population, and it has been argued that work-to-family conflict is the foremost construct of interest in these workers⁹.

The connection between the individual experience of stress and disturbance of sleep is well established³⁰. Previous studies have shown that work-family conflict is associated with perceived sleep quality³¹³²³³. A recent study reported a negative association between work-family spillover and sleep quality³¹. However, this study was limited by a small sample size and only investigated one component of sleep deficiency, the global quality of sleep³¹. Another study investigating the association had a larger sample size, but lacked adequate information about sleep, as they relied on a single item assessing sleep quality³². Also, none of these studies investigated the effects longitudinally. Thus, the question remains whether work-family conflict influences other components of sleep deficiency to a significant degree, and whether this association remains when other measures of work stress and psychological distress are controlled for. The associations and predictive relationship between these constructs should be investigated to shape interventions and support further investigation through prospective cohort studies.

The aims of the current study were 1) to investigate cross-sectional associations between work-family conflict and the composite sleep deficiency as well as its components in patient care workers, controlling for the potential confounders iso-strain, psychological distress and socio-demographics; and 2) to investigate longitudinally in a subset of workers, whether work-family conflict identified at baseline increases the risk of sleep deficiency and/or its components at follow-up over two years later, when controlling for baseline outcome.

Methods

Study Design

The data were collected as part of the “Be Well, Work Well” project at the Harvard School of Public Health, Center for Work, Health, and Well-being and used to inform the development of an integrated health protection/health promotion intervention. A survey was conducted in two academic hospitals in New England, USA between October 2009 and February 2010. We approached workers who had direct patient care responsibilities and were employed at the hospitals for more than 20 hours per week during 2008. A subset of respondents at one of the hospitals participated in an ancillary study that involved assessment of cardiovascular biomarkers and a follow-up survey. Follow-up visits took place from August to November 2011.

The local institutional Human Research Committees approved the study and all procedures were conducted in accordance with the Declaration of Helsinki.

Participants and Data Collection

At time 1, 2000 patient care workers were randomly selected and invited by email to complete the survey online. We sent 2 email reminders during the 4 weeks following the first contact, and then mailed a paper version of the questionnaire to those who had not finished the survey online. After 2 more weeks we sent a third email reminder and a second paper survey to all non-responders. A total of 1572 (79%) completed at least 50% of the survey. Details of the main sampling procedure has been described elsewhere³.

All patient care workers at one of the two hospitals who completed the initial survey were contacted via e-mail, reminding them of their participation in the original survey and asking about their interest in the ancillary study. Out of 840 employees who were re-contacted after completing the survey, a total of 102 (12.1 %) completed the follow visit and blood draw. The follow-up survey required an in-person meeting, so a much lower participation was anticipated. The flow of participants is illustrated in figure 1.

Measures

Self-Reported Sleep Outcomes—All sleep outcomes were reported both at baseline and at follow-up. *Short sleep duration* was assessed by asking participants how many hours they slept each night over the previous four weeks, and was defined as less than 6 hours per night in the last month. An item asking how often they had problems with waking up during the night assessed *sleep maintenance*. These items had four response categories ranging from “not at all in the last 4 weeks” to “3 or more times a week”. Having *sleep maintenance*

problems was defined as the problem being present 3 nights per week or more in the last month. *Sleep insufficiency* was measured by asking how often participants “felt rested upon awakening” with five response categories ranging from “never” to “always”. The presence of *sleep insufficiency* was defined as responding “never” or “rarely”. *Sleep deficiency* was operationalized as the presence of one or more of these components.

Independent variable—Work-family conflict was measured using a five item scale³⁴. The following instruction and items were included in the scale: How much do you agree or disagree with the following statements: (1) The demands of my work interfere with my family or personal time. (2) The amount of time my job takes up makes it difficult to fulfill family or personal responsibilities. (3) Things I want to do at home do not get done because of the demands my job puts on me. (4) My job produces strain that makes it difficult to fulfill my family or personal duties. (5) Due to work-related duties, I have to make changes to my plans for family or personal activities. Response categories ranging from 5 = “Strongly Agree” to 1 = “Strongly Disagree” yielding a score between 5–25, where higher scores indicate greater work-family conflict. We trichotomized the score into low (5–12), intermediate (13–17), high (18–25) conflict, as done in previous studies⁸, making the variable more intuitive and easier to interpret.

