HHS Public Access
Author manuscript
Sleep Health. Author manuscript; available in PMC 2022 April 20.

Published in final edited form as:
Sleep Health. 2015 March ; 1(1): 55–65. doi:10.1016/j.sleh.2014.11.003.

A workplace intervention improves sleep: Results from the randomized controlled Work, Family, and Health Study

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Abstract

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Conflicts of Interest (past year)
Orfeu Buxton has received consulting fees from Matsutani America not related to this article. All other authors have no conflicts of interest or disclosures to report. This work was produced without commercial financial support, and does not involve off-label or investigational use.

Study Objectives: The Work, Family, and Health Network Study tested the hypothesis that a workplace intervention designed to increase family-supportive supervision and employee control over work time improves actigraphic measures of sleep quantity and quality.

Design: Cluster-randomized trial.

Setting: A global Information Technology (IT) firm.

Participants: Knowledge workers employed in the US at the participating IT firm.

Interventions: Randomly selected clusters of managers and employees participated in a three-month, social and organizational change process intended to reduce work-family conflict. The intervention included interactive sessions with facilitated discussions, role-playing, and games. Managers completed training in family-supportive supervision.

Measurements and Results: Primary outcomes of total sleep time (sleep duration) and wake after sleep onset (WASO; sleep quality) were collected from week-long actigraphy recordings at baseline and 12 months. Secondary outcomes included self-reported sleep insufficiency and insomnia symptoms. Twelve-month interviews were completed by n=701 (93% retention), of whom 595 (85%) completed actigraphy. Restricting analyses to participants with ≥ 3 valid days of actigraphy yielded a final sample of n=474 for intervention effectiveness analyses. Actigraphy-measured sleep duration was 8 minutes/day greater among intervention employees relative to control employees ($p<.05$). Sleep insufficiency was also reduced among intervention employees ($p=.002$). WASO and insomnia symptoms were not different between groups. Path models indicated reduced work-family conflict partially mediated the improvement in sleep sufficiency.

Conclusions: The workplace intervention did not overtly address sleep, yet intervention employees' slept an hour/week more and reported greater sleep sufficiency. Interventions should address environmental and psychosocial causes of sleep deficiency, including workplace factors.

Keywords

intervention; workplace; managers; supportive supervision; control; actigraphy

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INTRODUCTION

Sleep deficiency [1, 2] has been linked to increased risk of chronic disease [3, 4] and early mortality [5–7]. Prospective studies yield evidence that short sleep duration and/or poor sleep quality is causally related to chronic disease risks of obesity [8, 9] and diabetes [4, 10, 11]. The recent Institute of Medicine report "Sleep Disorders and Sleep Deprivation: an Unmet Public Health Problem" highlighted improving sleep health in the US as a critical public health need [12]. For these reasons and others, increasing the proportion of US adults and adolescents obtaining adequate sleep has become a new federal priority in *Healthy People 2020* [13]. Clinical sleep medicine focuses primarily on treatment of individual patients' sleep disorders, however, individual-level treatments are limited in reach for meeting this challenge.

The role of workplace factors in sleep loss has been studied for decades [1, 14–16]. Most studies focus on the individual level and employ stress-based models. Extreme work hours have negative impacts on sleep duration that can be alleviated to some degree by changes in work schedules [17]. Demands of the global recession coupled with mobile technologies have extended work hours and blurred the boundaries between work and non-work, especially within information technology (IT) industries [18–20]. Time use studies suggest that US employees make the tradeoff of about two hours less of sleep for every one additional hour of work [21]. Therefore, it is important to understand the impact on sleep of particular workplace factors [22–24]. Most workplace stress interventions focus on individual coping behavior, such as yoga [25] or mindfulness practices [26, 27]. Few workplace studies have attempted to reduce employee stress and improve sleep by changing the structure of work [28, 29].

“Impoverished” environments, such as workplaces where employees lack social support and/or have limited control over their time, are associated with a range of negative health outcomes [30, 31]. Employees in low support/control work environments are particularly vulnerable to work-family conflict, which occurs when the demands of work are incompatible with the non-work demands of family and personal life [32, 33]. Work-family demands have increased for a growing number of dual-earner families, single mothers, and “sandwich” families who must simultaneously provide care for young and old [34–39]. High time-based work-family conflict increases insomnia and reduce self-reported sleep time and quality [40–43]. In an extended care (nursing home) workplace setting, employees whose managers were less supportive of work-family integration averaged about 30 minutes less daily sleep (measured with actigraphy) than employees with supportive managers [44]. Given the extensive negative health effects of work-family conflict [e.g., [28, 45]], the work-family interface has become a public health priority [46], including the evaluation of interventions to reduce this occupational health hazard and associated negative impacts on sleep [28, 47, 48].

Limited work-family intervention research has shown that improving supervisor support and employee control over work time benefits worker health and/or sleep. A randomized field experiment with grocery workers evaluated the effects of training supervisors on family supportive behaviors. For workers experiencing high work-family conflict, the intervention improved self-reported health and job satisfaction, and reduced turnover intentions [28]. A longitudinal study of white-collar employees at the headquarters of a Fortune 500 retail organization found that an intervention promoting greater employee control over time increased self-reported sleep on nights before work by almost an hour [29] and improved perceptions of adequate time for sleep [49]. However, structural workplace interventions to reduce work-family conflict remain scarce, and no prior work-family intervention has measured impacts on objective sleep outcomes within a randomized controlled trial.

The present study evaluated the effects of a theoretically-informed workplace intervention on objectively-measured employee sleep with a randomized controlled design. The study was implemented at an IT company (referred to as “Tomo” to protect company identity) and measures were collected at baseline, 6-month, and 12-months. Our primary hypotheses were that the intervention would improve actigraphically-measured total sleep time and Wake After Sleep Onset (WASO; a marker of insomnia symptoms), as well as self-reported measures of sleep insufficiency and insomnia symptoms at the 12-month time point relative to the usual practice (control) condition. Our secondary hypothesis was that intervention effects on sleep at the 12-month time point would be partially mediated by reduced work-family conflict at the 6-month time point.

METHODS

Study methods were approved by appropriate institutional review boards. Primary study outcomes were actigraphy-based measures of total sleep time per day and WASO (in minutes), and self-reported measures of sleep insufficiency and insomnia symptoms measured at baseline and 12 months. Of interest was the change in these outcomes over the study year in the intervention and usual practice (control) arms of the study.

Design and Data Collection

The study employed a cluster-randomized design with three measurement time points reported here (baseline, 6-months, 12-months). Recruitment spanned 09/2009-09/2010, and 12-month follow-up was completed 09/2011. Fifty-six “study groups”, or clusters of managers and employees, were identified with company representatives as eligible for randomization. Adaptive randomization occurred after baseline data collection for each study group as previously described [50]. All employees within these groups were eligible to participate. Some study groups involved large teams under one leader whereas other study groups involved multiple teams who worked closely together or reported to the same senior leader. We refer to randomization units as study groups to denote that they are aggregations of existing functional work groups that operated in the organization. Baseline demographic descriptive statistics for the sample are provided in Table 1.

Recruitment materials emphasized the value of the research for employees and the organization, as well as for scientific knowledge. Trained study site managers introduced the study to employees at work sites and coordinated project implementation. To minimize bias, separate and blinded study field interviewers obtained written informed consent and collected data from employees within intervention and usual practice study groups at baseline, 6-, and 12-month time points [50]. Baseline data were collected approximately one month before the onset of the three-month intervention. Self-reported measures were collected as part of a 60-minute interview at each time point. Employees were asked to wear a wrist actigraph for one week, as described below. Employees received up to $60 for completing all worksite data collection components at each time point. Figure 1 depicts study recruitment and retention.

Statistical Methods

While randomization occurred at the study group level (m=56), multi-level analyses utilized coding for the smaller unit of work group level to best account for functional day-to-day organization at Tomo (m=107). Given the non-independence of measures due to the nesting of observations within individuals across time and the nesting of individuals within work groups in the organization, we used a recommended general linear mixed modeling approach for cluster randomized designs, e.g. [51–53] in SAS (v.2.2, SAS Institute, 2010, Cary, NC) with restricted maximum likelihood estimation. The key model parameter was the interaction between assessment wave and the intervention indicator that represents the differential change in the sleep outcomes across time and intervention conditions. These models take into account baseline values of the outcome variable. Furthermore, differences between intervention and control groups on demographic variables are irrelevant because multiple waves are included in the models (i.e., each person controls for themselves, despite what group they are in), To test our secondary hypothesis of mechanisms underlying intervention effects, we used multi-level structural equation modeling approaches accounting for longitudinal and nesting features of the data [54] Mplus (v4.2, Muthen & Muthen, 2006, Los Angeles, CA). Changes in work-family conflict were hypothesized to mediate the relationship between the intervention and changes in sleep. Specifically, we modeled whether the intervention directly reduced work-family conflict at the 6-month time point, and then whether reductions in work-family conflict were directly related to sleep improvements at 12 months. The product of these two direct effects defines the indirect effect (i.e., mediation) in our model [54]. Sensitivity analyses using a full information maximum likelihood approach [56] revealed no substantive differences in mediation model results (data not reported).

