



Do sleep disturbances modify the effect of psychosocial work characteristics on future depression? A study of time-varying causal effect modification

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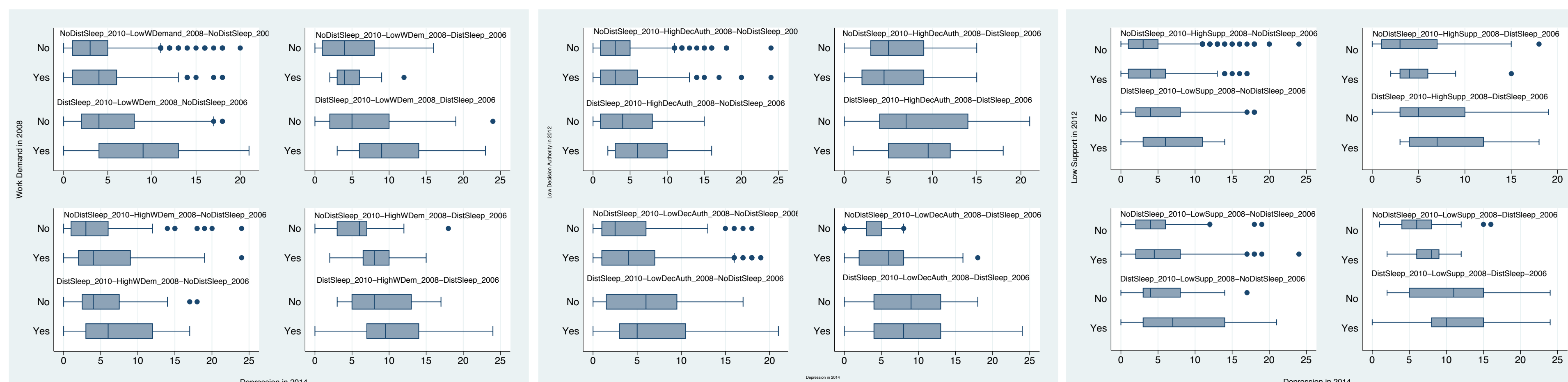
Background

Sleep is one of most important components of restitution, and stress in combination with poor restitution may lead to more long-term health problems including depression. However, it is unknown whether sleep disturbances can modify the relationship between work stressors, such as high work demands, low control and low support at work, and depression. The present study sought to investigate if sleep disturbances is an effect modifier of the longitudinal relationship between these work stressors and depression.

Methods

The study sample was derived from the SLOSH (Swedish Longitudinal Occupational Survey of Health) study, a longitudinal cohort survey with repeated measures every second year on an originally representative sample of the Swedish working population. For the present analyses we used data from 5 time points (1537 respondents in total working all time points). High work demands, low decision authority and low social support were measured in 2008 (distal exposure) and 2012 (proximal exposure), sleep disturbances (putative moderator/modifier) in 2006 and 2010, while the outcome variable was depression severity measured in 2014. To assess time-varying effect modification/moderation we used structural nested mean modeling (SNMM) estimated by means of a combined regression-with-residuals (RR) approach and an inverse-probability-of-treatment-weighting (IPTW) strategy (Almirall et al. *Statistics in Medicine* 2014; 33(20): 3466–3487). This approach overcomes problems with conventional methods such as bias from over-control of intermediate variables on the pathway and collider stratification, and provides unbiased estimates of the moderated effects of time-varying exposures when time-varying confounders and moderators are affected by past exposure.

Figure 1-3
Exploratory Data Analysis: Box and whisker plots of depression scores in 2014 by work stressors in 2012 conditional on disturbed sleep in 2006, work stressors in 2008 and disturbed sleep in 2010. Blue vertical lines denote the median



Preliminary results

While more proximal (2012) high demands, conditional on disturbed sleep in 2006, high work demands in 2008 and disturbed sleep in 2010, predicted depression severity (2014), there was no indication that sleep disturbances modified this association when adjusting for education, income, civil status, sex and age. Low decision authority on the other hand did not predict depression severity in the adjusted model. Both proximal and distal (2008) low social support at work, however, predicted later depression severity (2014) in a corresponding conditional model, and more proximal disturbed sleep (2010) was indicated as an effect modifier of the association between proximal low social support (2012) and depression (2014) ($p < 0.05$).

Table 1

Main results from the structural nested mean models: 2-stage regression estimates.

	Coefficient	SE		Coefficient	SE		Coefficient	SE
2008								
High demands	0.674	(0.771)	Low decision authority	2.517	0.845	Low social support	1.415	(0.683) *
High demands × Disturbed sleep	0.719	(0.705)	Low decision authority × Disturbed sleep	-0.998	0.705	Low social support × Disturbed sleep	0.459	(0.715)
2012								
High demands	2.296	(0.909) *	Low decision authority	1.287	0.849	Low social support	2.253	(0.771) *
High demands × Disturbed sleep	1.006	(0.649)	Low decision authority × Disturbed sleep	0.679	0.627	Low social support × Disturbed sleep	1.238	(0.609) *

* $p < 0.05$

Discussion

On the basis of these preliminary results disturbed sleep only seemed to modify the prospective relationship between proximal low social support at work and depression severity. A major strength is that the putative moderator is measured prior to the exposure and the main results are unbiased by past exposure. A possible limitation is the 2 year time lag between the measurements. The results will also be complemented with estimates under conditions of no previous high demands, low decision authority or low social support, as well as estimates of interaction to assess if the effect of work stressors and sleep disturbances together is different from the sum of their separate effect. Both analyses of effect modification and interaction can contribute to a greater understanding of how and when poor psychosocial working conditions are unfavorable to mental health which can facilitate design of more effective interventions.

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