Covariates from baseline measures—Covariates were selected *a priori* based on variables known to be associated with sleep quality, duration and sufficiency. These covariates include socio-demographics, work-related stress, psychological distress and night work.

Socio-demographic factors were obtained through participants reporting their *age* (years), *gender*, *race/ethnicity* (Hispanic, White, Black and mixed race/others), *occupation* (staff nurse, patient care associate and others), *ability to pay bills* (great deal of difficulty; some difficulty; a little difficulty; no difficulty; don’t know; refused), *height* (inches) and *weight* (pounds). *Body mass index* (BMI) was calculated using the self-reported weight and height (kilos per square meter).

Work-related stress was assessed by self-reported *job demands*, *decision latitude*, *coworker support* and *supervisor support*. A modified version of the Job Content Questionnaire¹⁹³⁵ measured *job demands*, *decision latitude*, *co-worker* and *supervisor support*. *Job demands* were assessed through 5 items that were weighted and summed yielding a scale from 12 to 48³⁵. *Decision latitude* was assessed through 9 items created as a weighted sum of decision authority and skill discretion from the Job Content Questionnaire. *Co-worker support* was assessed through 2 items with 5 response categories summed, yielding a scale from 2–10³⁵. *Supervisor support* was assessed through 3 items with 5 response categories summed and scaled giving a scale of 3 to 15³⁵.

Iso-strain was a composite variable assessed by measuring job demands, decision latitude and social support. Social support was in the composite variable defined as the participant level of co-worker and supervisor support. All three variables were dichotomized by their medians into low/high categories¹⁸. *Iso-strain* was defined as high job demands, low decision latitude and low social support¹⁸.

Severe psychological distress was measured with the K-6 Nonspecific Distress Scale. A summative 6-item scale, with responses to each item ranging from 0 indicating “no distress”, to 4 indicating “distress all of the time” yielded a range of scores between 0–24³⁶.

Night work was quantified from administrative payroll data and calculated as average night work-hours per month (between 10 PM and 6 AM), calculated from October 2008 until August 2009. Excluding shifts shorter than 4 hours, the variable was trichotomized into 0–6 hours, >6–72 hours or more than 72 hours per month.

Data analysis—Using the baseline data on the larger sample, the characteristics of workers who had sleep deficiency, sleep maintenance, sleep insufficiency and/or short sleep duration were compared to those who did not. We used the independent sample t-test for continuously measured characteristics and the Pearson’s Chi-square test or Fisher Exact Chi-Square test for categorical measures. To assess the multivariable associations of work family conflict and sleep controlling for the potential confounders, we used multiple logistic regression analysis. Covariates that had a *P*-value <0.2 in the bivariate analyzes were included in the multivariate models ensuring that variables were relevant, without a too stringent exclusion.

To assess aim 2, the longitudinal relationship between work-family conflict on subsequent sleep, we computed multiple logistic regression analysis using the subsample. We regressed sleep at time 2 on work family conflict at baseline, and controlled for baseline measures of sleep and the covariates determined to be associated with sleep at baseline. All analyses were carried out using SAS version 9.3. (SAS Institute, Inc. Cary, NC)

Results

Participant characteristics

The participants (n=1572) were 90 % women with a mean age of 41.4 years (SD, 11.7 years). The majority was white (79 %), married or living with a partner (66 %), staff nurses (70 %) with a college degree (53 %) In our main sample 63 % (n=896) reported sleep deficiency, 23 % (n=354) reported short sleep duration, 27 % (n=428) reported sleep insufficiency and 40 % (n=631) reported sleep maintenance. Figure 2 illustrates the number of participants with each sleep outcome, overlap between outcomes and missing data.