Intervention

The intervention was a three-month structural and social change process designed to increase (1) employee control over work time and (2) family supportive supervisory behaviors [57]. The change process was an integration of two interventions that in prior evaluations had independently addressed employee control and supportive supervision [28, 58]. Behavioral self-monitoring activities were also integrated to support transfer of training in the new intervention process [59, 60]. For implementation, the new intervention was named STAR (Support. Transform. Achieve. Results). See figure 2 for an overview of the intervention process.

Over the three-month intervention period, a facilitator led employees through eight hours of participatory sessions to transition them from a time-based to a results-based work culture. During this process leaders and employees were asked to make structural changes and exercise greater freedom to work at whatever time and whatever place they wanted, as long as they produced their expected work results. This change was expected to impact employee sleep by enabling greater control over wake time. Managers/supervisors participated in all change activities plus four hours of training in supportive supervision and meetings to discuss the change process. Increased support was expected to impact employee sleep primarily by reducing employee stress, thereby enhancing employee psychological and physical readiness for sleep onset in the evening and quality sleep through the night.

Participatory sessions for both managers and employees included structured presentations about the reasons for workplace changes, as well as facilitated discussions, role-playing, and games. After two meetings where employees were asked to take action, work groups participated in web polls where they collectively self-monitored changes they were making and viewed instant graphic feedback. To reduce the effort of participation, each web-poll was scheduled with employees as a two-week, repeating daily computerized calendar event that included a link to the poll. The first web poll focused on stopping negative behaviors and judgments about how co-workers spend their time. The second web poll focused on exercising more control over when and how work was performed, and on providing more support for co-workers family/personal lives and job performance.

Supportive supervisory training began early in the overall intervention process by having managers meet with a facilitator individually to complete training, goal setting, and self-monitoring. The training, which was named “weSupport for Supervisors” for implementation, was computer-based (cTRAIN, NWeta, Lake Oswego, OR) and designed according to behavioral principles (e.g., self-paced, mastery required, frequent quizzes). Training content addressed the rationale for STAR and taught supervisors about specific supportive behaviors impacting employee health and productivity. These included eight types of supportive behaviors (four types of family/personal support, and four types of job/performance support). Family/personal support categories were derived from the measure and construct developed by Hammer and colleagues [28]. Job/Performance support categories were derived from a review of behavioral performance analysis models [61]. Specific behavior examples in each category were developed through formative focus group research with information technology employees. Goal setting and self-monitoring of supportive behaviors was implemented using an Enterprise application for iPhone/iPod Touch (HabiTrack, Oregon Health & Science University, Portland, OR) that was designed based on best practices in clinical and workplace self-monitoring methods [60, 62]. Each supervisor completed two rounds of self-monitoring; the first occurring immediately after the computer-based training, and the second occurring toward the end of the change process. Each round lasted for two weeks, and concluded with supervisors receiving individual and group feedback. The iPod application helped managers set goals and self-monitor the eight types of family and job/performance support learned in training. The application included a home tab for recording behaviors and viewing feedback on progress toward goals, a statistics tab for viewing details on past behavior and submissions, a help tab for reviewing examples of each type of supportive behavior, and a settings tab where each manager could adjust their goals (if desired) once during each self-monitoring trial. As the overall intervention process unfolded, managers also attended “manager-only” meetings to discuss the overall change process together, and also to reflect on the results of their efforts to self-monitor and increase the support they provided to employees. The first manager only meeting occurred early in the change process, and the second occurred toward the end of the change process.

During intervention implementation, Tomo announced a pending merger. During mergers employees are likely to experience heightened job insecurity, which could impact work-family conflict and sleep. Therefore, to control for the possible effect of the merger announcement, multi-level models included an indicator of the timing of employee baseline interviews (pre- or post-merger announcement; Table 2).

Throughout the study, qualitative process evaluation data were collected via observation of training sessions and semi-structured interviews with employees and managers. The interview guide did not ask explicitly about sleep but did ask about health broadly. Selected excerpts from these discussions relevant to sleep and the intervention are included below.

Measures

Actigraphy Outcome Measures.—Wrist actigraphy (Actiwatch Spectrum, Philips/ Respironics, Murrysville, PA, USA) data were analyzed using the recently validated manufacturer's standard algorithm at medium sensitivity [63] for 24-hour Total Sleep Time (including naps) and Wake After Sleep Onset (WASO) during the main sleep period for all study days with a valid recording, as described below.

Data from each subjects' actiwatch was uploaded to databases (Respironics Actiware sleep scoring program version 5.61) and analyzed by at least two members of the scoring team. All analyses were completed blinded to condition. Scorers first determined the validity of each recording, the validity of each day of the recording, and then manually inserted sleep periods (main sleep intervals and naps) based on study-specific standard operating procedures applied similarly to all recordings. Scorers started by finding points of decreased activity levels and also used sudden, decreased light levels (lux) to help suggest, but not confirm, bedtimes. By visually reviewing the entire sleep recording before manually setting intervals, scorers took into consideration the activity intensity of the subject for determining naps and sleep periods to be able to accurately define sleep periods rather than low movement activities such as watching tv or reading in bed. Sleep periods began at the last epoch of high activity (>10 activity counts) preceding at least five 30-second epochs of <10 activity counts, indicating little to no movement. Wake times were determined the same way by finding the first epoch of sustained high activity (>10 activity counts) after at least five 30-second epochs of <10 activity counts. A recording was deemed invalid if there was constant false activity (a device malfunction), or if the data were irretrievable. Reasons for invalid days within a recording include watch error, such as false activity, and subject non-compliance (greater than four hours of actiwatch off-wrist time throughout the day, or an off-wrist period greater than 60 minutes within 10 minutes of the determined beginning or end of the main time in bed period for that day). Sleep diaries were not used due to subject burden, recall bias, and low response rates in other studies [64].

Concordance between at least two scorers was measured for the validity of the recording and the number of valid days. All scorers used the same cut time to define 24-hr days. If there were no discrepancies between scorers in any of those variables, the analyses were then checked that all scorers determined the recording had the same number of sleep periods and that each sleep period as a main sleep or nap were labeled in an identical manner. Any discrepancies were resolved amongst the scoring team with the final determination by the last author. Finally, each of the sleep periods were checked on an interval-by interval-basis. Any corresponding intervals that exceeded a 15-minute difference in duration or exceeded 15 minutes of either total sleep time or WASO were rescored with all final adjudications by the last author. The Actiware sleep scoring program separates the recording into 30-s epochs and determines sleep or wake using weighted activity counts using the medium sensitivity standard algorithm, as recently validated versus the gold standard of polysomnography [63]. If the total activity count exceeded the wake threshold level determined by the researchers (medium wake threshold level selection uses a wake threshold value of 40 total activity counts), then the epoch was determined to be wake; and if the total activity count was below the set wake threshold level, the epoch was determined to be sleep. Total sleep time was the total number of epochs determined to be sleep multiplied by the set epoch length, while WASO was the total number of epochs determined to be wake multiplied by the set epoch length, with both variables being presented as a value in minutes for both main sleep intervals and nap sleep intervals. Actigraphy measures were screened for outliers using box and whisker plots, but no outliers were present. Analyses were conducted with and without outliers found in more conservative histograms, but results did not change. Thus, the current analyses are based on the larger sample.