Cross-sectional analyses of overall sample

Sleep deficiency and the components are all significantly associated with work-family conflict, such that greater work-family conflict is associated with a higher prevalence of sleep deficiency (Table 1). Similarly for each of the components of sleep deficiency, greater work-family conflict is associated with greater prevalence of sleep disturbance. Covariates associated with greater prevalence of sleep deficiency include higher BMI, having an occupation other than staff nurse or patient care associate, having iso-strain and/or having at least some difficulty paying bills. Results were similar for the components of sleep deficiency; though only higher work-family conflict and more psychological distress were negatively associated with all sleep outcomes (Table 1).

For multivariable analysis of work family conflict and sleep deficiency we included the variables from the bivariate analyses with p-values <0.20 to select relevant variables without excluding potentially important covariates (see Table 2).

After adjusting for covariates, higher work-family conflict was significantly associated with sleep deficiency (“medium” vs. “low” OR 1.57, 95 % CI, 1.19–2.07, “high” vs. “low” OR 1.70, 95 % CI, 1.20–2.40, $P=0.0008$). An increase in severe psychological distress and older age was also significantly associated with increased sleep deficiency in the multivariable analysis.

Looking at the components of sleep deficiency, higher work-family conflict was associated with sleep insufficiency (“medium” vs. “low” OR 1.68, 95 % CI, 1.25–2.27, “high” vs. “low” OR 2.36, 95 % CI, 1.67–3.34, $P<0.0001$) and short sleep duration (“medium” vs. “low” OR 1.23, 95 % CI, 0.88–1.72, “high” vs. “low” OR 1.64, 95 % CI, 1.11–2.41, $P=0.04$) when controlled for covariates. Also, the variable displayed clear trends of higher work-family conflict being associated with increased risk of sleep maintenance (Table 2).

Cross-sectional analyses of the subsample (n=102)

Our subsample was similar to the overall sample on socio-demographic characteristics and outcomes with the exception of race/ethnicity. The subsample had a higher percentage of white patient care workers than the main sample. Our subsample was predominantly white (91 %), female (97 %), nurses (68 %) with a college degree (65 %) and a mean age of 40.8 (SD 11.9) years. Sleep deficiency was reported by 64 (63 %) of the participants at baseline. With similar distributions in the variables there was a reasonable assumption that the baseline multivariable models could be replicated in the biomarker subsample.

Longitudinal analysis of subsample (n=102)

After controlling for baseline scores in sleep outcomes, work-family conflict was no longer significantly associated with sleep deficiency. When the components were investigated separately, higher work-family conflict was significantly associated with perceived sleep insufficiency (Table 3).

Psychological distress, iso-strain and socio-demographic factors did not predict sleep outcomes at follow-up. Tests of interaction effects examining the effect of work-family conflict combined with each baseline sleep outcome, on sleep outcomes at time 2, revealed no significant interactions (data not shown).

Discussion

The goals of the current study were to assess how work-family conflict was cross-sectionally associated with sleep deficiency (sleep maintenance problems, short sleep duration and/or sleep insufficiency) when controlling for psychological distress, other work stress variables, and socio-demographic factors. Furthermore, we aimed to see whether or not work-family conflict at baseline predicted sleep outcomes at follow-up in a subsample. In baseline cross-sectional analyses, we found significant associations of higher levels of work-family conflict and increased risk of the composite sleep deficiency. Increased psychological distress and

older age also significantly increased the risk for sleep deficiency. All associations remained significant when controlling for socio-demographic and occupational covariates.

In the subsample (n=102) that participated in the follow-up, higher levels of work-family conflict was not associated with sleep deficiency. However, higher levels of work-family conflict significantly predicted sleep insufficiency and showed a negative trend in short sleep duration. The effect of work-family conflict on subsequent sleep outcomes, when controlling for psychological distress and iso-strain, suggests that sleep and work stress studies should include a measure of conflict in the work-family interface. Work-family conflict was also the only significant predictor in our two-year follow-up, making role conflict and scheduling a prime subject both in future longitudinal studies and interventions targeting sleep deficiency and work stress.

A diary study of 91 employees studied for 14 consecutive days highlighted work-family conflict as a separate, salient construct in the work stress paradigm²². That work-family conflict in our study was strongly associated with sleep deficiency when controlling for job strain accentuates this, and is consistent with previous work³³. In our study we also controlled for co-worker/supervisor support, severe psychological distress and socio-demographic factors, and the influence of work-family conflict remained. Univariate analyses showed a significant relationship between iso-strain and sleep deficiency. However this association disappeared when controlled for work-family conflict, among other covariates. The relationship between iso-strain components and sleep deficiency is well established¹⁷, however this study could be viewed as an argument for work-family conflict being the salient factor in the relationship between work stress and sleep deficiency. It is at the least a strong argument to include this variable in future studies.

Our results showed a predictive and associative relationship between high work-family conflict and not feeling rested upon awakening, which may have several possible explanations. One possible mechanism is that the trade-off between work and family duties cause rumination and worry, two cognitive processes linked to increased arousal³⁷. Arousal from cognitive processes have been claimed to both cause disturbed sleep and to influence the individuals perception of their sleep³⁸. Another possible explanation is a previous finding demonstrating how sleep suffered from prioritizing between work, family and sleep³⁹. The conservation of resources theory is frequently cited in the work-family conflict field. It claims that work-family stress is often caused by a threat of losing resources, a loss of resources, or a lack of expected gain in resources⁴⁰. Resources that apply to a work-life setting could be threats to ones image as good wife or husband; personal characteristics like work-related confidence and self-esteem; or material resources like time, knowledge and money⁴⁰.

In line with the principles of conservation of resources theory, the trend in short sleep duration could also partly explain the link between work-family conflict and sleep insufficiency. The results from our subsample do not have the power or measure-points to properly describe any causal mechanisms. However, the many demands in work and home life can restrict the actual hours available for sleeping, either this is voluntary or not, which would explain the reported sleep insufficiency. The results in this study and previous work

indicate that sleep is the loser when we aim to increase/protect other resources. The down prioritizing of sleep should therefore be highlighted as a important part of the work-life domain, and made salient in organizational health promotion programs ³⁹.

Psychological distress was strongly associated with all sleep outcomes at baseline, but it was not associated with any outcomes longitudinally. The cross-sectional associations support numerous other studies showing a link between psychological distress and sleep ¹¹⁶. One possible explanation for the lack of association at follow-up is that psychological distress has a more temporary effect on sleep outcomes than work-family conflict. Earlier studies have claimed that sleep maintenance problems are most likely an intermediate phenotype in depression ⁴¹, but the two are still separate co-occurring disorders influencing each other. This coincides with other studies reporting a bi-directional relationship between insomnia and depression ¹. The natural course of unipolar depression will often lead to recovery within 6 months, even without treatment ⁴² and, in a small sample such as ours, a change in depressive disorders could very well influence the effects at follow-up. The concept of sleep deficiency as a comorbid condition in psychiatric disorders is evident looking at DSM-IV. Sleep maintenance problems are part of the criteria in 19 DSM-IV diagnoses, and it has been suggested that sleep deficiency is a trans-diagnostic mechanism contributing to the development and maintenance of mental disorders ⁴³. The sample size at follow-up does not allow for an investigation of the cross-sectional relationship between sleep outcomes and psychological distress at time 2, an important factor that might influence the sleep outcomes in this study.

Limitations

This analysis has some limitations, which will now be considered. The cross-sectional approach in the initial analyses does not allow for any causal inferences regarding directionality or mechanisms regarding the effect of work-family conflict and psychological distress on sleep. We do have a small sample with two time points, but two time points are only slightly better than one, and mediating mechanisms cannot be described with this approach. Also, the small sample was only collected from one of the two hospitals, with a low response rate, making the selection more vulnerable for bias. However, the low response rate was expected seeing as the ancillary study required an in-person meeting and a blood sample from participants.