Self-Report Outcome and Mediation Measures.—Participants answered questions regarding their sleep for the previous four weeks. *Sleep insufficiency* was assessed by asking participants how often they got enough sleep to feel rested upon waking up, with response categories of never, rarely, sometimes, often, and very often [65, 66], similar to current CDC surveillance for state-level sleep insufficiency [67]. *Insomnia symptoms* were assessed using components of the Pittsburgh Sleep Quality Index [68]: how often they woke in the middle of the night or early morning with response categories of never, less than once a week, once or twice a week, and three or more times a week. An hypothesized mediator of intervention effects, *Work-family conflict*, was assessed using the mean of five items (computed only if participants provided four or more valid responses to the five items); "The demands of your work interfere with your family or personal time," "The amount of time your job takes up makes it difficult to fulfill your family or personal responsibilities," "Things you want to do at home do not get done because of the demands your job puts on you," "Your job produces strain that makes it difficult to fulfill your family or personal duties," and "Due to your work-related duties, you have to make changes to your plans for family or personal activities." Each item used the following response categories; "strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree."

Role of Funding Source

The NIH, CDC, and other funders did not play a directive role in study design, conduct, reporting, or decision to submit a manuscript. NICHD Extramural Staff Scientist Rosalind King served as project collaborator and fulfilled contributing author responsibilities.

RESULTS

Baseline interviews were completed by n=823 (70% response rate), of whom 710 (86%) also completed wrist actigraphy. Among these individuals, a minimum of three valid days of actigraphy, a quality metric for reliable sleep estimates, were available in a final baseline sample of n=618 (intervention n= 313, control n=305). The 12-month interviews were completed by n=701 (93% retention rate), of whom 595 (85%) completed wrist actigraphy. A minimum of 3 valid days of actigraphy were available at both baseline and 12-month time points from a sample of n=473-474 (intervention n=233-234, control n=240), which was the functional sample size for the current intervention analyses. A smaller sample (n=456-457; intervention n=227-228, control n=229), due to non-participation at 6-month wave, was used in mediation path models. As noted in the statistical analysis section, study groups (m=56; intervention=27, control=29) were the unit of randomization (see Figure 2 for study flow diagram), but smaller clusters of work groups (m=107; intervention m=54, control m=53) were used as the nesting variable in multi-level analyses.

The baseline burden of sleep deficiency using actigraphy and self-reported data is depicted in Figure 3: 65% of the sample exhibited at least 1 of the 3 components of sleep deficiency, including 18% with short actigraphic mean sleep duration, 41 with mean actigraphic WASO>45/min/day, and 22% self-reported sleep insufficiency. In qualitative interviews, common problems that emerged as self-reported reasons for losing sleep included smart phones, staying in bed and thinking about work, not being able to shake a cold because of sleep deprivation and merger-related sleep deprivation. One participant volunteered the fact that he has trouble sleeping every night because he is constantly on his smartphone, right up until bedtime. He answers his last e-mail for the night, turns it off, and spends hours trying to unwind as he lays there. Then when he gets up in the morning, he’s already got emails waiting that came in through the night. He said that it started a few years ago, that things have gotten much more hectic and the pace of work has sped up over the past few years, and his lack of sleep is a result of that.

Relative to the control condition, the intervention resulted in significant improvements in employees’ actigraphy-measured total sleep time ($\gamma = 8.17$, $t = 2.07$, $p = .041$) and reported sleep insufficiency ($\gamma = -0.25$, $t = -3.11$, $p = .002$) at follow-up (Table 2). Significant intervention-by-time interactions for respective models are shown in Table 3. Intervention participants demonstrated an average of 8 minutes more total sleep time per night (approximately one hour per week increase in sleep) and an average of 0.25 point lower sleep insufficiency ratings (5 point scale) compared to control participants (Figure 4). Although parameter estimates were in the anticipated direction, the intervention did not have a significant impact on changes in actigraphy-measured WASO ($\gamma = 1.31$, $t = 1.15$, $p = .25$) or reported insomnia symptoms ($\gamma = -0.01$, $t = -0.20$, $p = .85$) at follow-up.

Path modeling (Figure 5) examined whether changes in work-family conflict [see [69]] at 6-months served as a mediating variable for the effects of the intervention on changes in sleep outcomes at 12-months. We observed a significant indirect effect of the intervention on changes in self-reported sleep insufficiency through reductions in work-family conflict (indirect effect = −0.05, $Z = -2.16$, $p = .03$). Path modeling confirmed the significant direct effects of the intervention on actigraphy-based total sleep time and self-reported sleep insufficiency.

In qualitative interviews, employees also offered examples of how the intervention had helped them improve their sleep. In interviews conducted after the intervention, sleep was mentioned in 27 of 128 interviews (21%, combining 9- and 15-month rounds of interviews). A theme observed in these qualitative data was how control over work time allowed employees to adjust their sleep for a better fit with acute and chronic demands. For example, one employee said, “I don’t have to get up at 5 o’clock to leave the house at seven, I can get up at a quarter to seven and be online, or sleep until ten till 8 or whatever…” Another employee reported that before the intervention she had to get up at 4:30 to get an early start at work and avoid evening rush hour traffic. After the intervention, she reported that “if I’m working from home I don't get up until 6:00 or 6:30 and I start working at 7:00… I think that's been extremely beneficial to me in that I do get more sleep than I've had in years."

DISCUSSION

The current study was a randomized experimental evaluation of the effects of a workplace intervention on directly-measured sleep outcomes 12-months after baseline. Relative to the control, intervention employees increased total sleep time by an hour per week, and their perceptions of sleep insufficiency improved. Sleep changes were in part mediated by reductions in work-family conflict, which was an intervention change target. Various interventions with other populations have increased actigraphy-measured total sleep time, including delayed school start times in children [70], medical resident work hour scheduling [17], and a variety of pharmacological and behavioral treatments in insomniacs [71]. In contrast, the current study evaluated the effects of an intervention on actigraphy-measured total sleep time among working adults in a stressful occupation. Our findings suggest that there is potential to improve sleep duration in the general US population, a federal priority articulated in Healthy People 2020 [13], by addressing environmental and contextual causes of insufficient sleep, particularly within workplace psychosocial environments.

Our Work, Family, and Health Network (WFHN) intervention was informed by the theoretical expectation that increases in (a) employee control over work time and (b) supervisor support for integrating work and non-work demands would reduce work-family conflict [31]. Decreases in work-family conflict would in turn, be expected to improve employee health outcomes, including sleep [72]. The current project used a transdisciplinary research model, as previously described [50], to test the hypothesis that the WFHN intervention would improve employee sleep quantity and quality, and that intervention effects on sleep would be partially mediated by reductions in work-family conflict. We observed partial mediation of intervention effects on perceived sleep insufficiency via reductions in work-family conflict. However, the significant direct effect of the intervention on total sleep time was not mediated by this particular work-related stressor, suggesting that factors other than work-family conflict mediated this direct intervention effect (e.g., improved employee control over work timing and location). We also observed no direct intervention effects on WASO or insomnia symptoms. A potential explanation for these null results is that the intervention did not create sufficiently large reductions in work-family conflict to impact WASO or insomnia symptoms. It is also possible that work-family conflict is simply unrelated to these metrics of sleep quality, however, a number of prior studies show positive relationships between work-family conflict and sleep problems [40, 41, 73, 74].

Clinical and health implications of findings

The intervention's main effect of 8 min more sleep per day (or ~ 1 hour more sleep per week) relative to the control condition is socially important and may have clinically significant health benefits over time. The clinical health benefits of an extra hour of sleep per week are not clearly known, but an extra hour is important at the population level, especially since work-related factors remain important predictors of sleep even after controlling for home-based factors [40]. CDC analyses of 2010 National Health Interview

Survey data revealed that 30.0% of employed US civilian adults report short sleep duration (≤ 6 hours/day), with significant variation by sector [76]. *Healthy People 2020* articulates a federal goal of increasing the proportion of Americans receiving adequate sleep by 1% [13], an uphill battle in the face of increasing short sleep among employed US adults [77]. The partial mediation of the intervention effect on sleep insufficiency via reductions in work-family conflict suggests that we should also expect other generalized benefits of reduced work stress for employees and employers, such as improved health and reduced absenteeism/ turnover. If a collectively administered workplace intervention, such as the group-level WFHN intervention, was enhanced with an individual-level sleep intervention component at work or elsewhere, even larger effects might be anticipated. Indeed, CDC/NIOSH has also identified the workplace as a locus of sleep interventions, concluding that “further explorations of the relationship between work and sleep are needed” [76].