Another limitation is that this study has no measure of the amount of extra work shifts or overtime that workers may have done. Patient care associates and other staff, which consist mainly of support staff, are lower wage earners than their staff nurse counterparts. These lower wage earners may have overtime pay or other jobs that also may contribute to increased work-family conflict and to sleep deficiency.

The follow-up in this study is limited to a very small number of subjects. The effects of a small sample size are evident looking at the Odds Ratios of higher work-family conflict on sleep deficiency in the small and large samples. The Odds Ratios in the small sample are actually higher than in the large one, but are still non-significant. Several longitudinal and intervention studies on larger samples will be needed to understand the causal mechanisms of how work-family conflict affects sleep. This is however, the first study to examine this

with a follow-up. Furthermore, sleep outcomes were self-reported and so were the other measures in this study. Future studies on work-family conflict and the sleep outcomes might benefit if the components of sleep deficiency were measured more objectively through actigraphy or polysomnography.

Conclusion

This study is the first study to investigate the effects of work-family conflict on sleep deficiency in patient care workers while controlling for several important covariates and using follow-up data. Work-family conflict was the only variable that could predict sleep problems two years later when controlling for baseline sleep outcomes. Patient care workers are an occupational group with a very high prevalence of sleep deficiency, and the deficiency is tied to musculoskeletal pain, functional limitation and psychological distress³. The results from this study indicate that future studies and interventions on sleep deficiency and occupational health should include a specific focus on work-family conflict.

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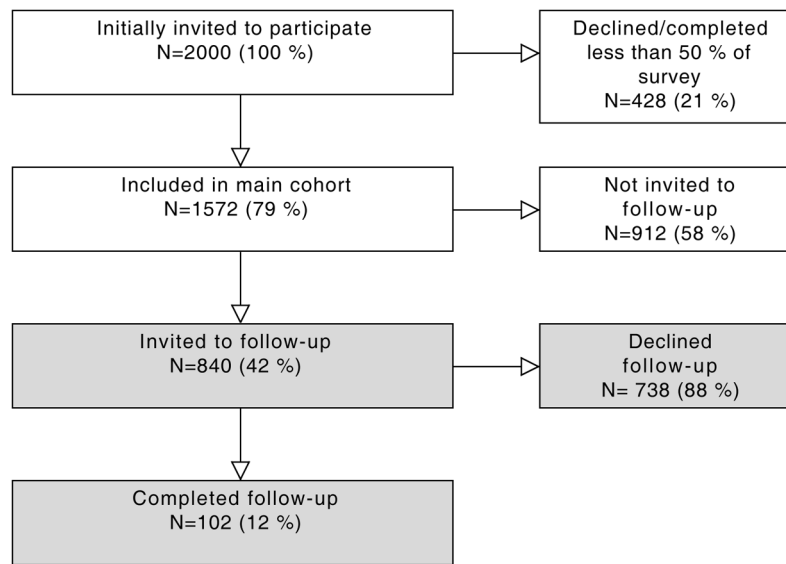


FIGURE 1.
The Flow of Study Participants from Main Cohort to Follow-up, Two Years Later.