Conclusion

The current study, a randomized experimental evaluation of a work-family intervention, did not overtly address sleep. Yet, after organizational and policy changes at the manager and team level, employees’ sleep time increased by an hour per week, as did perceptions of sleep sufficiency. Sleep changes were in part mediated by reductions in work-family conflict, a target of the intervention. Increasing family supportive supervision and employee control over work reduces stress and improves sleep. Workplace interventions may be a particularly effective approach with sufficiently broad reach for achieving the Healthy People 2020 goal to increase the number of adults who are getting sufficient sleep (US baseline = 69.6%; 2020 goal = 70.9%; [13]). Work, while a source of financial security and fulfillment, has modifiable facets that may hinder a healthful lifestyle. In the current study we modified work, and improved measured sleep duration and perceived sleep sufficiency, strongly suggesting workplaces as foci for future sleep interventions.

Strengths/Limitations.

Primary strengths of the study include the randomized controlled design, actigraphy-measured sleep outcomes, one-year follow-up, qualitative and wuantitive data, and a focus on working adults as the target population. Additional strengths include mediation analyses involving a target of the intervention collected at a separate, earlier time point from outcomes. Limitations include using only two weeks of actigraphy per participant (minimum 3 valid days for each week-long recording), and the IT worker sample not representative of all workforces. Although actigraphy is superior to self-report data, the methodology has limitations and measurement error, including a particular weakness for detecting wakefulness during sleep [63].

Acknowledgements

Special acknowledgement goes to Extramural Staff Science Collaborator, Rosalind Berkowitz King, Ph.D. and Lynne Casper, Ph.D. for design of the original Workplace, Family, Health and Well-Being Network Initiative (responsible for generating and encompassing the Work, Family, and Health Network). We wish to express our gratitude to the worksites, employers, and employees who participated in this research and made this publication possible. We thank the members of the Biomarker and Actigraphy Data Coordinating Center, James H. Porter, Deirdre T. McLaren, Richard M. Lilienthal, and Chloe M. Beverly for assistance with data collection, scoring, and preparation of this manuscript, and Rachel Magennis and Yagmur Karayaka for assistance with qualitative data.

Support

This research was conducted as part of the Work, Family, and Health Network (www.WorkFamilyHealthNetwork.org), which is funded by a cooperative agreement through the National Institutes of Health and the Centers for Disease Control and Prevention: *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (U01HD051217, U01HD051218, U01HD051256, U01HD051276), National Institute on Aging (U01AG027669), Office of Behavioral and Social Sciences Research, the National Heart, Lung and Blood Institute (R01HL107240), and National Institute for Occupational Safety and Health (U01OH008788, U01HD059773). Grants from the William T. Grant Foundation, Alfred P Sloan Foundation, and the Administration for Children and Families have provided additional funding. The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official views of these institutes and offices.

References

1. Luyster FS, Strollo PJ Jr., Zee PC, Walsh JK. Sleep: a health imperative. Sleep 2012;35:727–34. [PubMed: 22654183]
2. National Center on Sleep Disorders Research. National Institutes of Health Sleep Disorders Research Plan. Bethesda, MD: National Institutes of Health, 2011 06/01/2011.
3. Buxton OM, Marcelli E. Short and long sleep are positively associated with obesity, diabetes, hypertension, and cardiovascular disease among adults in the United States. Social Science & Medicine 2010;71:1027–36. [PubMed: 20621406]
4. Cappuccio FP, D'Elia L, Strazzullo P, Miller MA. Quantity and quality of sleep and incidence of type 2 diabetes: a systematic review and meta-analysis. Diabetes Care 2010;33:414–20. [PubMed: 19910503]
5. Wingard DL, Berkman LF. Mortality risk associated with sleeping patterns among adults. Sleep 1983;6:102–7. [PubMed: 6878979]
6. Grandner MA, Hale L, Moore M, Patel NP. Mortality associated with short sleep duration: the evidence, the possible mechanisms, and the future. Sleep Med Rev 2010;14:191–203. [PubMed: 19932976]
7. Murray G, Nicholas CL, Kleiman J, et al. Nature's clocks and human mood: the circadian system modulates reward motivation. Emotion. 2009;9:705–16. [PubMed: 19803592]
8. Cappuccio FP, Taggart FM, Kandala NB, et al. Meta-analysis of short sleep duration and obesity in children and adults. Sleep 2008;31:619–26. [PubMed: 18517032]
9. McAllister EJ, Dhurandhar NV, Keith SW, et al. Ten putative contributors to the obesity epidemic. Critical Reviews in Food Science and Nutrition 2009;49:868–913. [PubMed: 19960394]
10. Steptoe A, O'Donnell K, Marmot M, Wardle J. Positive affect, psychological well-being, and good sleep. J Psychosom Res 2008;64:409–15. [PubMed: 18374740]
11. Knutson KL, Van Cauter E. Associations between sleep loss and increased risk of obesity and diabetes. Annals of the NY Academy of Science 2008;1129:287–304.
12. Committee on Sleep Medicine Research Board on Health Sciences Policy. Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem. Washington, D.C.: Institute of Medicine of the National Academies; The National Academies Press, 2006.
13. US Department of Health and Human Services. Healthy People 2020 Objective Topic Areas and Page Numbers. 2010 2011/01/04/ [cited; 300–1]. Available from: http://healthypeople.gov/2020/topicsobjectives2020/default.aspx
14. Takahashi M Prioritizing sleep for healthy work schedules. Journal of Physiological Anthropology 2012;31:6. [PubMed: 22738292]
15. Sorensen G, Stoddard AM, Stoffel S, et al. The role of the work context in multiple wellness outcomes for hospital patient care workers. Journal of Occupational and Environmental Medicine 2011;53:899–910. [PubMed: 21775897]
16. Theorell T, Åkerstedt T. Day and night work: changes in cholesterol, uric acid, glucose and potassium in serum and in circadian patterns of urinary catecholamine excretion. Acta Medica Scandinavica 1976;200:47–53. [PubMed: 785960]
17. Lockley SW, Cronin JW, Evans EE, et al. Effect of reducing interns' weekly work hours on sleep and attentional failures. N.Engl.J.Med 2004;351:1829–37. [PubMed: 15509816]

18. Chesley N Technology use and employee assessments of work effectiveness, workload, and pace of life. Information, Communication, & Society 2010;13:485–514.
19. Chesley N Blurring boundaries? Linking technology use, spillover, individual distress, and family satisfaction. Journal of Marriage and Family 2005;67:1237–48.
20. Park Y, Fritz C, Jex SM. Relationships between work-home segmentation and psychological detachment from work: the role of communication technology use at home. Journal of Occupational Health Psychology 2011;16:457–67. [PubMed: 21728434]
21. Basner M, Fomberstein KM, Razavi FM, et al. American time use survey: Sleep time and its relationship to waking activities. Sleep 2007;30:1085–95. [PubMed: 17910380]
22. Major VS, Klein KJ, Ehrhart MG. Work time, work interference with family, and psychological distress. The Journal of Applied Psychology 2002;87:427–36. [PubMed: 12090600]
23. Moen P, Kelly EL, Lam J. Healthy work revisited: Do changes in time strain predict well-being? Journal of Occupational Health Psychology 2013;18:157–72. [PubMed: 23506547]
24. Roxburgh S ‘There just aren’t enough hours in the day’: the mental health consequences of time pressure. Journal of Health and Social Behavior 2004;45:115–31. [PubMed: 15305755]
25. Hartfiel N, Havenhand J, Khalsa SB, Clarke G, Krayer A. The effectiveness of yoga for the improvement of well-being and resilience to stress in the workplace. Scandanavian Journal of Work, Environment, and Health 2010.
26. Brand S, Holsboer-Trachsler E, Naranjo JR, Schmidt S. Influence of mindfulness practice on cortisol and sleep in long-term and short-term meditators. Neuropsychobiology 2012;65:109–18. [PubMed: 22377965]
27. Kozasa EH, Hachul H, Monson C, et al. Mind-body interventions for the treatment of insomnia: A review. Revista Brasileira de Psiquiatria 2010;32:437–43. [PubMed: 21308266]
28. Hammer LB, Kossek EE, Anger WK, Bodner T, Zimmerman K. Clarifying work-family intervention process: the roles of work-family conflict and family supportive supervisor behaviors. Journal of Applied Psychology 2011;96:134–50.
29. Moen P, Kelly EL, Tranby E, Huang Q. Changing work, changing health: can real work-time flexibility promote health behaviors and well-being? Journal of Health and Social Behavior 2011;52:404–29. [PubMed: 22144731]
30. Taylor SE, Repetti RL, Seeman T. Health psychology: What is an unhealthy environment and how does it get under the skin? Annual Review of Psychology 1997;48:411–47.
31. King RB, Karuntzos GT, Casper LM, et al. Work-family Balance Issues and Work-Leave Policies. In: Gatchel RJ, Schultz IZ, eds. Handbook of Occpational Health and Wellness. New York: Springer, 2013:323–40.
32. Greenhaus JH, Beutell NJ. Sources of conflict between work and family roles. Academy of Management Review 1985;10:76–88.
33. Bogan EC. Economics of the wider family. In: Marciano T, Sussman M, eds. Wider Families: New Traditional Family Forms. New York: Harworth Press, 1991:9–27.
34. Bianchi SM, Casper LM, King RB, eds. Work, Family, Health and Well-Being. Mahwah, NJ: Lawrence Erlbaum, 2005.
35. Casper LM, Bianchi SM. Continuity and Change in the American Family: Anchoring the Future. Thousand Oaks, CA: Sage, 2002.
36. Bianchi S, Milkie MA. Work and Family Research in the First Decade of the 21st Century. Journal of Marriage and Family 2010;72:705–25.
37. Moen P It’s About Time: Couples and Careers. Ithaca, NY: Cornell University Press, 2003.
38. Moen P, Chesley N. Toxic Job Ecologies, Time Convoys, and Work-Family Conflict: Can Families (Re)Gain Control and Life-Course “Fit”. In: Korabik K, Lero DS, Whitehead DL, eds. Handbook of Work-Family Integration: Research, Theory, and Best Practices. Neew York, NY: Elsevier, 2008.
39. Neal MB, Hammer LB. Working couples caring for children and aging parents: Effects on work and well-being. Mahwah, NJ: Lawrence Erlbaum Associates, 2007.
40. Burgard SA, Ailshire JA. Putting work to bed: stressful experiences on the job and sleep quality. Journal of Health and Social Behavior 2009;50:476–92. [PubMed: 20099452]

41. Maume DJ, Sebastian RA, Bardo AR. Gender differences in sleep disruption among retail food workers. American Sociological Review 2009;74:989–1007.
42. Barnes CM, Wagner DT, Ghumann S. Borrowing from sleep to pay work and family: Expanding time-based conflict to the broader non-work domain. Personell Psychology 2012;65:789–819.
43. Barnes CM. Working in our sleep: Sleep and self-regulation in organizations. Organizational Psychology Review 2012;2:234–57.
44. Berkman LF, Buxton OM, Ertel K, Okechukwu C. Manager's practices related to work-family balance predict employee cardiovascular risk and sleep duration in extended care settings. Journal of Occupational Health Psychology 2010;115:316–29.
45. Grzywacz JG. Work-family spillover and health during midlife: is managing conflict everything? American Journal of Health Promotion 2000;14:236–43. [PubMed: 10915535]
46. McSweeny T Workplace Flexibility at the White House. 2010 [cited 7/18/2013]; Available from: http://www.whitehouse.gov/blog/2010/04/01/workplace-flexibility-white-house
47. Hammer LB, Cullen JC, Neal MB, Sinclair RR, Shafiro MV. The longitudinal effects of work-family conflict and positive spillover on depressive symptoms among dual-earner couples. J Occup Health Psychol 2005;10:138–54. [PubMed: 15826224]
48. Thomas L, Ganster D. Impact of family-supportive work variables on work-family conflict and strain: A control perspective. Journal of Applied Psychology 1995;80:6–15.
49. Moen P, Fan W, Kelly EL. Team-level flexibility, work-home spillover, and health behavior. Social Science & Medicine 2013;84:69–79. [PubMed: 23517706]
50. Bray JW, Kelly E, Hammer LB, et al. An integrative, multilevel, and transdisciplinary research approach to challenges of work, family, and health. Research Triangle Park, NC, 2013.
51. Donner A, Klar N. Pitfalls of and controversies in cluster randomization trials. American Journal of Public Health 2004;94:416–22. [PubMed: 14998805]
52. Murray DM, Varnell SP, Blitstein JL. Design and analysis of group-randomized trials: a review of recent methodological developments. American Journal of Public Health 2004;94:423–32. [PubMed: 14998806]
53. Varnell SP, Murray DM, Janega JB, Blitstein JL. Design and analysis of group-randomized trials: a review of recent practices. American Journal of Public Health 2004;94:393–9. [PubMed: 14998802]
54. MacKinnon DP. An Introduction to Statistical Mediation Analysis. New York, NY: Lawrence Erlbaum Associates, 2008.
55. Schafer J Analysis of Incomplete Multivariate Data. London: Chapman and Hall, 1997.
56. Enders C Applied Missing Data Analysis. New York: Guilford, 2010.
57. Kossek EE, Hammer LB, Kelly E, Moen P. Designing work, family & health organizational change initiatives. Organizational Dynamics 2014;43:53–63. [PubMed: 24683279]
58. Kelly EL, Moen P, Tranby E. Changing workplaces to reduce work-family conflict: schedule control in a white-collar organization. American Sociological Review 2011;76:265–90. [PubMed: 21580799]
59. Gravina N, Olson R. Behavioral self monitoring: a new way to transfer training. Training and Development 2009;63:18.
60. Olson R, Winchester J. Behavioral self-monitoring of safety and productivity in the workplace: a methodological primer and quantitative literature review. Journal of Organizational and Behavioral Management 2008;28:9–74.
61. Austin J Performance analysis and performance diagnostics. In: Austin J, Carr JE, eds. Handbook of Applied Behavior Analysis. Reno, NV: Context Press, 2000:321–49.
62. Korotisch WJ, Nelson-Gray RO. An overview of self-monitoring research in assessment and treatment. Psychological Assessment 1999;11:415–25.
63. Marino MM, Li Y, Rueschman MN, et al. Measuring sleep: Accuracy, sensitivity, and specificity of wrist actigraphy compared to polysomnography. Sleep 2013;36:1747–55. [PubMed: 24179309]
64. Lauderdale DS, Knutson KL, Yan LL, et al. Objectively measured sleep characteristics among early-middle-aged adults: the CARDIA study. Am.J Epidemiol. 2006;164:5–16. [PubMed: 16740591]

65. Buxton OM, Hopcia K, Sembajwe G, et al. Relationship of sleep deficiency to perceived pain and functional limitations in hospital patient care workers. Journal of Occupational and Environmental Medicine 2012;54:851–8. [PubMed: 22796931]
66. Buxton OM, Quintiliani LM, Yang MH, et al. Association of sleep adequacy with more healthful food choices and positive workplace experiences among motor freight workers. American Journal of Public Health 2009;S 99:636–43.
67. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Survey Questionnaire. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2013.
68. Buysse DJ, Reynolds III CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh sleep quality index: a new instrument for psychiatric practice and research. Psychiatry Research 1989;28:193–213. [PubMed: 2748771]
69. Kelly EL, Moen P, Oakes M, Fan W. Changing work and work-family conflict in an information technology workplace: evidence from a group-randomized trial. American Sociological Review Accepted.
70. Lufi D, Tzischinsky O, Hadar S. Delaying school starting time by one hour: some effects on attention levels in adolescents. Journal of clinical sleep medicine 2011;7:137–43. [PubMed: 21509327]
71. Sadeh A The role and validity of actigraphy in sleep medicine: An update. Sleep Med Rev 2011;15:259–67. [PubMed: 21237680]
72. Greenhaus JH, Allen TD, Spector PE. Health consequences of work-family conflict: the dark side of the work-family interface. In: Perrewe PL, Ganster DC, eds. Research in Occupational Stress and Well-being. Amsterdam: JAI Press, 2006:61–98.
73. Barnes CM, Wagner DT, Ghumman S. Borrowing from Sleep to Pay Work and Family: Expanding Time-Based Conflict to the Broader Non-Work Domain. Personnel Psychology 2012.
74. Barnes CM, Ghumman S, Scott BA. Sleep and Organizational Citizenship Behavior: The Mediating Role of Job Satisfaction. Journal of Occupational Health Psychology 2012.
75. Erman MK, Zammit G, Rubens R, et al. A polysomnographic placebo-controlled evaluation of the efficacy and safety of eszopiclone relative to placebo and zolpidem in the treatment of primary insomnia. Journal of Clinical Sleep Medicine 2008;4:229–34. [PubMed: 18595435]
76. Centers for Disease Control and Prevention. Short sleep duration among workers -- United States, 2010. Morbidity and Mortality Weekly Report (MMWR) 2012;61:281–5. [PubMed: 22534760]
77. Knutson KL, Van Cauter E, Rathouz PJ, DeLeire T, Lauderdale DS. Trends in the prevalence of short sleepers in the USA: 1975-2006. Sleep 2010;33:37–45. [PubMed: 20120619]