Sleep Deficiency, 1 of any component; n=896, 57%

N = 1572 Missing = 56

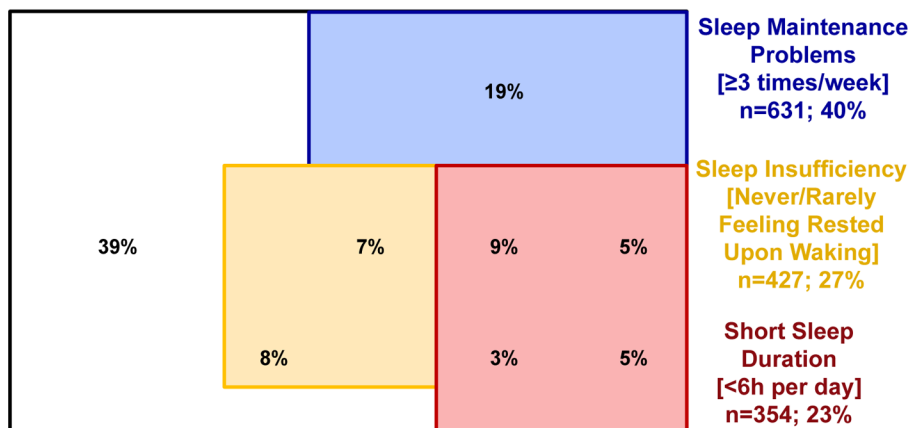


FIGURE 2. Participant frequencies, distribution and overlap on baseline sleep outcomes. Sleep maintenance is represented by the blue square, short sleep duration by the red square and sleep insufficiency by the yellow square.

TABLE 1

In our main sample, table 1 shows the frequency (%) or mean (SD) of respondent characteristics. The figures are listed by the presence or absence of sleep deficiency, short sleep duration, sleep maintenance and sleep insufficiency, with P-value for associations with outcomes

Characteristics	Sleep Deficiency		Short Sleep Duration		Sleep Maintenance Problems		Sleep Insufficiency		P-Value ^d
	Yes (N=896)	No (N=620)	Yes (N=354)	No (N=1115)	Yes (N=631)	No (N=872)	Yes (N=428)	No (N=1075)	
Work-Family Conflict									
0: Low	378 (51.6%)	355 (48.4%)	143 (20.2%)	564 (79.8%)	269 (37.0%)	459 (63.0%)	144 (19.9%)	580 (80.1%)	
1: Medium	310 (65.1%)	166 (34.9%)	115 (24.7%)	351 (75.3%)	222 (47.1%)	249 (52.9%)	158 (33.5%)	314 (66.5%)	< 0.0001
2: High	196 (68.5%)	90 (31.5%)	89 (32.2%)	187 (67.8%)	133 (46.8%)	151 (53.2%)	123 (43.0%)	163 (57.0%)	
Psych Distress	3.0 (± 3.67)	1.9 (± 2.66)	3.2 (± 3.68)	2.3 (± 3.21)	3.1 (± 3.69)	2.2 (± 3.02)	3.7 (± 4.11)	2.1 (± 2.83)	< 0.0001
Night Work									
0: 0-6 hrs monthly	523 (60.3%)	344 (39.7%)	188 (22.4%)	651 (77.6%)	379 (44.2%)	479 (55.8%)	228 (26.6%)	629 (73.4%)	0.18
1: >6 hrs but < 72	221 (55.7%)	176 (44.3%)	99 (25.4%)	291 (74.6%)	160 (40.6%)	234 (59.4%)	121 (30.6%)	274 (69.4%)	
2: 72+	152 (60.3%)	100 (39.7%)	67 (27.9%)	173 (72.1%)	92 (36.7%)	159 (63.3%)	79 (31.5%)	172 (68.5%)	
Age (yrs)	41.9 (±11.48)	40.5 (±11.95)	42.3 (±11.45)	40.9 (±11.77)	42.9 (±11.56)	40.1 (±11.60)	39.6 (±10.88)	42.0 (±11.93)	0.0003
BMI (kg/m ²)	26.6 (±5.48)	25.9 (±4.95)	27.3 (±5.84)	26.0 (± 5.04)	26.5 (±5.37)	26.1 (±5.22)	26.4 (±5.45)	26.3 (± 5.22)	0.77
Gender									
1: Male	81 (57.0%)	61 (43.0%)	29 (21.2%)	108 (78.8%)	60 (42.6%)	81 (57.4%)	41 (29.3%)	99 (70.7%)	0.77
2: Female	806 (59.3%)	553 (40.7%)	323 (24.5%)	998 (75.5%)	567 (42.1%)	780 (57.9%)	379 (28.1%)	969 (71.9%)	
Marital Status									
0: Single / living alone	303 (59.8%)	204 (40.2%)	134 (26.9%)	364 (73.1%)	198 (39.5%)	303 (60.5%)	141 (28.1%)	360 (71.9%)	0.91
1: Married / living with partner	572 (58.7%)	402 (41.3%)	213 (22.6%)	730 (77.4%)	419 (43.4%)	547 (56.6%)	275 (28.4%)	692 (71.6%)	
Race									
1: Hispanic	35 (54.7%)	29 (45.3%)	13 (21.0%)	49 (79.0%)	18 (28.6%)	45 (71.4%)	20 (31.7%)	43 (68.3%)	0.92
2: White	703 (59.4%)	481 (40.6%)	261 (22.4%)	905 (77.6%)	528 (44.8%)	650 (55.2%)	330 (28.1%)	845 (71.9%)	
3: Black	92 (58.6%)	65 (41.4%)	50 (35.2%)	92 (64.8%)	48 (31.8%)	103 (68.2%)	45 (29.4%)	108 (70.6%)	
4: Mixed race / other	53 (60.2%)	35 (39.8%)	27 (33.3%)	54 (66.7%)	30 (34.1%)	58 (65.9%)	24 (27.3%)	64 (72.7%)	