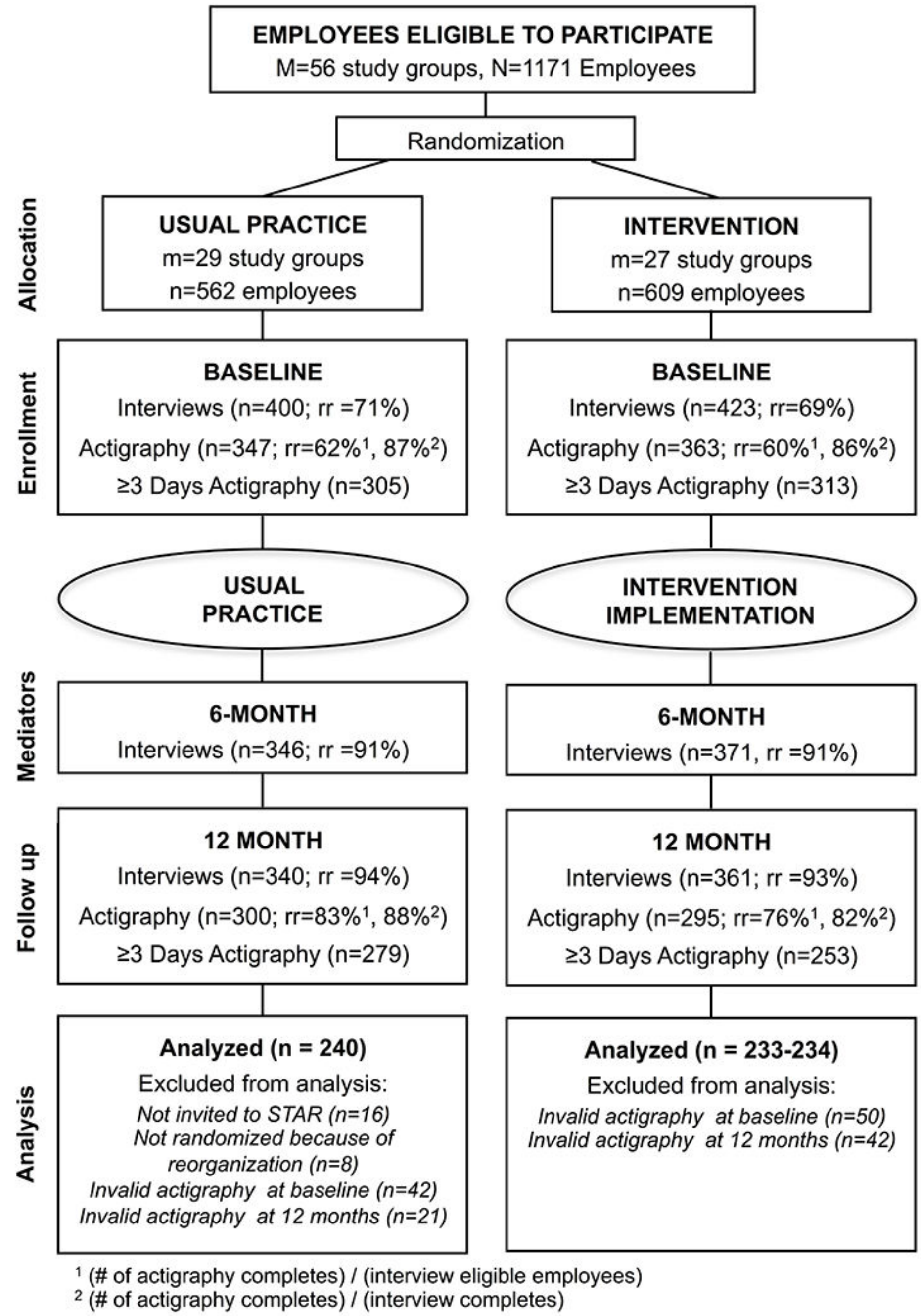

FIGURE 1. Flow diagram of study recruitment and retention

Note: rr = retention rate.

[1](# of actigraphy completes) / (interview eligible employees).

[2](# of actigraphy completes) / (interview completes)

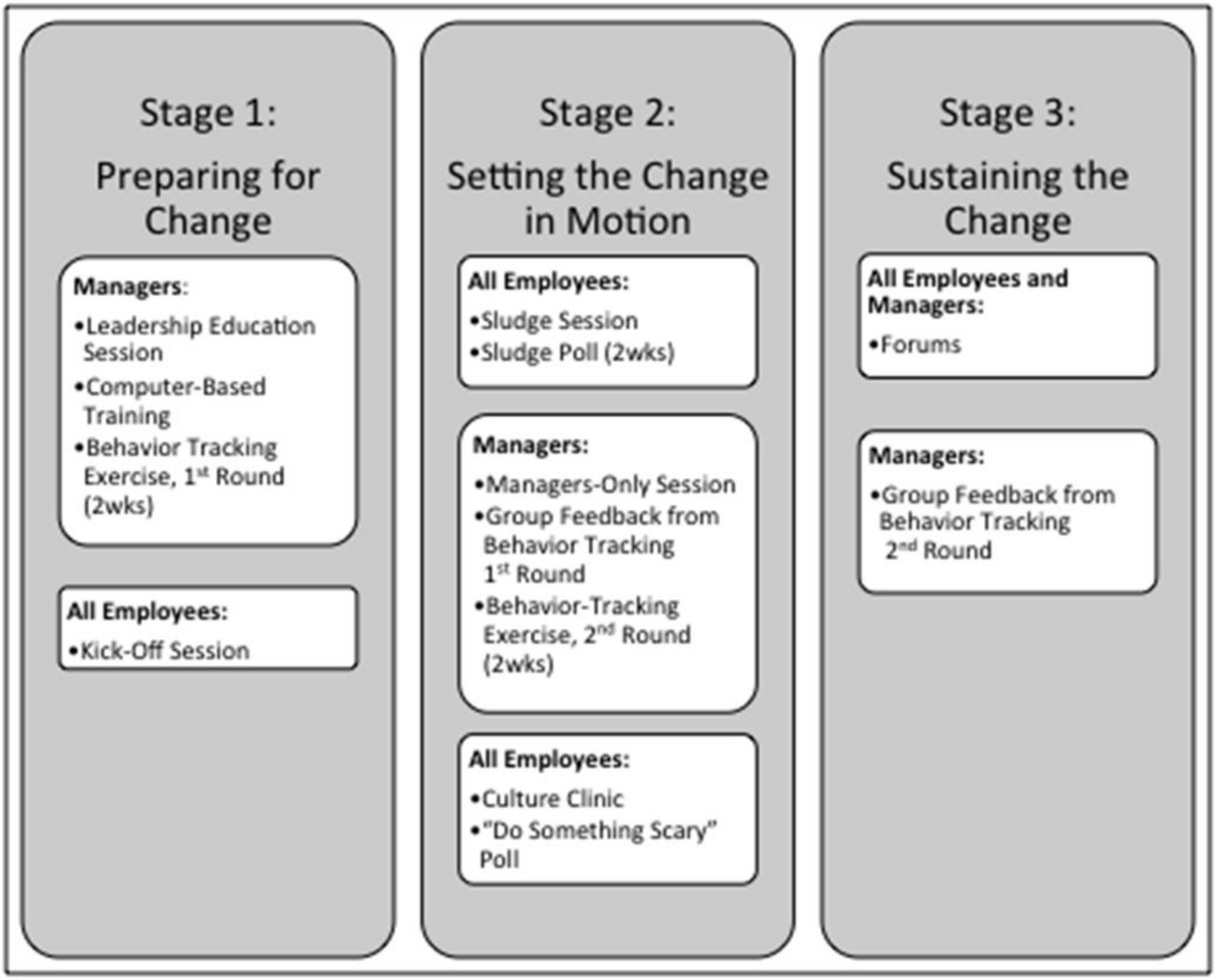

FIGURE 2. Overview of the workplace-based cultural change Intervention.
Adapted from Kossek et al. [57]