Characteristics	Sleep Deficiency		Short Sleep Duration		Sleep Maintenance Problems		Sleep Insufficiency		P-Value ^I
	Yes (N=896)	No (N=620)	Yes (N=354)	No (N=1115)	Yes (N=631)	No (N=872)	Yes (N=428)	No (N=1075)	
Occupation									
1: Staff Nurse	610 (57.2%)	457 (42.8%)	238 (22.7%)	812 (77.3%)	447 (42.2%)	612 (57.8%)	291 (27.5%)	768 (72.5%)	
2: Patient Care Associate	67 (57.8%)	49 (42.2%)	31 (31.3%)	68 (68.7%)	35 (30.7%)	79 (69.3%)	32 (28.1%)	82 (71.9%)	0.38
3: Other, please specify	216 (66.1%)	111 (33.9%)	84 (26.8%)	230 (73.2%)	147 (45.4%)	177 (54.6%)	102 (31.5%)	222 (68.5%)	
Iso-Strain									
0: No	697 (57.3%)	520 (42.7%)	274 (23.0%)	915 (77.0%)	504 (41.7%)	705 (58.3%)	334 (27.7%)	872 (72.3%)	0.02
1: Yes	119 (68.4%)	55 (31.6%)	46 (27.5%)	121 (72.5%)	77 (44.5%)	96 (55.5%)	63 (36.4%)	110 (63.6%)	
Difficulty paying bills?									
0: Little difficulty w/ bills	619 (56.8%)	471 (43.2%)	242 (22.6%)	827 (77.4%)	455 (42.1%)	625 (57.9%)	262 (24.3%)	817 (75.7%)	< 0.0001
1: At least some difficulty w/ bills	229 (66.2%)	117 (33.8%)	96 (28.9%)	236 (71.1%)	142 (41.4%)	201 (58.6%)	144 (41.9%)	200 (58.1%)	

^I P-values for continuous variables were based on t-tests; P-values for categorical variables were based on Chi-Square. Significant P-values are bolded.