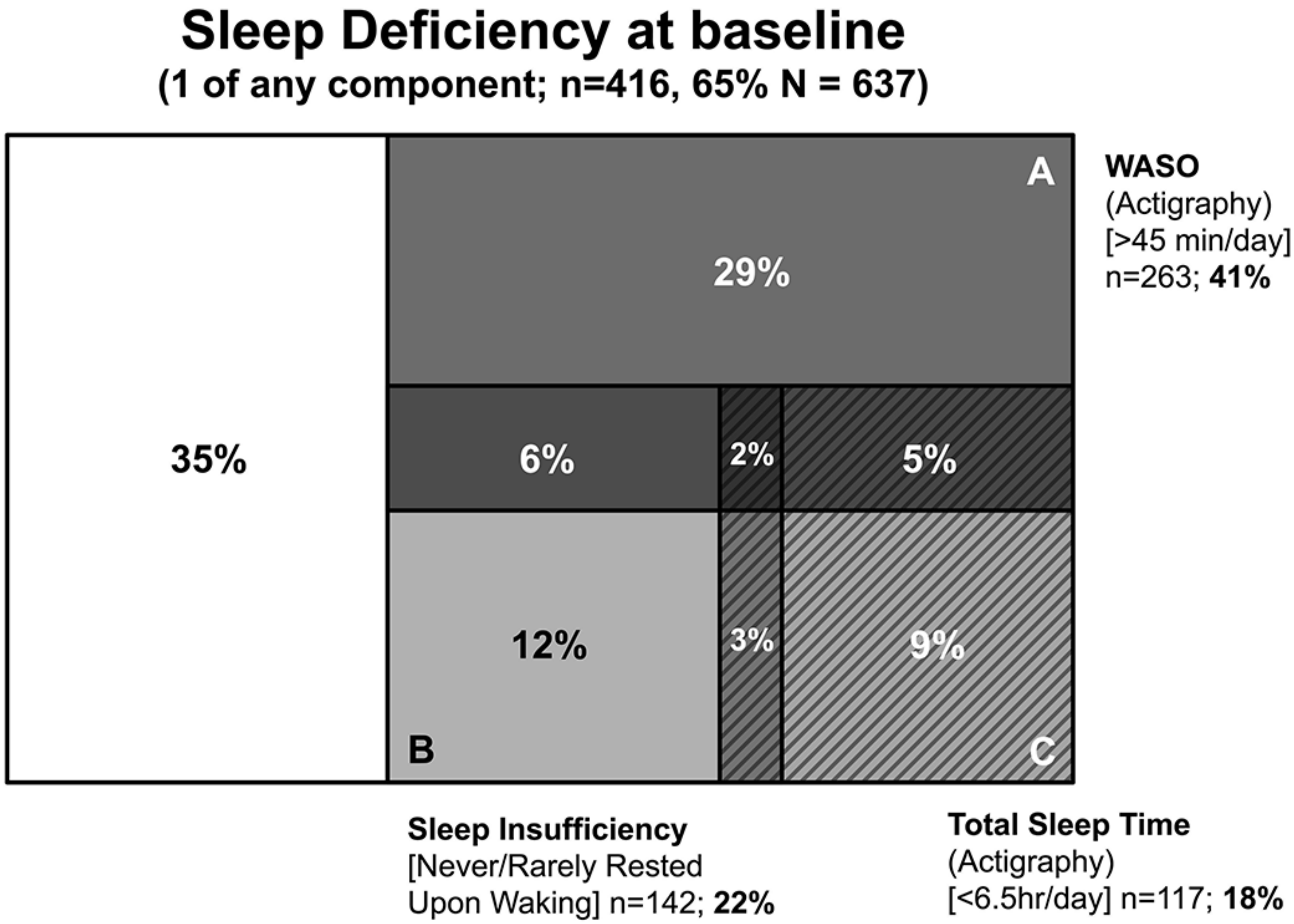

FIGURE 3. Venn diagram of the burden of sleep deficiency in the cohort at baseline.

Sleep Deficiency at baseline (insufficient sleep duration and/or inadequate sleep quality) was defined as having at least one of any component: mean Wake After Sleep Onset > 45 min per main sleep period (measured with wrist actigraphy and indicative of insomnia); self-reported sleep insufficiency (never or rarely feeling rested upon waking); and/or mean Total Sleep Time <6.5 h per 24-hr (measured from actigraphy).

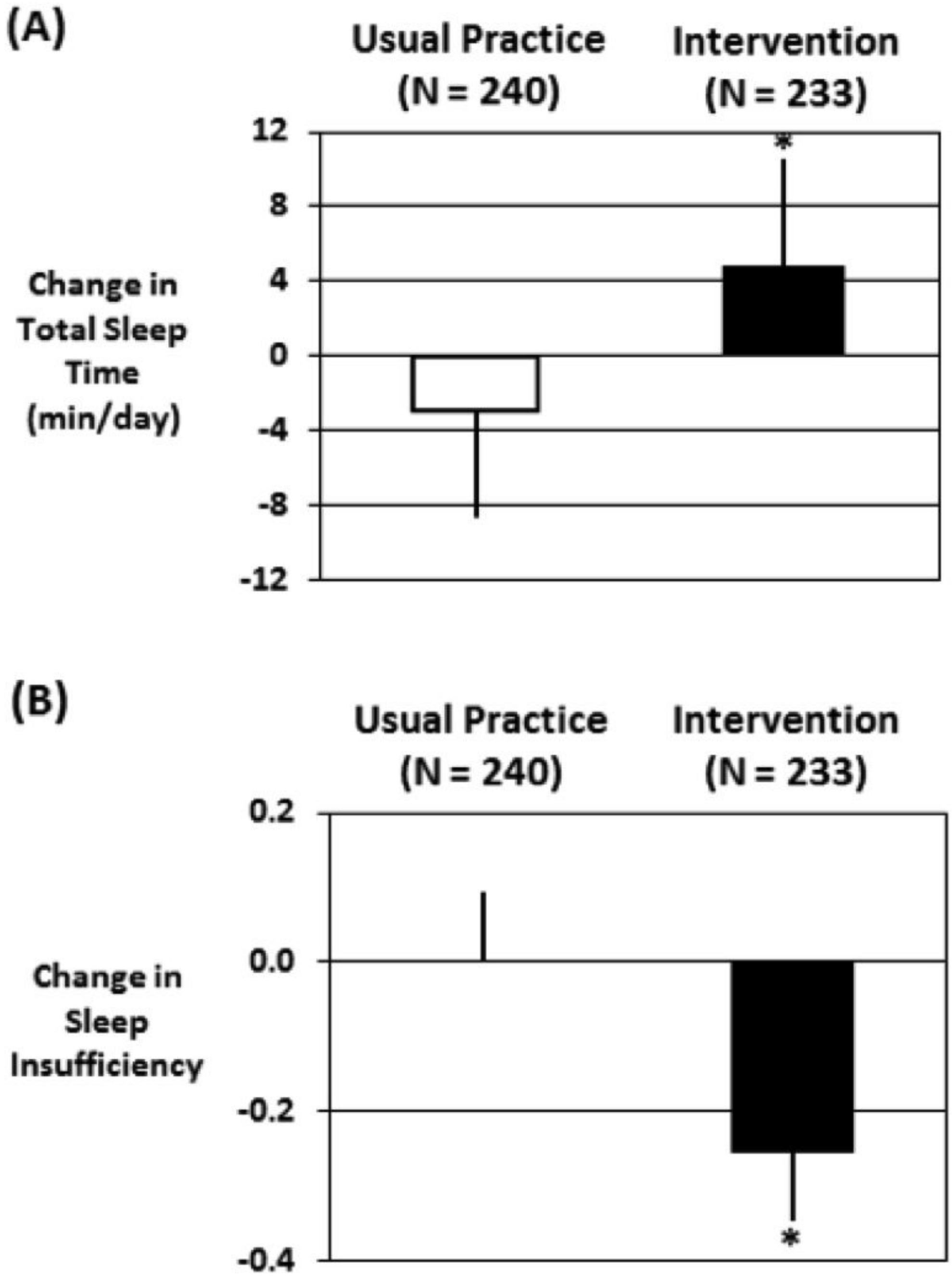

FIGURE 4. Effects of the intervention on sleep.

Adjusted mean changes in (A) actigraphic measures of sleep duration in min/day ±SE of the change and (B) mean changes in self-reported sleep insufficiency ±SE of the change. Sleep insufficiency was a self-report of never or rarely feeling rested upon awakening in the past month.