Table 2
Cross-sectional multivariate associations between selected variables (P<0.2) from bivariate analyses

Independent Variables	Sleep Deficiency			Short Sleep Duration			Sleep Maintenance Problems			Sleep Insufficiency		
	Odds Ratio	95% CI	P-Value	Odds Ratio	95% CI	P-Value	Odds Ratio	95% CI	P-Value	Odds Ratio	95% CI	P-Value
Work-Family Conflict												
1: Medium vs. 0: Low	1.57	1.19 – 2.07	0.0008	1.23	0.88 – 1.72	0.04	1.34	1.03 – 1.74	0.08	1.68	1.25 – 2.27	<.0001
2: High vs. 0: Low	1.70	1.20 – 2.40		1.64	1.11 – 2.41		1.26	0.91 – 1.74		2.36	1.67 – 3.34	
Psychological Distress	1.11	1.06 – 1.16	<.0001	1.06	1.02 – 1.11	0.004	1.10	1.06 – 1.14	<.0001	1.10	1.05 – 1.14	<.0001
Night-Work Category												
1: >6 hrs. but < 72 vs. 0: 0–6 hrs. monthly				1.67	1.16 – 2.40	0.02	0.93	0.69 – 1.25	0.11	0.90	0.65 – 1.24	0.72
2: 72+ vs. 0: 0–6 hrs. monthly				1.47	0.98 – 2.20		0.70	0.50 – 0.98		1.04	0.73 – 1.49	
Age (years)	1.01	1.00 – 1.02	0.01	1.02	1.01 – 1.03	0.003	1.02	1.01 – 1.03	<.0001	0.99	0.98 – 1.00	0.11
BMI (kg/m ²)	1.02	0.99 – 1.04	0.20	1.03	1.00 – 1.05	0.06	1.01	0.99 – 1.04	0.23			
Marital Status												
1: Married / living with partner vs. 0: Single / living alone				0.76	0.57 – 1.03	0.08	1.18	0.92 – 1.50	0.20			
Race/Ethnicity												
2: White vs. 1: Hispanic				1.80	0.68 – 4.80		1.65	0.86 – 3.17				
3: Black vs. 1: Hispanic				4.35	1.52 – 12.5	0.0008	0.94	0.45 – 1.96	0.03			
4: Mixed race / other vs. 1: Hispanic				3.56	1.16 – 10.9		1.07	0.48 – 2.39				
Occupation												
2: Patient Care Associate vs. 1: Staff Nurse	0.94	0.56 – 1.59	0.13	0.61	0.29 – 1.27	0.34	1.02	0.59 – 1.74	0.83			
3: Other, please specify vs. 1: Staff Nurse	1.36	1.00 – 1.85		1.07	0.73 – 1.56		1.10	0.81 – 1.49		1.06	0.72 – 1.56	0.76
Iso-Strain												
1: Yes vs. 0: No	1.33	0.90 – 1.97	0.15	1.17	0.76 – 1.79	0.48						
Difficulty paying bills?												
1: At least some difficulty w/ bills vs. 0: Little difficulty w/ bills	1.24	0.92 – 1.66	0.16	1.09	0.78 – 1.53	0.60				1.80	1.35 – 2.39	<.0001

Significant P-values are bolded. All variables are not tested for all outcomes because of the selection criteria (P<0.2)

TABLE 3
 Longitudinal associations between Baseline Outcome, Work-Family Conflict and Sleep Outcomes at follow-up

Independent variables	Sleep Deficiency		Short Sleep Duration		Sleep Maintenance		Insufficient Sleep	
	Odds Ratio (95 % CI)	P-value	Odds Ratio (95 % CI)	P-value	Problems Odds Ratio (95 % CI)	P-value	Odds Ratio (95 % CI)	P-value
Baseline Outcome	5.57 (2.14 – 14.5)	0.0004	12.0 (4.14 – 34.7)	<0.0001	6.67 (2.50 – 17.8)	0.0001	13.4 (4.59 – 39.4)	<0.0001
Work-Family Conflict:								
1: Medium vs 0: Low	2.37 (0.64 – 8.75)	0.43	2.81 (0.81 – 9.76)	0.27	0.67 (0.21 – 2.10)	0.31	5.10 (1.47 – 17.7)	0.04
2: High vs 0: Low	1.15 (0.39 – 3.45)		1.58 (0.43 – 5.85)		0.45 (0.15 – 1.33)		2.15 (0.61 – 7.52)	

Significant P-values are bolded