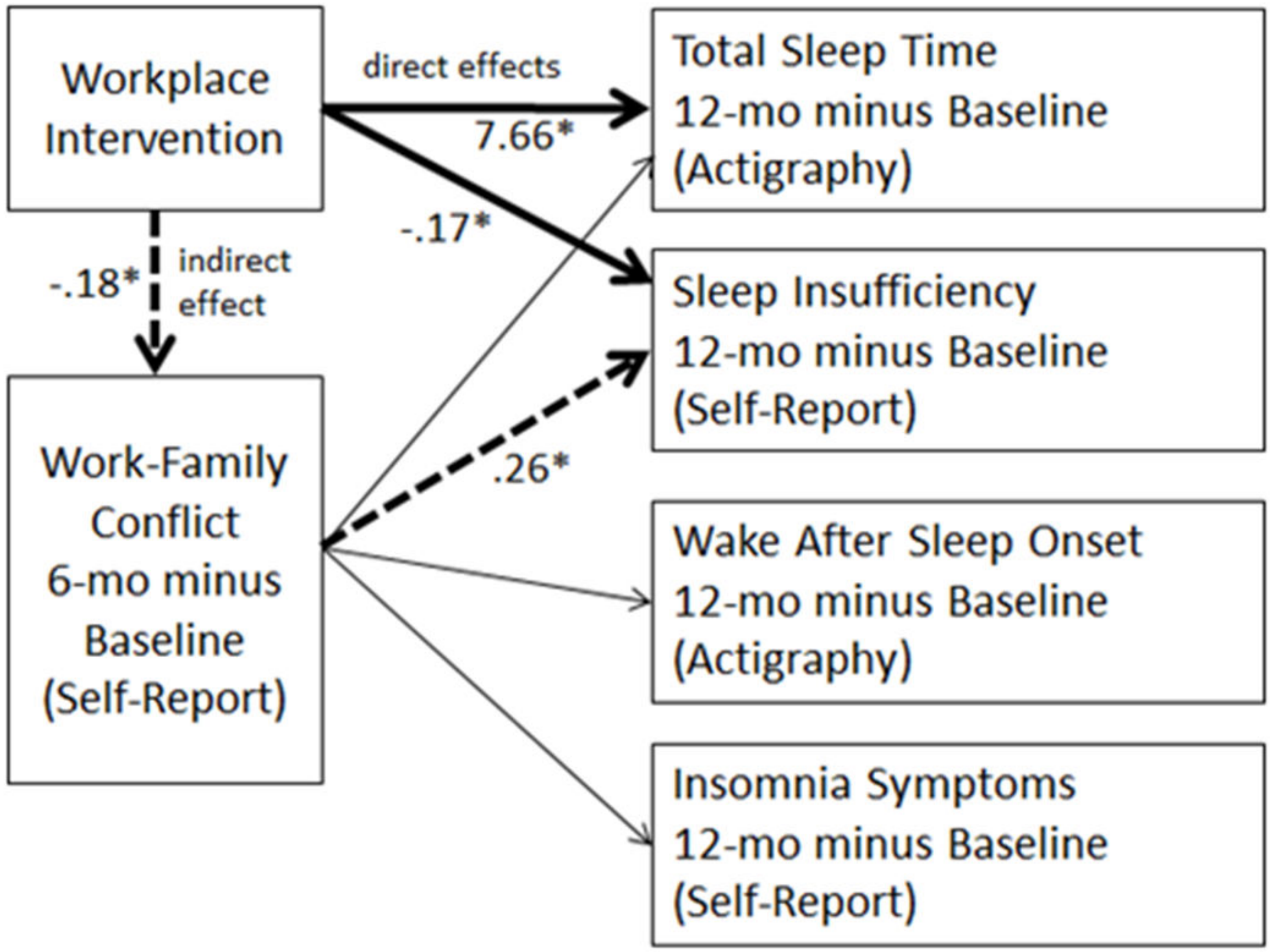

FIGURE 5. Intervention path model: Reduced sleep insufficiency at 12 months partially mediated by reduced work-family conflict at 6 months (*n* = 456).

Dashed red arrows depict significant indirect effects (mediation), whereas solid red arrows depict significant direct effects. Black arrows = ns. *p<.05.

TABLE 1.

Percentage or mean ±SD for demographic characteristics by condition (*n* = 474)

	Usual Practice (*n* = 240)	Intervention (*n* = 234)
Female	37.9%	42.7%
Age	46.6 ±8.4	46.8 ±8.8
Race/Ethnicity		
White, Non-Hispanic	72.1%	70.5%
Black or African American, Non-Hispanic	1.3%	1.7%
Asian Indian	13.8%	12.4%
Other Asian	4.2%	5.1%
Other Pacific Islander	0.8%	1.3%
Hispanic	6.7%	8.1%
More Than One Race	1.3%	0.9%
Married or Living with Partner	79.2%	81.2%
Number of children	1.0 ±1.2	1.0 ±1.0
Elder Care	25.8%	24.4%
Education		
High School Graduate	2.5%	3.0%
Some College or Technical School	17.9%	22.7%
College Graduate	79.6%	74.4%
Hours worked per week	45.5 ±6.0	45.6 ±5.5
Shift		
Variable Schedule	21.3%	20.9%
Regular Daytime	77.9%	78.2%
Rotating	0.4%	0.9%
Split Shift	0.4%	0.0%

TABLE 2.

General linear mixed modeling analysis of intervention effects on sleep outcomes (n = 473-474)

Predictor	Total Sleep Time (min)		Sleep Insufficiency (rating 1-5)		Wake After Sleep Onset (min)		Insomnia Symptoms (rating 1-4)	
	γ	**(95% CI)**	**γ**	**(95% CI)**	**γ**	**(95% CI)**	**γ**	**(95% CI)**
Intercept	**437.2** ***	**(422.2, 452.3)**	**2.5** ***	**(2.2, 2.8)**	**45.2** ***	**(40.8, 49.6)**	**2.5** ***	**(2.3, 2.7)**
Intervention	0.1	(−10.2, 10.4)	**0.2** *	**(0.0, 0.4)**	−2.6	(−5.7, 0.4)	0.1	(−0.0, 0.2)
Wave	−4.0	(−9.6, 1.6)	**0.2** ***	**(0.1, 0.4)**	1.0	(−0.6, 2.6)	0.1	(−0.0, 0.2)
Intervention *Wave	**8.2** *	**(0.3, 16.0)**	**−0.2** **	**(−0.4, −0.1)**	1.3	(−0.9, 3.5)	−0.0	(−0.1, 0.1)
Merger	−8.7 *	(−20.0, 2.6)	−0.1	(−0.3, 0.0)	−0.7	(−4.0, 2.6)	−0.0	(−0.2, 0.1)

Note: γ, unstandardized regression coefficient. CI, confidence interval. Merger (0=before merger announcement, 1 = after merger announcement). Analyses also controlled for 1) the number of employees for randomization and 2) groups where the most individuals were involved in software development (groups dominated by other IT jobs are the reference group), but neither of the coefficients were significant and are thus not included in this table. Significant p values are bolded.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

TABLE 3.

Mean ±SD for work-family conflict and sleep outcomes by condition over time (*n* = 457-474)

		Usual Practice				Intervention			
	Unit	**Baseline**	**6 mos**	**12 mos**	**Change**	**Baseline**	**6 mos**	**12 mos**	**Change**
Work-Family Conflict	Rating 1-5	3.1 ±1.0 (n = 240)	3.0 ±0.9 (n = 229)		−0.1 ±0.8	3.2 ±0.9 (n = 234)	2.9 ±0.9 (n = 228)		−0.3 ±0.9
Total Sleep Time	Minutes	440.9 ±49.8 (n = 240)		436.8 ±51.5 (n = 240)	−4.2 ±42.2	433.4 ±58.7 (n = 234)		437.4 ±58.6 (n = 234)	4.0 ±43.8
Sleep Insufficiency	Rating 1-5	2.8 ±0.9 (n = 240)		2.8 ±0.9 (n = 240)	0.0 ±0.9	2.9 ±0.9 (n = 234)		2.6 ±0.9 (n = 234)	−0.2 ±0.9
Wake After Sleep Onset	Minutes	42.7 ±16.3 (n = 240)		40.4 ±13.7 (n = 240)	−2.3 ±12.8	43.6 ±17.0 (n = 234)		42.5 ±15.7 (n = 234)	−1.0 ±11.8
Insomnia Symptoms	Rating 1-4	2.8 ±0.8 (n = 240)		2.7 ±0.8 (n = 240)	−0.0 ±0.7	2.7 ±0.8 (n = 233)		2.6 ±0.7 (n = 234)	−0.1 ±0.7